



# H·CUP

HEALTHCARE COST AND UTILIZATION PROJECT



Agency for Healthcare  
Research and Quality



U.S. Department of Health and Human Services  
Agency for Healthcare Research and Quality

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## Introduction

Cardiovascular and cerebrovascular diseases are significant health care issues, affecting 35 percent of Americans.<sup>1</sup> Heart disease is the leading cause of death, accounting for 1 in every 4 deaths, and stroke is the fourth leading cause of death in the United States.<sup>2,3</sup> These diseases are among the most common and costly reasons for hospital admissions.<sup>4,5</sup> The prevalence of cardiovascular and cerebrovascular diseases increases with age, with cardiovascular disease occurring in fewer than 15 percent of adults aged 20–39 years but more than 70 percent of adults aged 60 years and older.<sup>6</sup> Sex differences in these diseases also exist; for example, women tend to have a lower mortality rate following a stroke compared with men.<sup>7</sup>

A variety of national initiatives are underway that aim to reduce the prevalence of cardiovascular and cerebrovascular diseases in the United States. The Affordable Care Act provides up to \$100 million for community programs targeted at reducing chronic diseases, including heart disease and stroke, and another \$40 million for statewide efforts focused on chronic diseases.<sup>8</sup> The Million Hearts® initiative, co-led by the Centers for Disease Control and Prevention (CDC) and the Centers for Medicare & Medicaid Services (CMS), was initiated in 2012 with the goal “to prevent 1 million heart attacks and strokes by 2017.”<sup>9</sup>

Timely information on trends for cardiovascular and cerebrovascular conditions provides analysts and policy makers with baseline information and can be used to help evaluate the impact of health improvement efforts. A forward-looking initiative from the Agency for Healthcare Research and Quality’s (AHRQ) Healthcare Cost and Utilization Project (HCUP) is used in this report to produce timely, current inpatient statistics on two specific cardiovascular and cerebrovascular conditions, acute myocardial infarction (AMI) and acute stroke.

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<sup>1</sup> Go AS, Mozaffarian D, Roger VL, Benjamin EJ, Berry JD, et al. Executive summary: Heart disease and stroke statistics—2014 update: A report from the American Heart Association. *Circulation*. 2014;129:399–410.

<sup>2</sup> Million Hearts Initiative website. <http://millionhearts.hhs.gov/aboutmh/overview.html>. Accessed May 4, 2016.

<sup>3</sup> Murphy SL, Xu JQ, Kochanek JD. Deaths: Final Data for 2010. *National Vital Statistics Reports*; vol 61 no 4. Hyattsville, MD: National Center for Health Statistics, 2013.

<sup>4</sup> Pfuntner A, Wier LM, Stocks C. Most Frequent Conditions in U.S. Hospitals, 2011. HCUP Statistical Brief #162. September 2013. Agency for Healthcare Research and Quality. Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb162.pdf>. Accessed May 4, 2016.

<sup>5</sup> Pfuntner A, Wier LM, Steiner C. Costs for Hospital Stays in the United States, 2011. HCUP Statistical Brief #168. December 2013. Agency for Healthcare Research and Quality. Rockville, MD. <http://www.hcup-us.ahrq.gov/reports/statbriefs/sb168-Hospital-Costs-United-States-2011.pdf>. Accessed May 4, 2016.

<sup>6</sup> Go et al., 2014.

<sup>7</sup> Ibid.

<sup>8</sup> Department of Health and Human Services, press releases dated May 13, 2011 (<http://wayback.archive-it.org/3926/20140108162204/http://www.hhs.gov/news/press/2011pres/05/20110513c.html>) and June 7, 2011 (<http://wayback.archive-it.org/3926/20140108162147/http://www.hhs.gov/news/press/2011pres/06/20110607a.html>). Accessed May 4, 2016.

<sup>9</sup> Million Hearts initiative website.

## Introduction (continued)

The HCUP State Inpatient Databases (SID) from 2005 to 2014 include about 380 million inpatient discharges from Partner organizations for 47 States and the District of Columbia. The list of statewide data organizations that contribute to HCUP is available in Appendix I. In this report we use the historical SID data with early 2015 data from 17 HCUP States to develop national quarterly projections of 2015 and 2016 inpatient statistics for:

- Acute myocardial infarction (AMI)
- Acute stroke, and
- AMI or acute stroke.

Statistics for each condition are reported in total and separately by adult age group (18–44 years, 45–64 years, and 65 years and older) and by sex. The two cardiovascular and cerebrovascular conditions, AMI and acute stroke, reported in this study are identified by the principal diagnosis on an inpatient stay record. Appendix II includes specifications for AMI and acute stroke.

Four outcomes are projected for AMI, acute stroke, and AMI or acute stroke: counts of inpatient discharges, average total hospital cost, average length of stay, and in-hospital mortality rate. Average total hospital costs reflect actual expenses incurred in the production of hospital services; the average costs do not include physician billing. No adjustment has been made to the costs to equate them to a constant year. However, the Gross Domestic Product (GDP) price index is included to demonstrate deflation. In HCUP, the length of stay counts nights spent in the hospital. If a patient is admitted and discharged on the same day, the length of stay is zero. Mortality is in-hospital only; post-hospital mortality is not included.

A detailed explanation of the projection methodology is included in Appendix III. More information on HCUP is available on the HCUP User Support Website (<http://www.hcup-us.ahrq.gov>).

## Summary

The following table summarizes the change from 2005 annual estimates to 2016 projected annual estimates for AMI, acute stroke, and AMI or acute stroke for each of the four outcomes. Detailed graphs showing historical data and projections by quarter follow for each measure and outcome. The data presented in the table is for all adults. Graphs following this summary also show data for three adult age groups and by sex. Up or down arrows indicate change of over 10 percent between annual weighted estimates from 2005 to 2016. Dashes indicate inconsistent or little change.

Measure	Projected Annual Total Discharges for All Adults 2016	Change from 2005 to 2016 Projection for All Adults			
		Total Discharges	Average Total Hospital Cost	Average Length of Stay	In-Hospital Mortality Rate
Acute Myocardial Infarction for Adults	604,288	—	↑	↓	↓
Acute Stroke for Adults	585,217	↑	↑	↓	↓
AMI or Acute Stroke for Adults	1,207,952	↑	↑	↓	↓

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## **Acute Myocardial Infarction (AMI) for Adults**

An acute myocardial infarction (AMI) is commonly known as a heart attack. A heart attack occurs when blood flow to the heart is blocked. Using the HCUP SID from 2005 to 2014 and early 2015 data from 17 States, different outcomes for inpatient discharges with a principal diagnosis of AMI are projected for 2015 to 2016.

**Projections include the following:**

**HCUP Projections:  
Acute Myocardial Infarction (AMI) and Acute Stroke**

- Total inpatient discharges for all adults, adults by age group, and adults by sex. Discharge counts exclude inpatient stays that were transferred out to another acute care hospital. This ensures that these events are not double counted.
- Average total hospital cost for all adults, adults by age group, and adults by sex. Average total hospital cost reflects actual expenses incurred in the production of hospital services; physician costs are not included. For comparison, a line is included that depicts the change in the average inpatient hospital cost per admission in the first quarter of 2005 (Q1 2005) due solely to economy-wide inflation. The difference between the actual/projected cost line and the inflation-adjusted Q1 2005 cost line represents cost increases due to other noninflation factors, such as new technology, patient case mix, etc.
- Average length of stay for all adults, adults by age group, and adults by sex. In HCUP, the length of stay counts nights spent in the hospital. If a patient is admitted and discharged on the same day, the length of stay is zero.
- In-hospital mortality rate for all adults, adults by age group, and adults by sex.

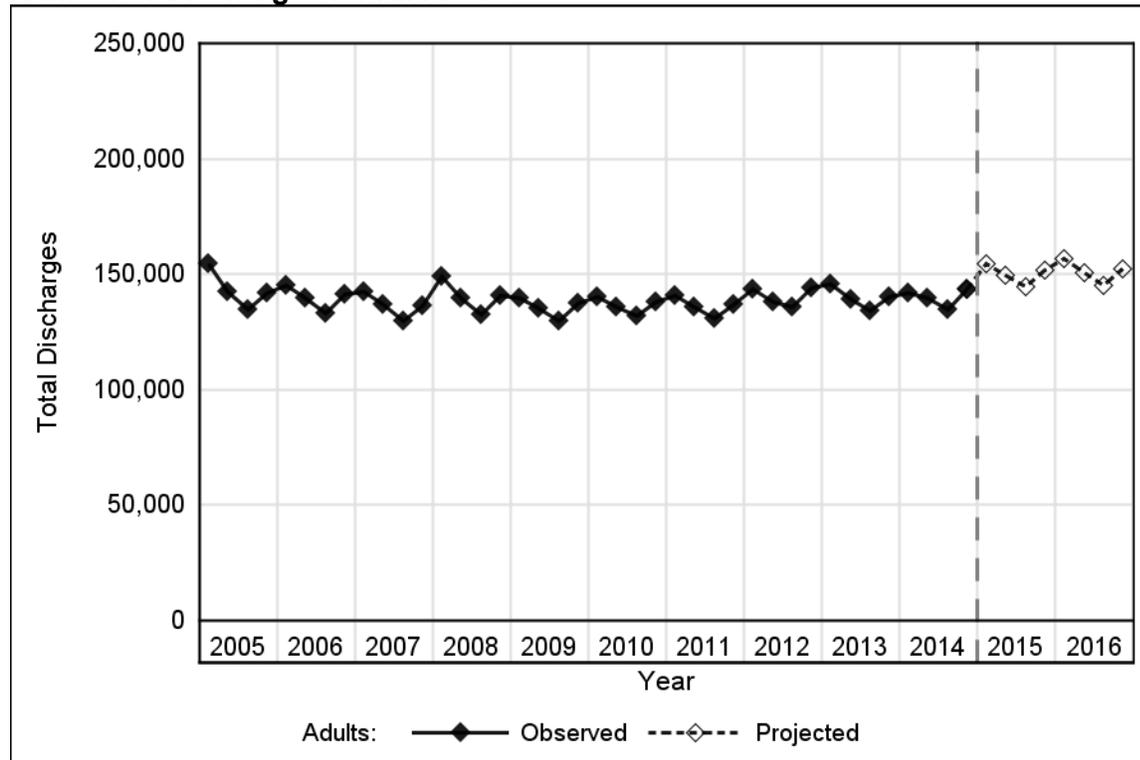
## Acute Myocardial Infarction (AMI) for Adults

### Number of Discharges

#### Key Findings:

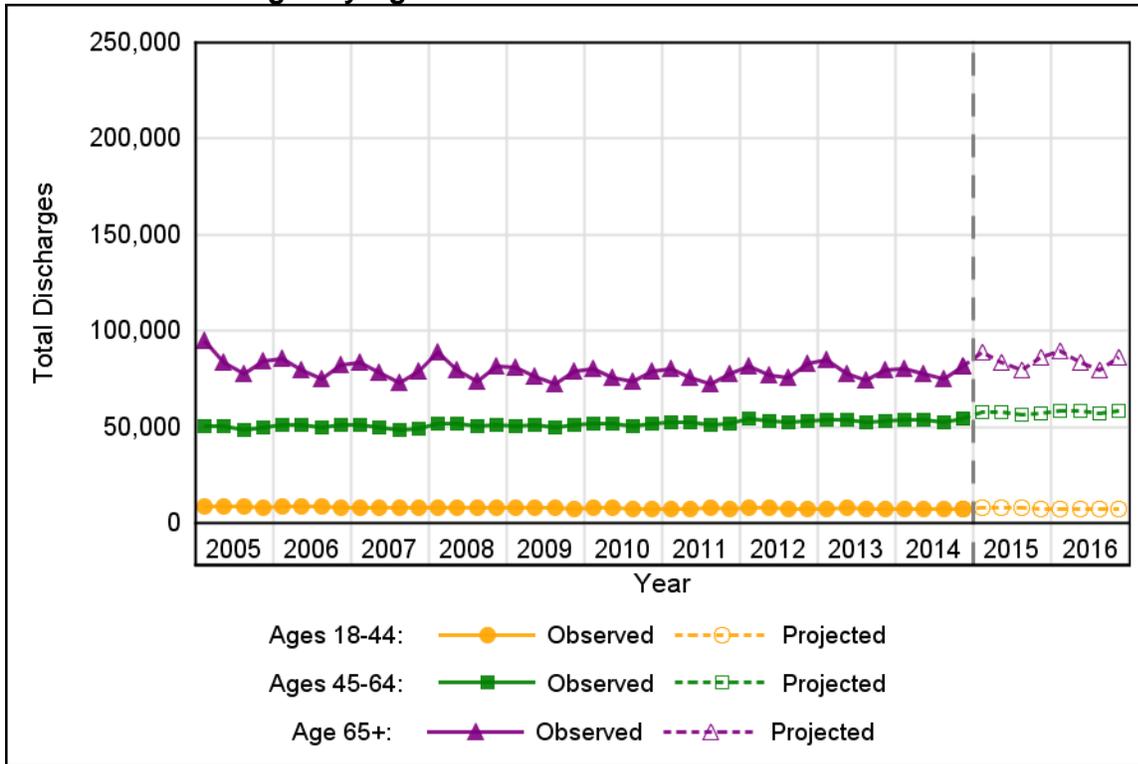
- The number of discharges for AMI was relatively stable over time, vacillating around 139,000 discharges per quarter between 2005 and 2014. The number of discharges is projected to be 152,500 at the end of 2016.
- Adults aged 65 years and older had the highest number of discharges, remaining relatively stable between 2005 and 2014 vacillating around 79,500 discharges per quarter. Adults aged 45–64 years had the next highest number of discharges, remaining relatively stable at about 51,500 discharges per quarter. Adults aged 18–44 years had the lowest number of discharges, at about 8,500 discharges per quarter in 2005 and decreasing to 7,500 discharges per quarter in 2014.
- Males had about 29,000 more discharges per quarter than did females between 2005 and 2014. Males had a relatively stable number of discharges over time at about 84,000 discharges per quarter. Females also had a relatively stable number of discharges over time at about 55,000 discharges per quarter.

#### Number of Discharges for All Adults

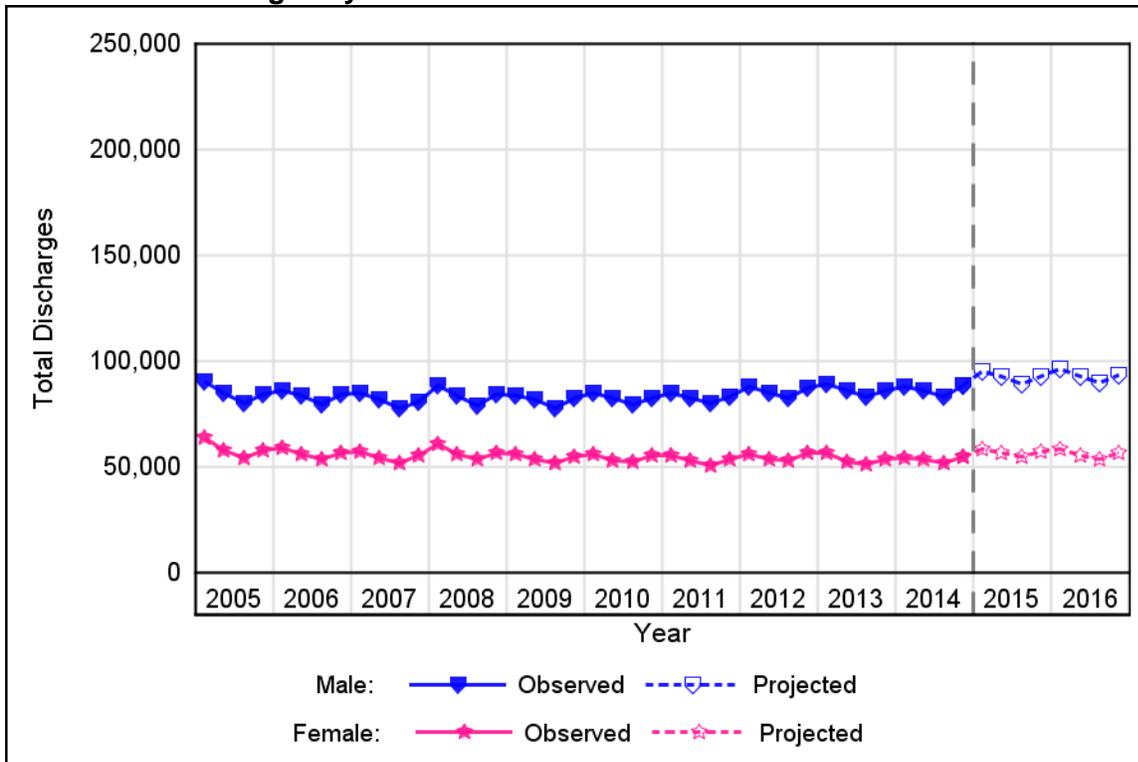


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Number of Discharges by Age



Number of Discharges by Sex



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

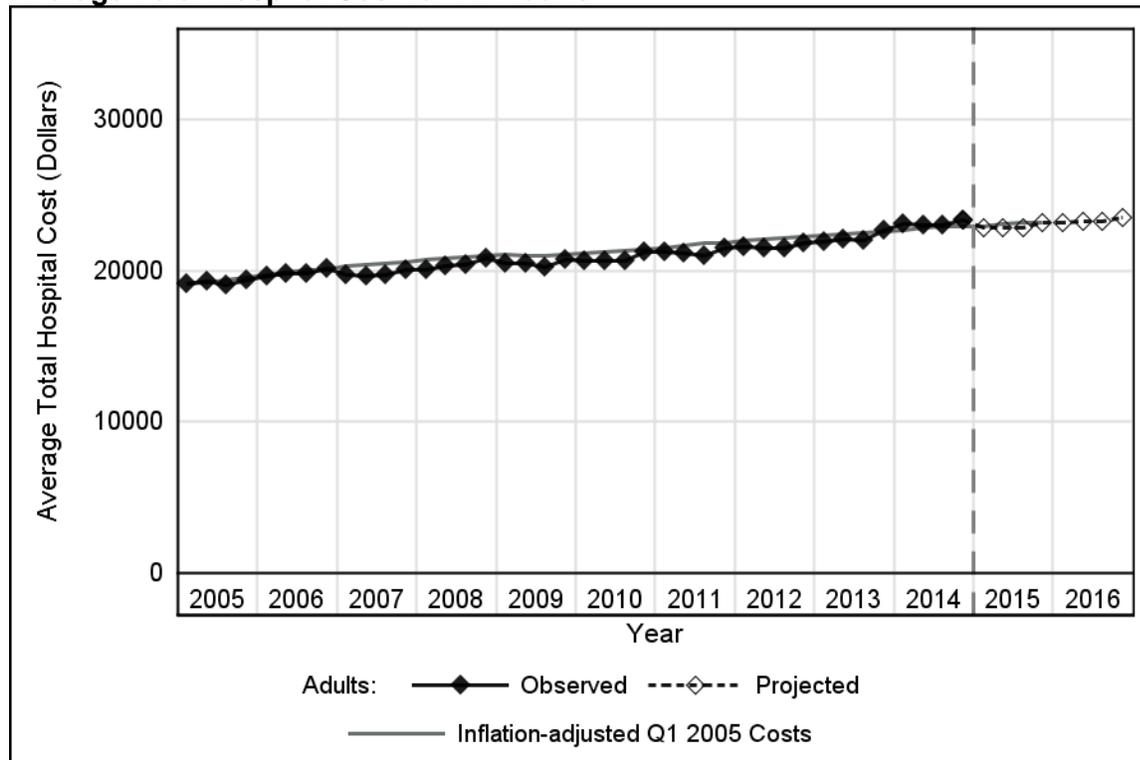
## Acute Myocardial Infarction (AMI) for Adults

### Average Total Hospital Cost

#### Key Findings:

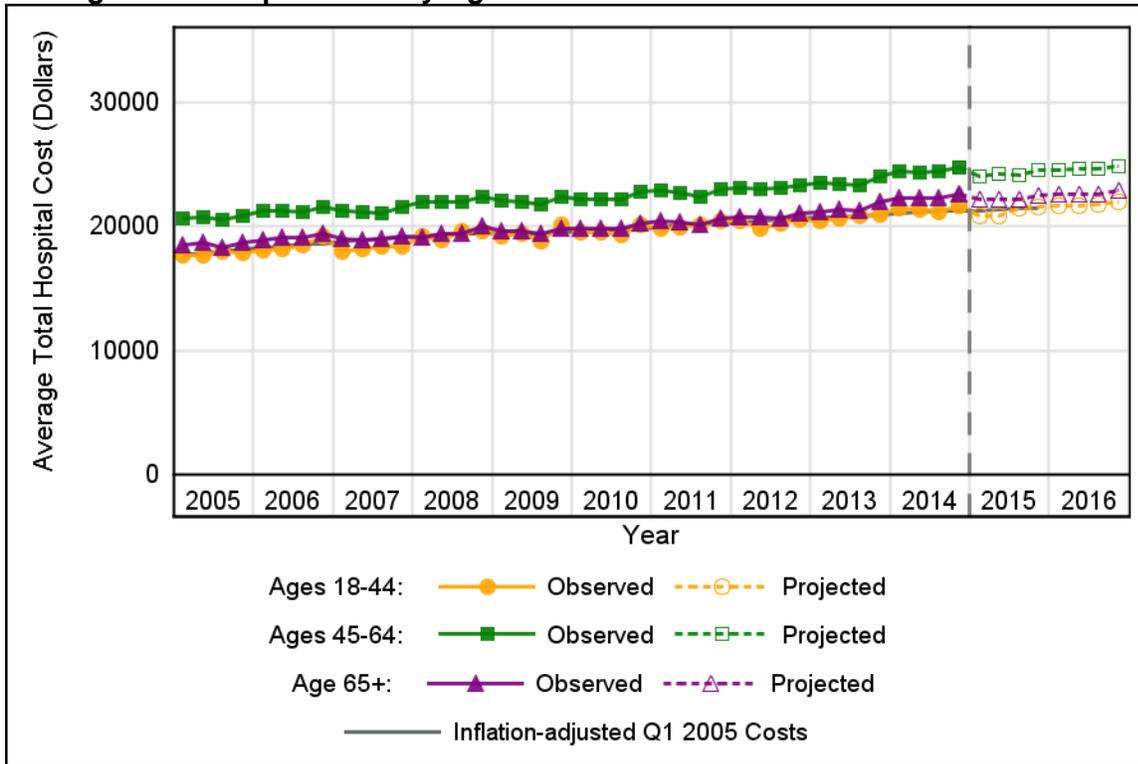
- The average hospital cost for discharges with AMI increased from about \$19,000 in 2005 to \$23,000 in 2014. The average hospital cost is projected to be \$23,500 at the end of 2016.
- The average hospital cost was highest for adults aged 45–64 years, increasing from about \$20,500 in 2005 to \$24,500 in 2014. The youngest and oldest age groups had similar average hospital costs, at about \$18,000 in 2005 and increasing to \$22,000 in 2014.
- The average hospital cost was about \$3,000 higher for males than for females between 2005 and 2014. Males had an average hospital cost that increased from about \$20,500 in 2005 to \$24,500 in 2014. Females had an average hospital cost that increased from about \$17,500 in 2004 to \$21,000 in 2014.
- Using the Gross Domestic Product (GDP) price index, a cost of \$19,000 in 2005 would be equivalent to a cost of \$23,000 at the end of 2014. The average hospital cost through 2014 remained relatively consistent with the cost expected by inflation alone.

#### Average Total Hospital Cost for All Adults

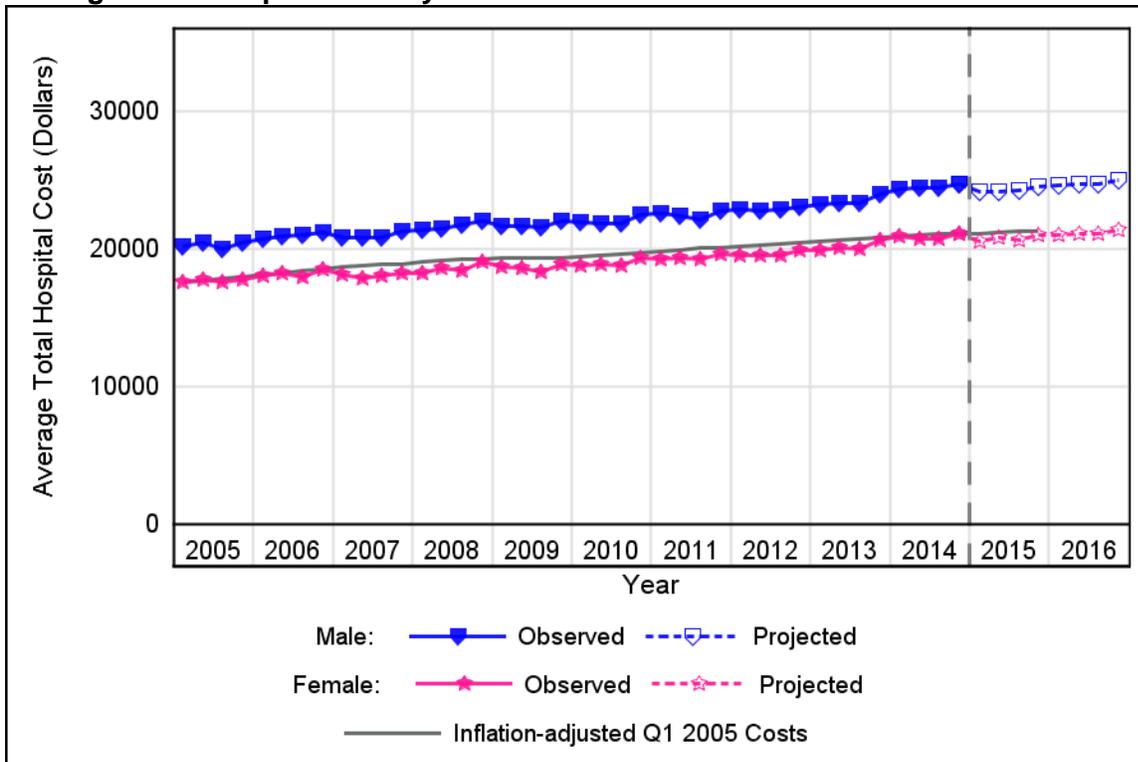


Inflation-adjusted Q1 2005 Costs: Cost per admission in the first quarter of 2005, adjusted for economy-wide inflation.  
Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Average Total Hospital Cost by Age



Average Total Hospital Cost by Sex



Inflation-adjusted Q1 2005 Costs: Cost per admission in the first quarter of 2005, adjusted for economy-wide inflation. Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID) HCUP (06/01/16) 9 AMI and Acute Stroke Projections

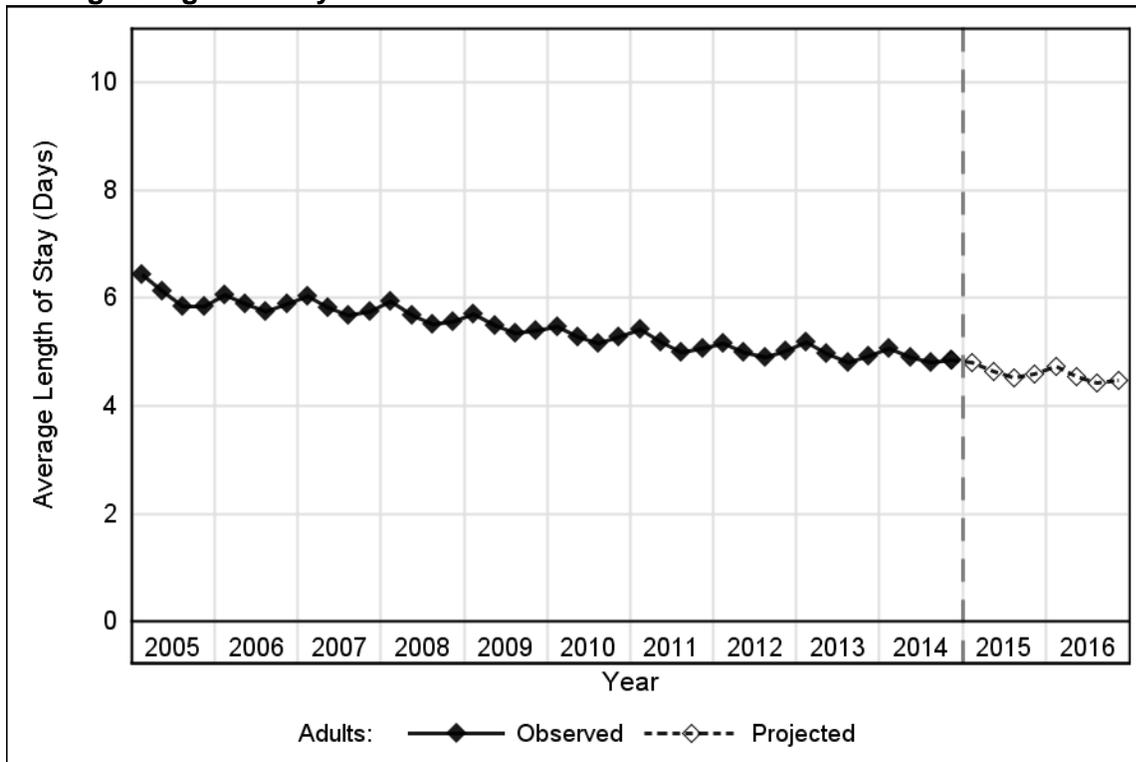
## Acute Myocardial Infarction (AMI) for Adults

### Average Length of Stay

#### Key Findings:

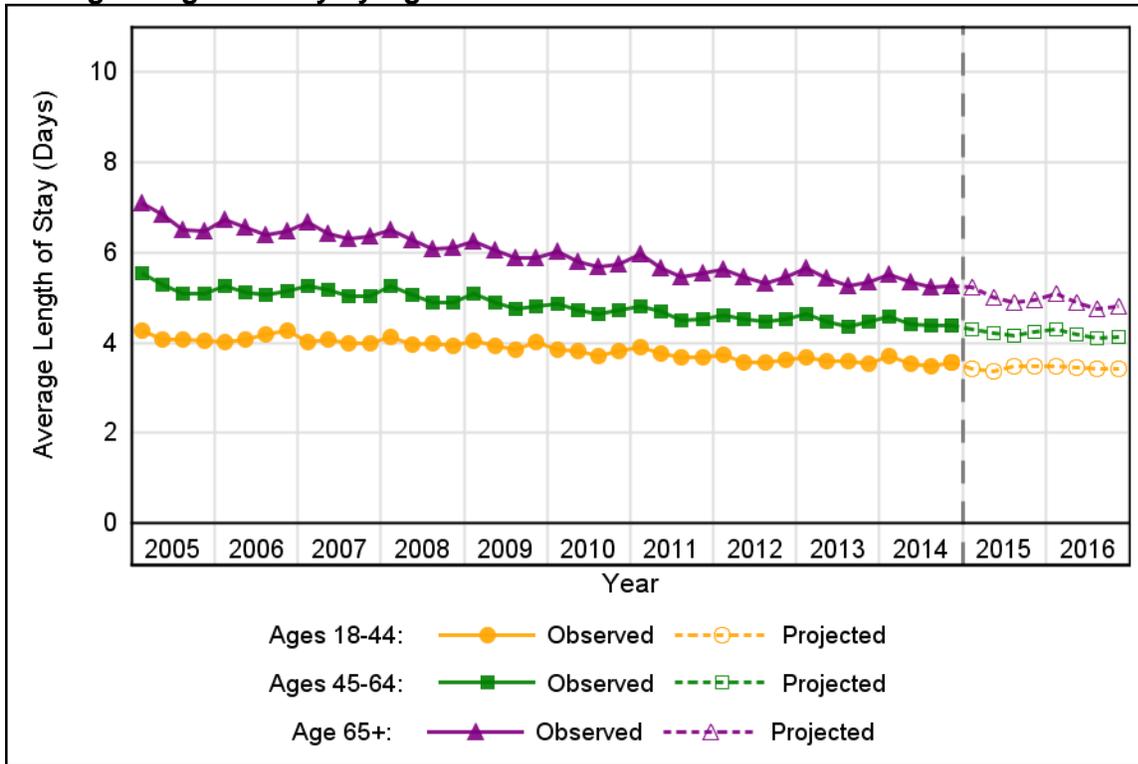
- The length of stay for discharges with AMI decreased over time, from 6.0 days in 2005 to 4.9 days in 2014. The length of stay is projected to be 4.5 days at the end of 2016.
- Adults aged 65 years and older had the longest length of stay, at 6.7 days in 2005 and decreasing to 5.3 days in 2014. Adults aged 45–64 years had the next longest length of stay, at 5.3 days in 2005 and decreasing to 4.5 days in 2014. Adults aged 18–44 years had the shortest length of stay, at 4.1 days in 2005 and decreasing to 3.6 days in 2014.
- Length of stay was similar for males and females, decreasing from 6.0 days in 2005 to 4.9 days in 2014.

#### Average Length of Stay for All Adults

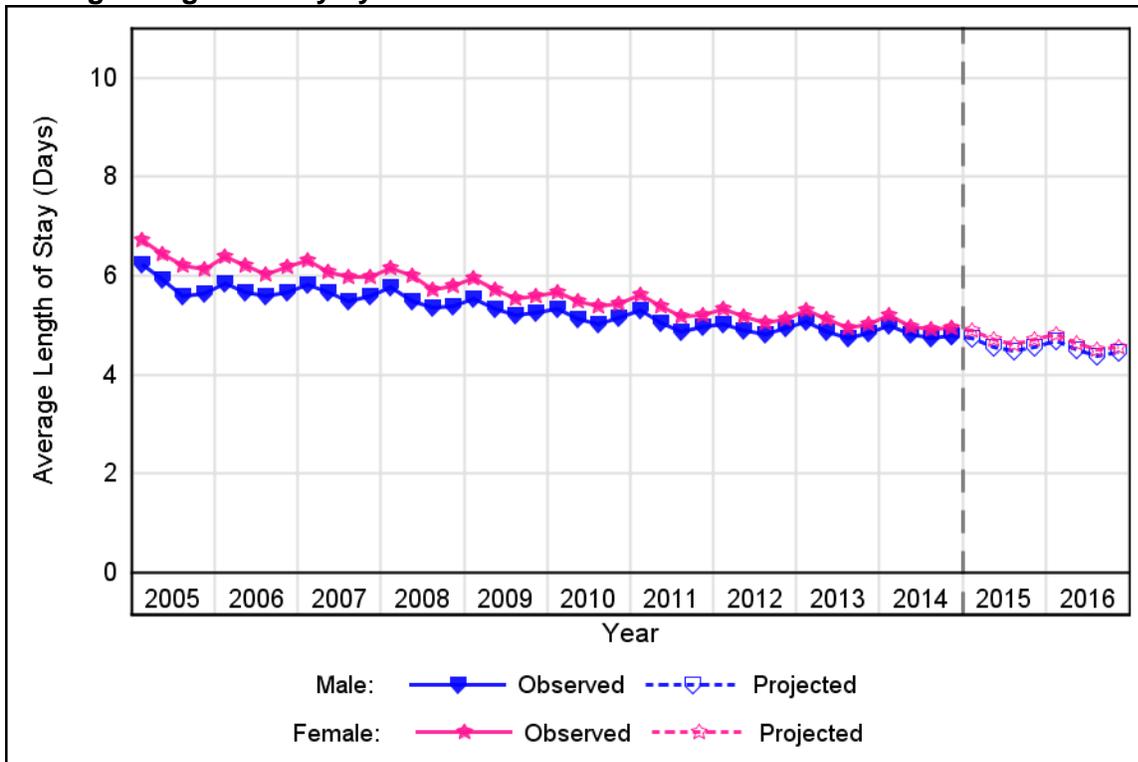


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Average Length of Stay by Age



Average Length of Stay by Sex



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

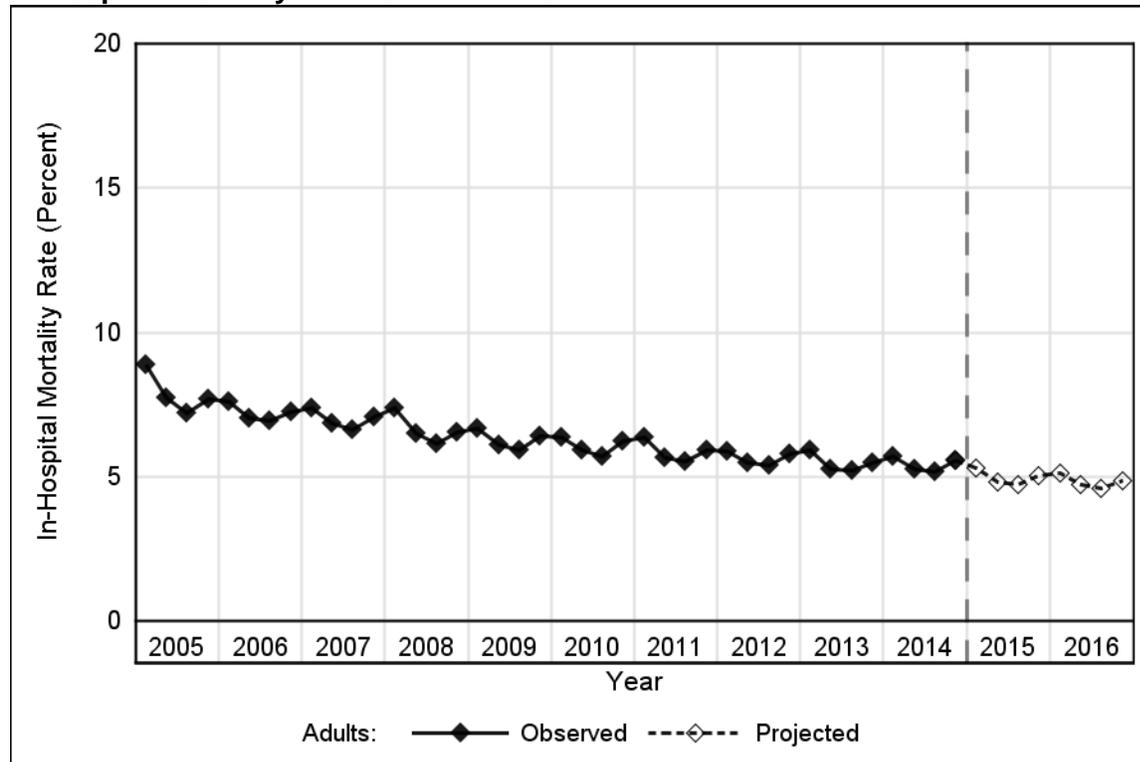
## Acute Myocardial Infarction (AMI) for Adults

### In-Hospital Mortality Rate

#### Key Findings:

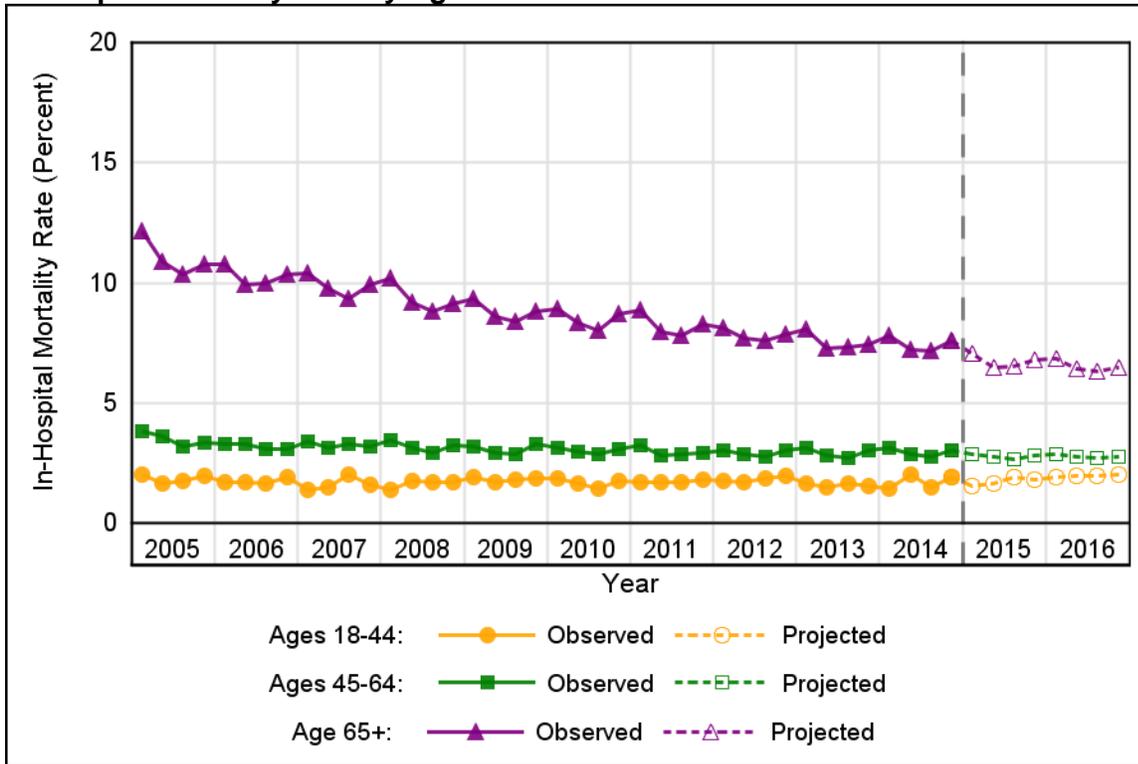
- The mortality rate for discharges with AMI decreased over time, from 7.9 percent in 2005 to 5.5 percent in 2014. This decreasing trend is projected to continue in 2015 and 2016, with the mortality rate projected to be 4.9 percent at the end of 2016.
- Adults aged 65 years and older had the highest mortality rate, at 11.1 percent in 2005 and decreasing to 7.5 percent in 2014. Adults aged 45–64 years had the next highest mortality rate, at 3.5 percent in 2005 and decreasing to 3.0 percent in 2014. Adults aged 18–44 years had the lowest mortality rate, remaining relatively stable over time at about 1.7 percent.
- The mortality rate was 1.9 percentage points higher for females than for males between 2005 and 2014. Females had a mortality rate that decreased from 9.6 percent in 2005 to 6.2 percent in 2014. Males had a mortality rate that decreased from 6.7 percent in 2005 to 5.0 percent in 2014.

#### In-Hospital Mortality Rate for All Adults

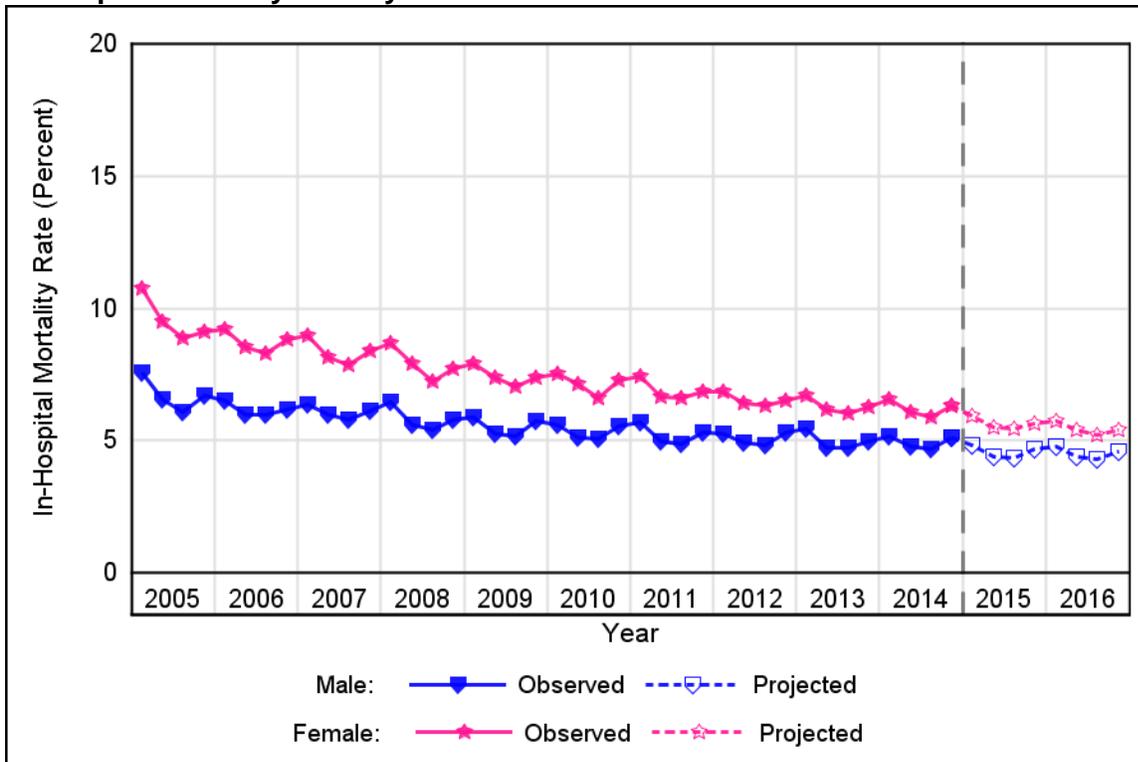


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

**In-Hospital Mortality Rate by Age**



**In-Hospital Mortality Rate by Sex**



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

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## Acute Stroke for Adults

A stroke occurs when a blood vessel that carries oxygen and nutrients to the brain is either blocked by a clot or bursts. When that happens, part of the brain cannot get the blood (and oxygen) it needs, which results in either temporary or permanent injury to the brain. Using the HCUP SID from 2005 to 2014 and early 2015 data from 17 States, different outcomes for inpatient discharges with a principal diagnosis of acute stroke are projected for 2015 to 2016.

### Projections include the following:

- Total inpatient discharges for all adults, adults by age group, and adults by sex. Discharge counts exclude inpatient stays that were transferred out to another acute care hospital. This ensures that these events are not double counted.
- Average total hospital cost for all adults, adults by age group, and adults by sex. Average total hospital cost reflects actual expenses incurred in the production of hospital services; physician costs are not included. For comparison, a line is included that depicts the change in the average inpatient hospital cost per admission in the first quarter of 2005 (Q1 2005) due solely to economy-wide inflation. The difference between the actual/projected cost line and the inflation-adjusted Q1 2005 cost line represents cost increases due to other noninflation factors, such as new technology, patient case mix, etc.
- Average length of stay for all adults, adults by age group, and adults by sex. In HCUP, the length of stay counts nights spent in the hospital. If a patient is admitted and discharged on the same day, the length of stay is zero.
- In-hospital mortality rate for all adults, adults by age group, and adults by sex.

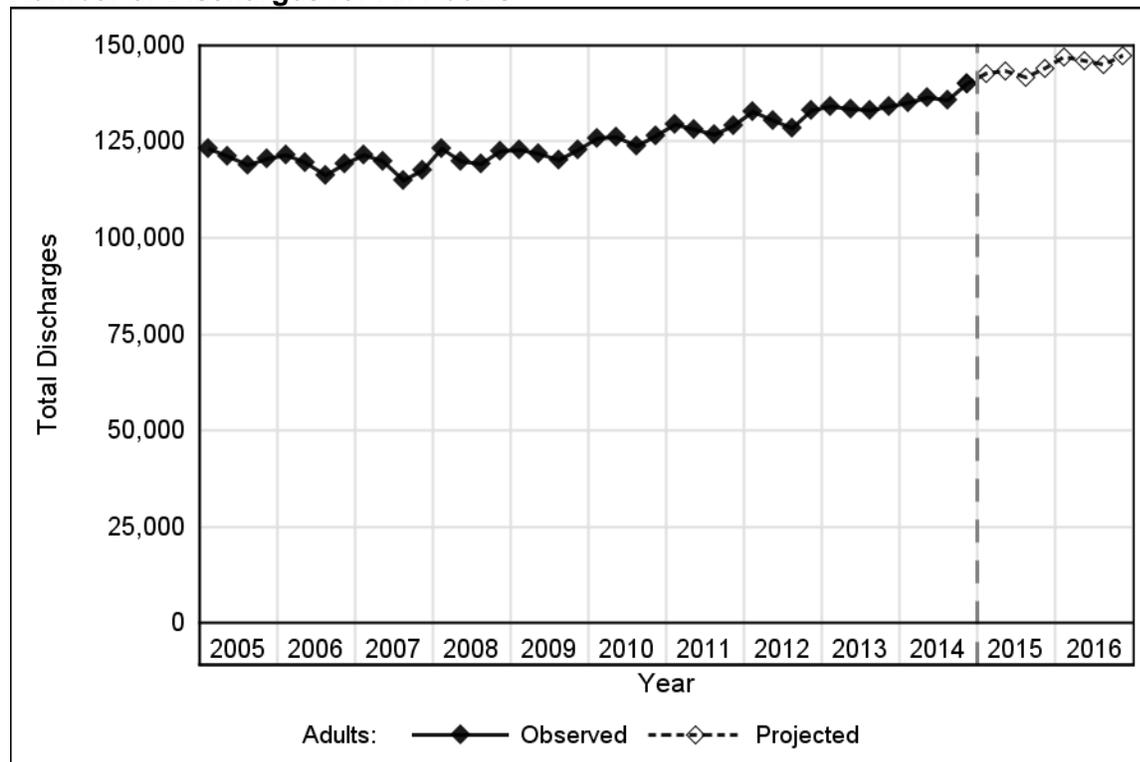
## Acute Stroke for Adults

### Number of Discharges

#### Key Findings:

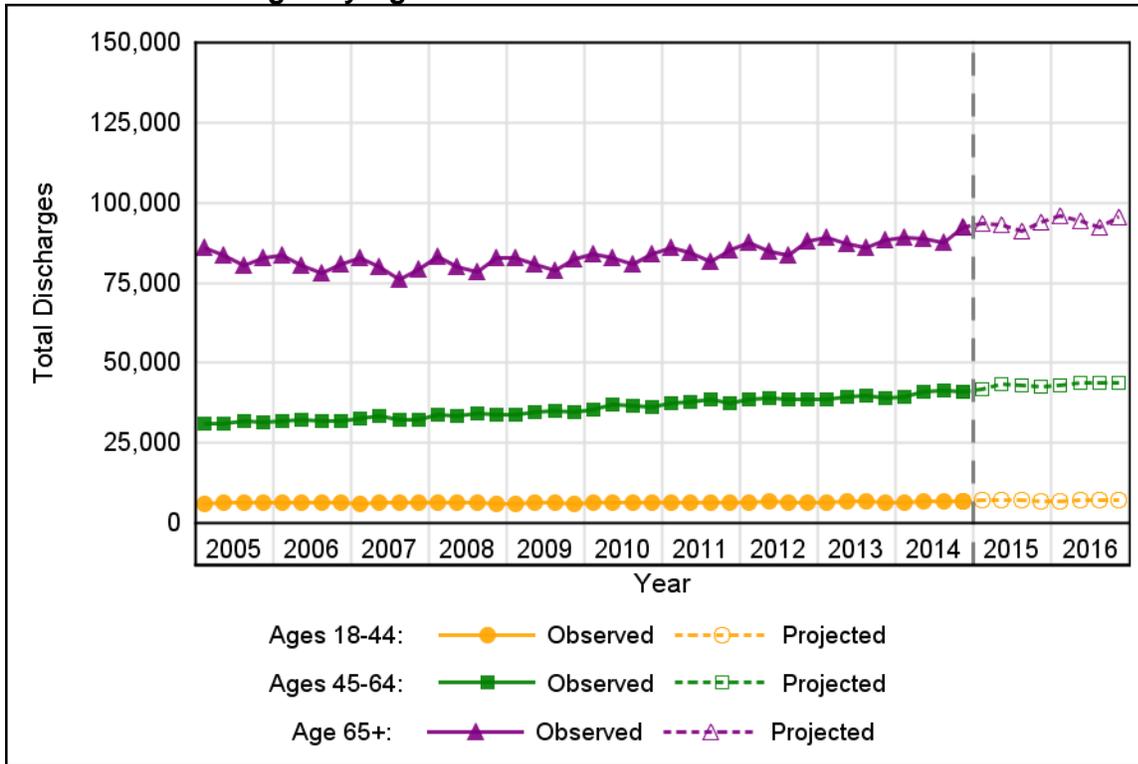
- The number of acute stroke discharges was relatively stable between 2005 and 2009, at about 120,500 discharges per quarter, but then increased to 137,000 discharges per quarter in 2014. The number of discharges is projected to be 147,500 at the end of 2016.
- Adults aged 65 years and older had the highest number of discharges, remaining relatively stable between 2005 and 2014 at about 83,500 discharges per quarter. Adults aged 45–64 years had the next highest number of discharges, at about 31,500 discharges per quarter in 2005 and increasing to 40,500 discharges per quarter in 2014. Adults aged 18–44 years had the lowest number of discharges, remaining relatively stable over time at about 6,500 discharges per quarter.
- Females had about 10,500 more discharges per quarter than did males in 2005 (66,000 versus 55,500 discharges per quarter). This initial difference disappeared over time with both sexes having about 68,500 discharges per quarter in 2014.

#### Number of Discharges for All Adults

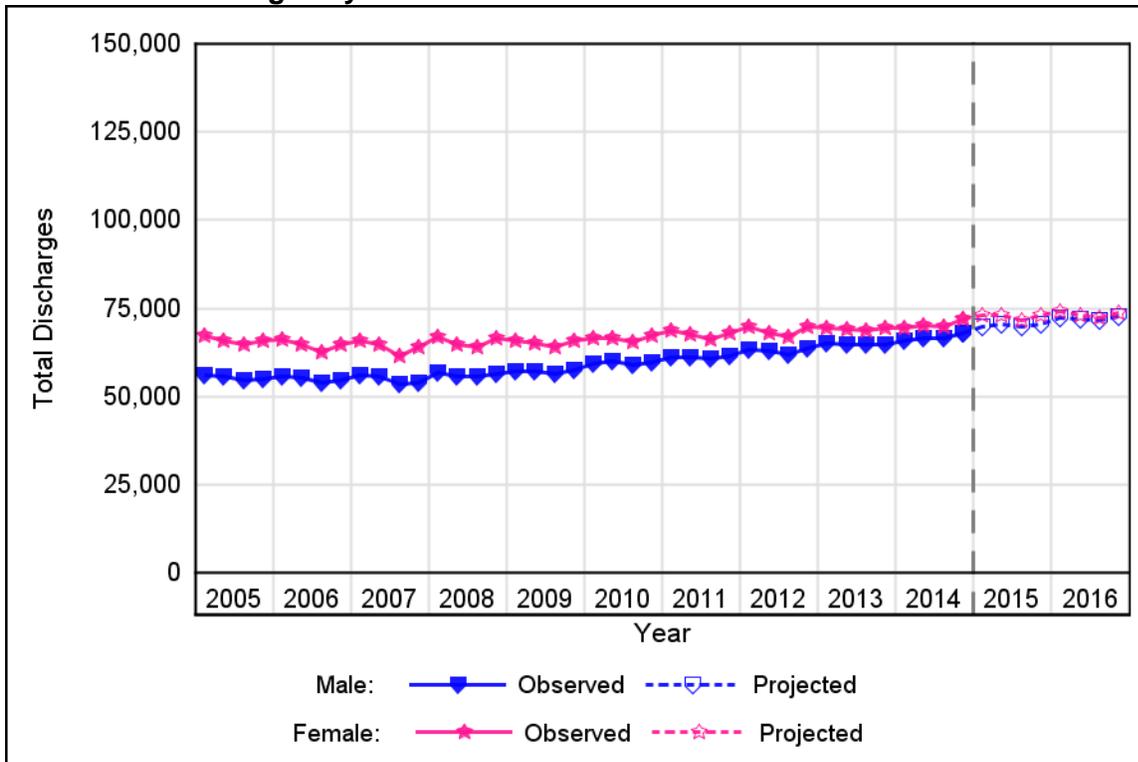


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Number of Discharges by Age



Number of Discharges by Sex



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

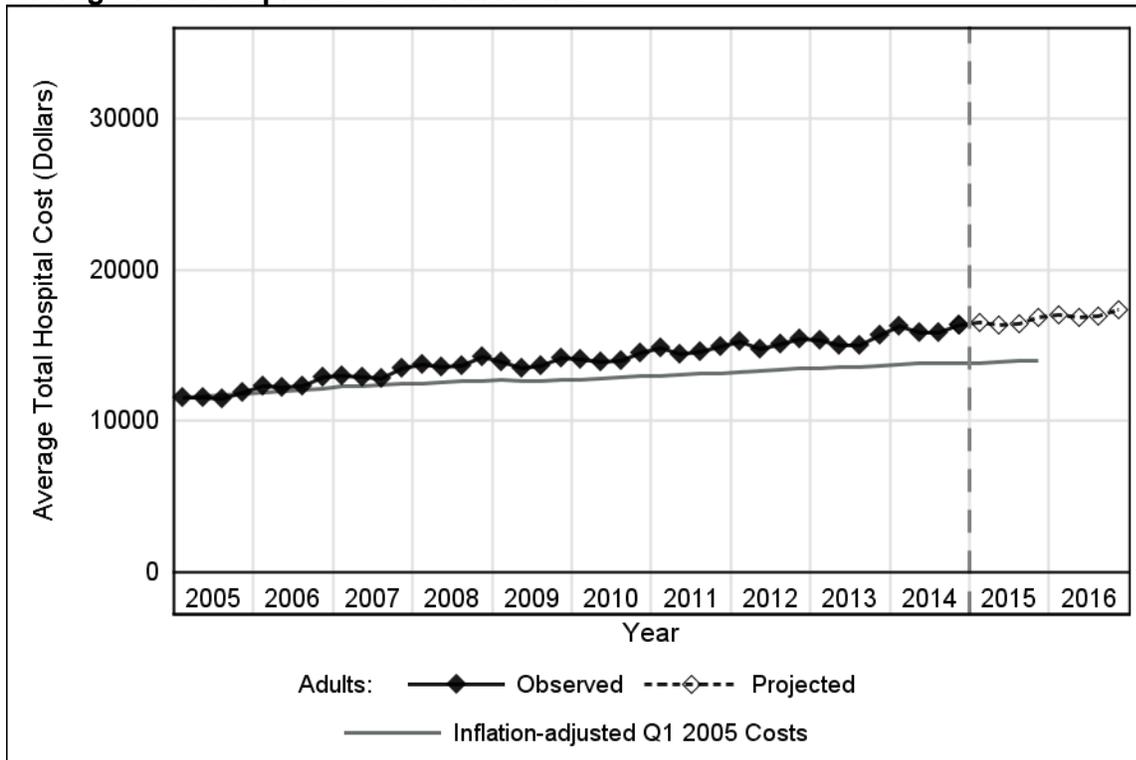
## Acute Stroke for Adults

### Average Total Hospital Cost

#### Key Findings:

- The average hospital cost for discharges with acute stroke increased over time, from about \$11,500 in 2005 to \$16,000 in 2014. The average hospital cost is projected to be \$17,500 at the end of 2016.
- The average hospital cost was highest for adults aged 18–44 years, increasing from about \$19,000 in 2005 to \$26,500 in 2014. Adults aged 45–64 years had the next highest average hospital cost, at about \$14,500 in 2005 and increasing to \$19,500 in 2014. Adults aged 65 years and older had the lowest average hospital cost, at about \$10,000 in 2005 and increasing to \$13,500 in 2014.
- The average hospital cost was similar for males and females, increasing from about \$11,500 in 2005 to \$16,000 in 2014.
- Using the Gross Domestic Product (GDP) price index, a cost of \$11,500 in 2005 would be equivalent to a cost of \$14,000 in 2014. By the end of 2014, the average hospital cost exceeded the cost expected by inflation alone.

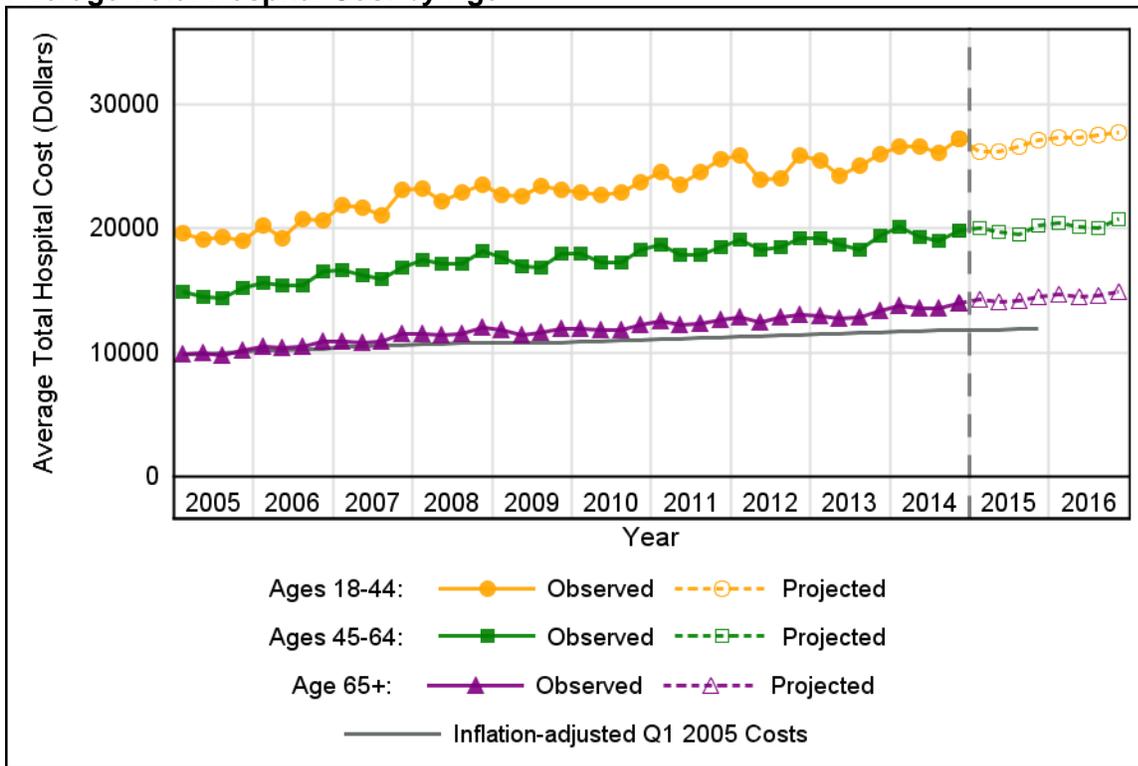
#### Average Total Hospital Cost for All Adults



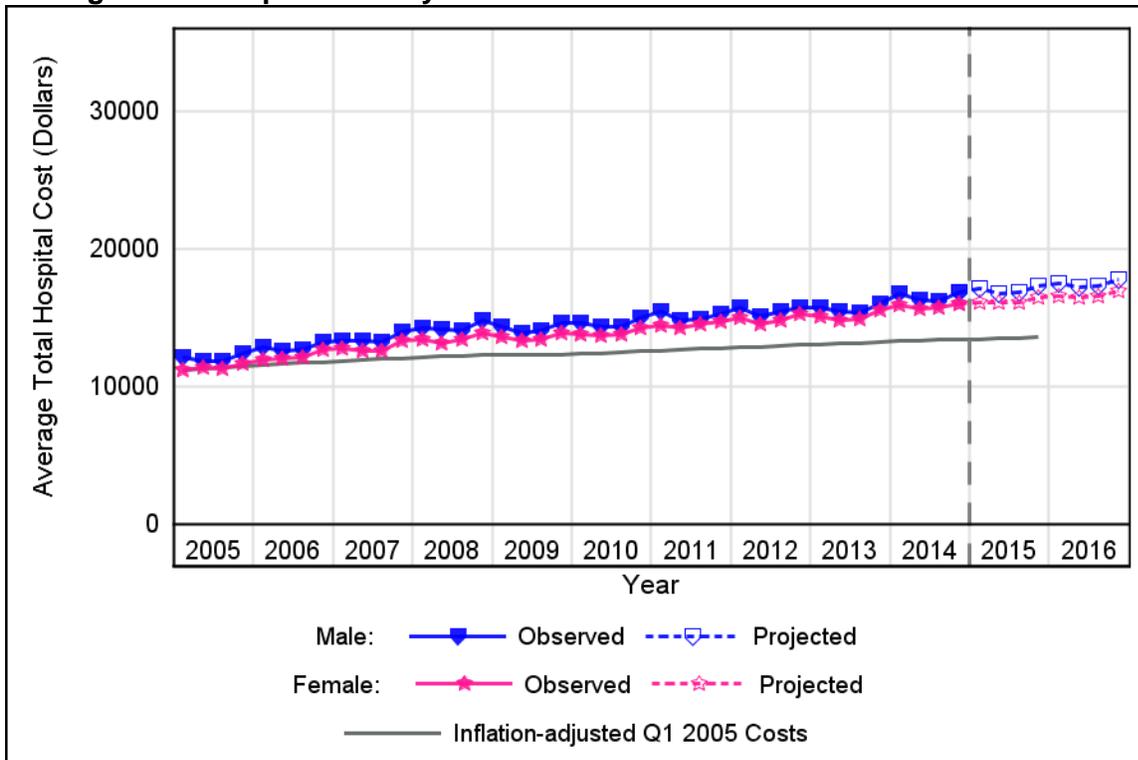
Inflation-adjusted Q1 2005 Costs: Cost per admission in the first quarter of 2005, adjusted for economy-wide inflation.

Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Average Total Hospital Cost by Age



Average Total Hospital Cost by Sex



Inflation-adjusted Q1 2005 Costs: Cost per admission in the first quarter of 2005, adjusted for economy-wide inflation.  
Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)  
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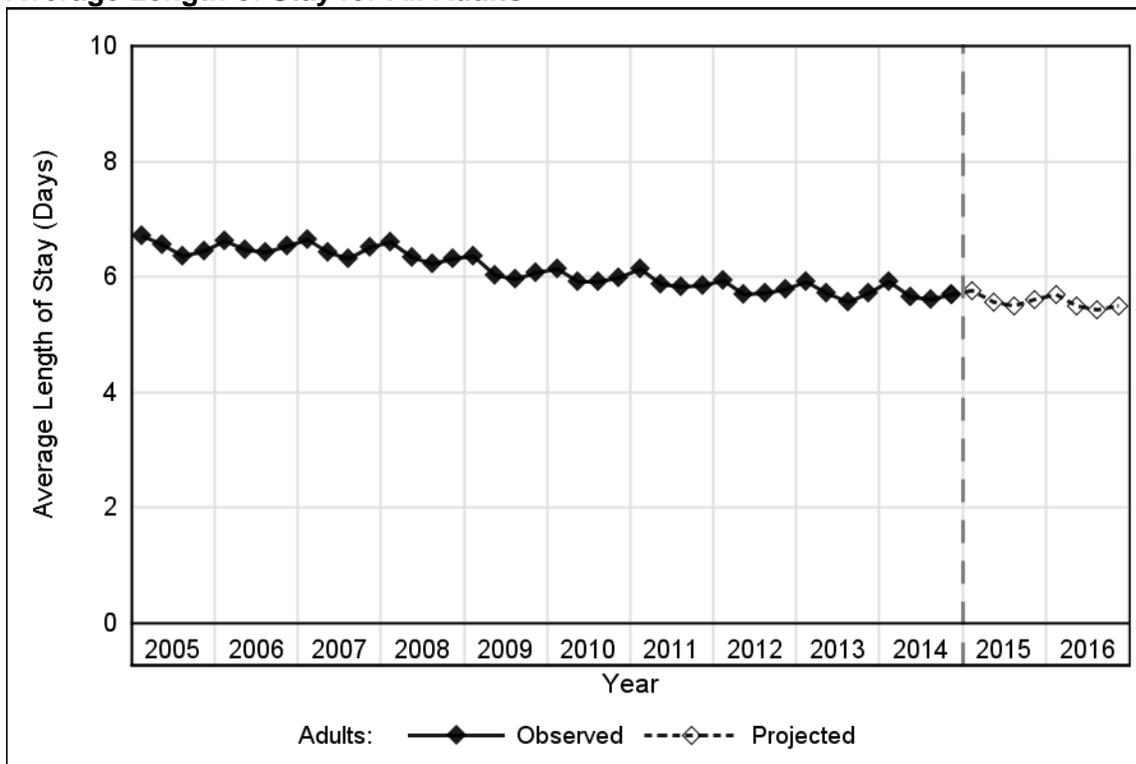
## Acute Stroke for Adults

### Average Length of Stay

#### Key Findings:

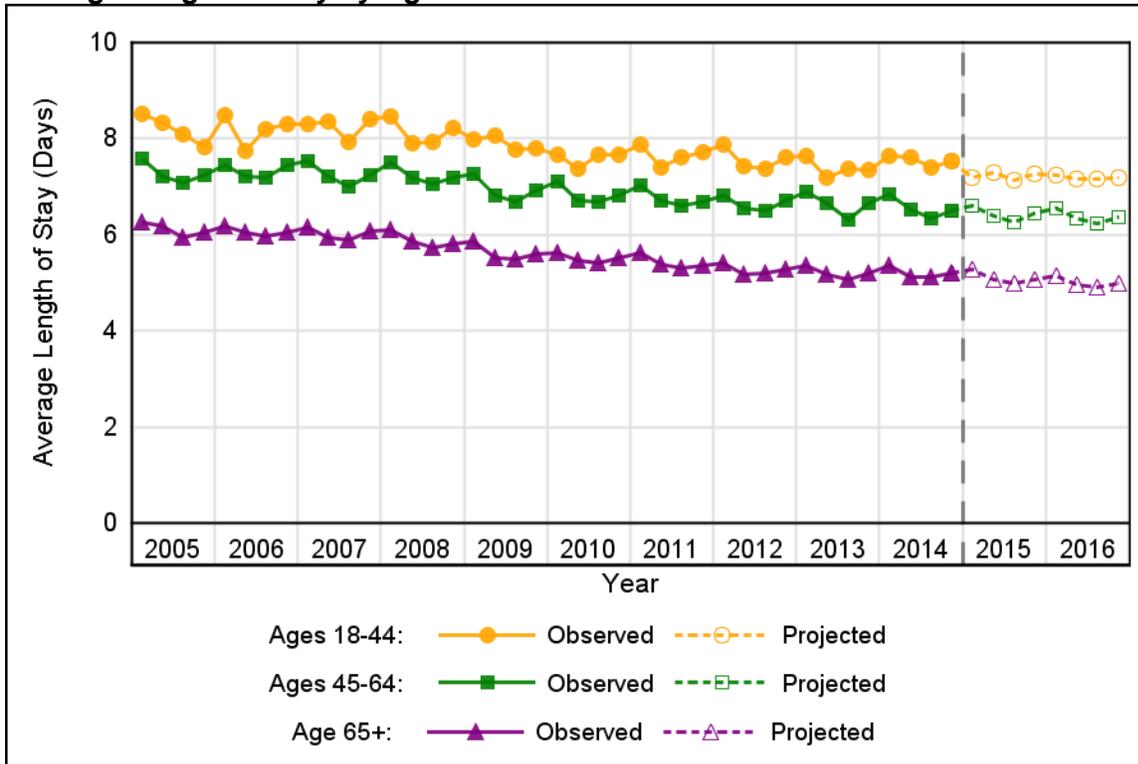
- The length of stay for discharges with acute stroke decreased over time, from 6.6 days in 2005 to 5.7 days in 2014. The length of stay is projected to be 5.5 days at the end of 2016.
- Adults aged 18–44 years had the longest length of stay, remaining relatively stable between 2005 and 2014 at 7.8 days. Adults aged 45–64 years had the next longest length of stay, at 7.3 days in 2005 and decreasing to 6.5 days in 2014. Adults aged 65 years and older had the shortest length of stay, at 6.2 days in 2005 and decreasing to 5.2 days in 2014.
- Length of stay was similar for males and females, decreasing from around 6.6 days in 2005 to 5.7 days in 2014.

#### Average Length of Stay for All Adults

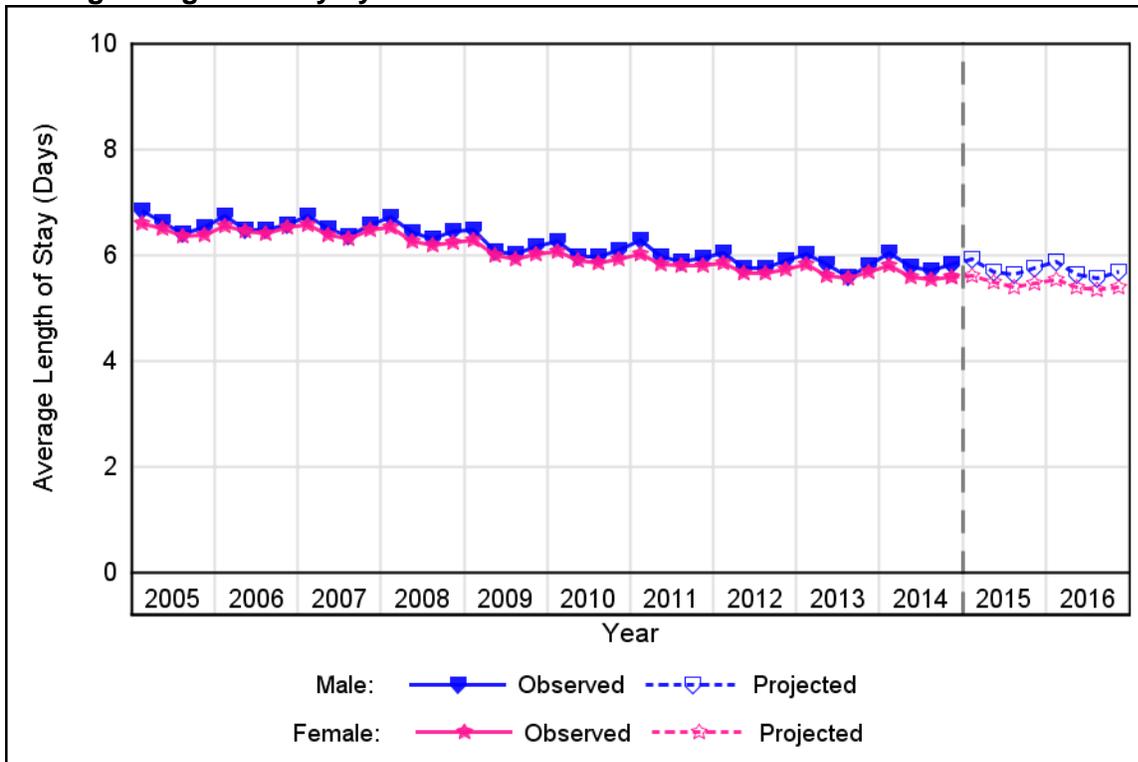


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Average Length of Stay by Age



Average Length of Stay by Sex



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

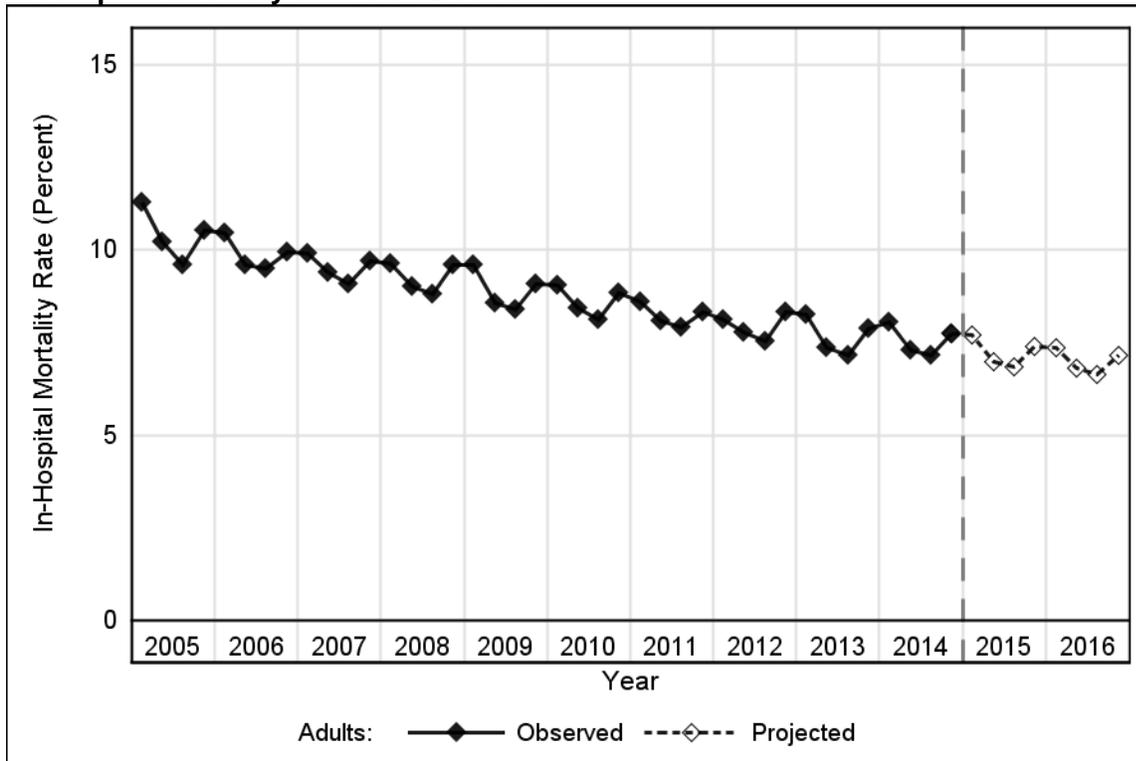
## Acute Stroke for Adults

### In-Hospital Mortality Rate

#### Key Findings:

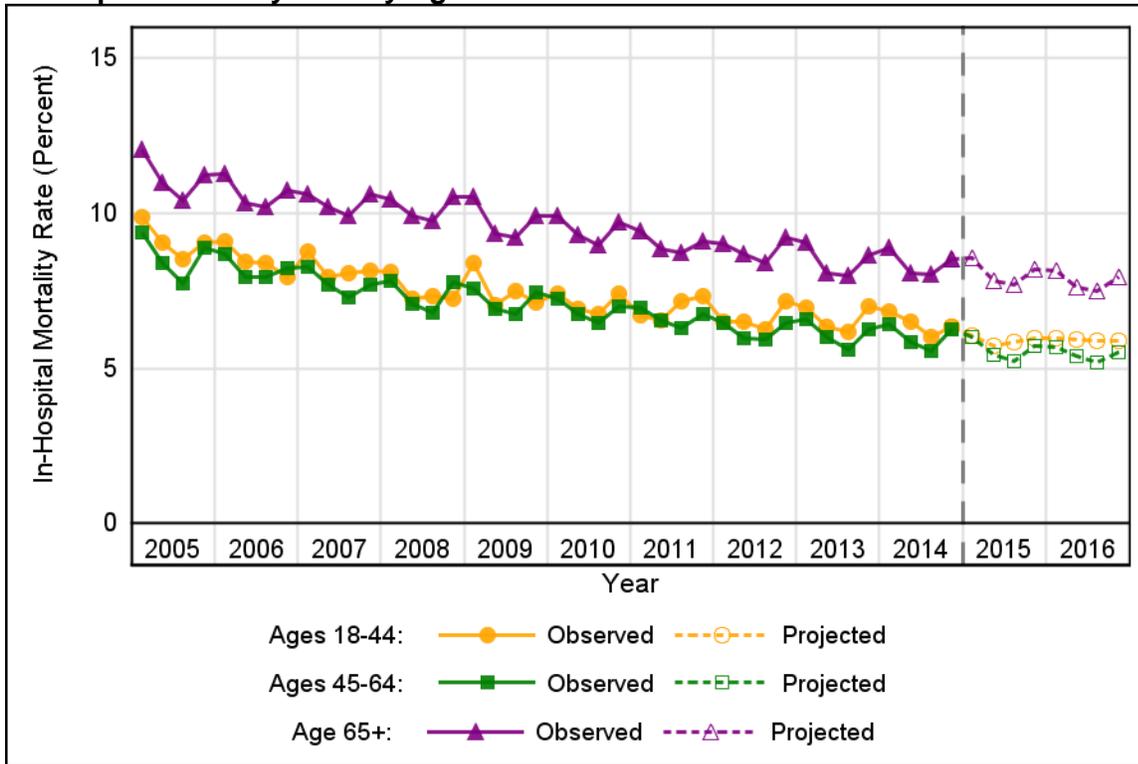
- The mortality rate for discharges with acute stroke decreased over time, from 10.4 percent in 2005 to 7.6 percent in 2014. The mortality rate is projected to be 7.2 percent at the end of 2016.
- Adults aged 65 years and older had the highest mortality rate, at 11.2 percent in 2005 and decreasing to 8.4 percent in 2014. The two youngest age groups had a similar mortality rate, at around 8.9 percent in 2005 and decreasing to 6.2 percent in 2014.
- The mortality rate was similar for males and females, decreasing from around 10.4 percent in 2005 to 7.6 percent in 2014.

#### In-Hospital Mortality Rate for All Adults

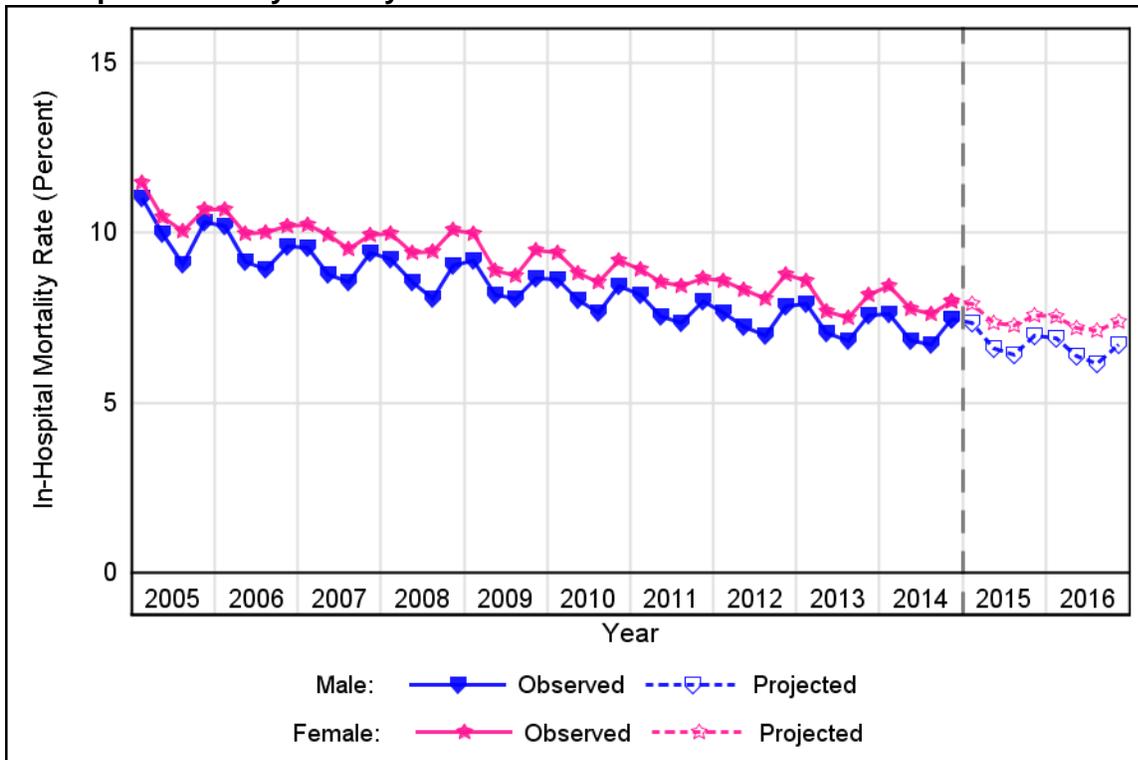


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

**In-Hospital Mortality Rate by Age**



**In-Hospital Mortality Rate by Sex**



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

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## AMI or Acute Stroke for Adults

Using the HCUP SID from 2005 to 2014 and early 2015 data from 17 States, different outcomes for inpatient discharges with a principal diagnosis of AMI or acute stroke are projected for 2015 to 2016.

### Projections include the following:

- Total inpatient discharges for all adults, adults by age group, and adults by sex. Discharge counts exclude inpatient stays that were transferred out to another acute care hospital. This ensures that these events are not double counted.
- Average total hospital cost for all adults, adults by age group, and adults by sex. Average total hospital cost reflects actual expenses incurred in the production of hospital services; physician costs are not included. For comparison, a line is included that depicts the change in the average inpatient hospital cost per admission in the first quarter of 2005 (Q1 2005) due solely to economy-wide inflation. The difference between the actual/projected cost line and the inflation-adjusted Q1 2005 cost line represents cost increases due to other noninflation factors, such as new technology, patient case mix, etc.
- Average length of stay for all adults, adults by age group, and adults by sex. In HCUP, the length of stay counts nights spent in the hospital. If a patient is admitted and discharged on the same day, the length of stay is zero.
- In-hospital mortality rate for all adults, adults by age group, and adults by sex.

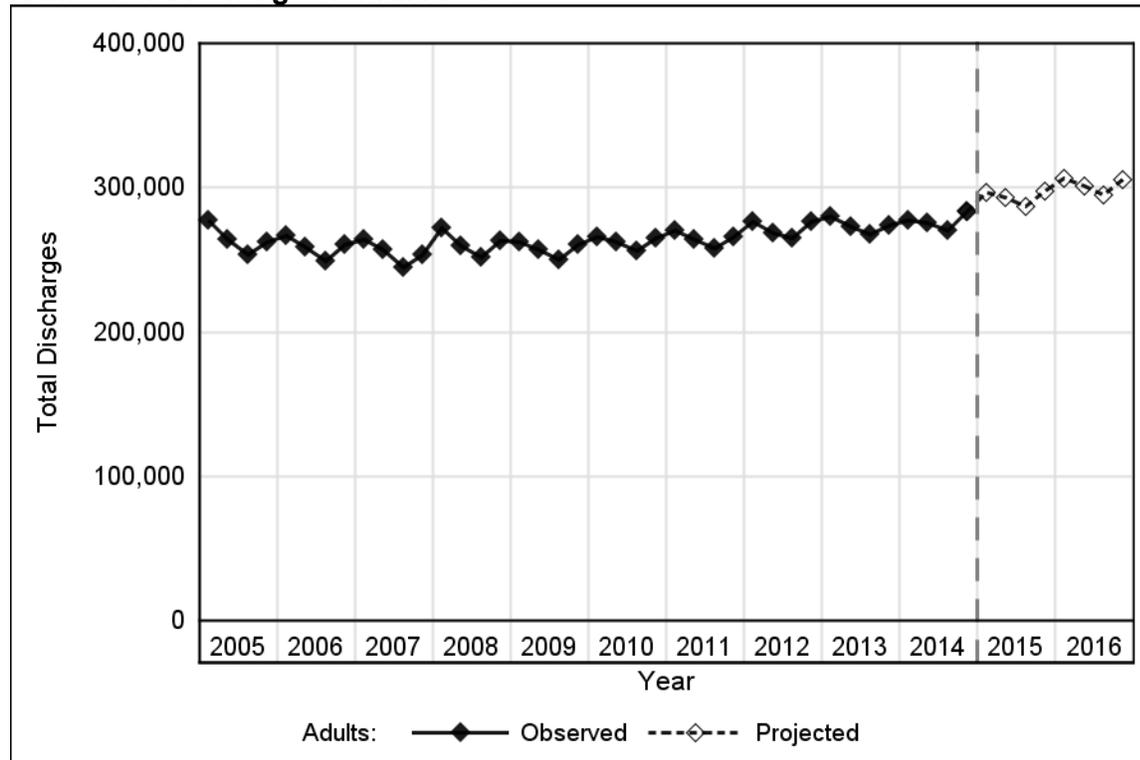
## AMI or Acute Stroke for Adults

### Number of Discharges

#### Key Findings:

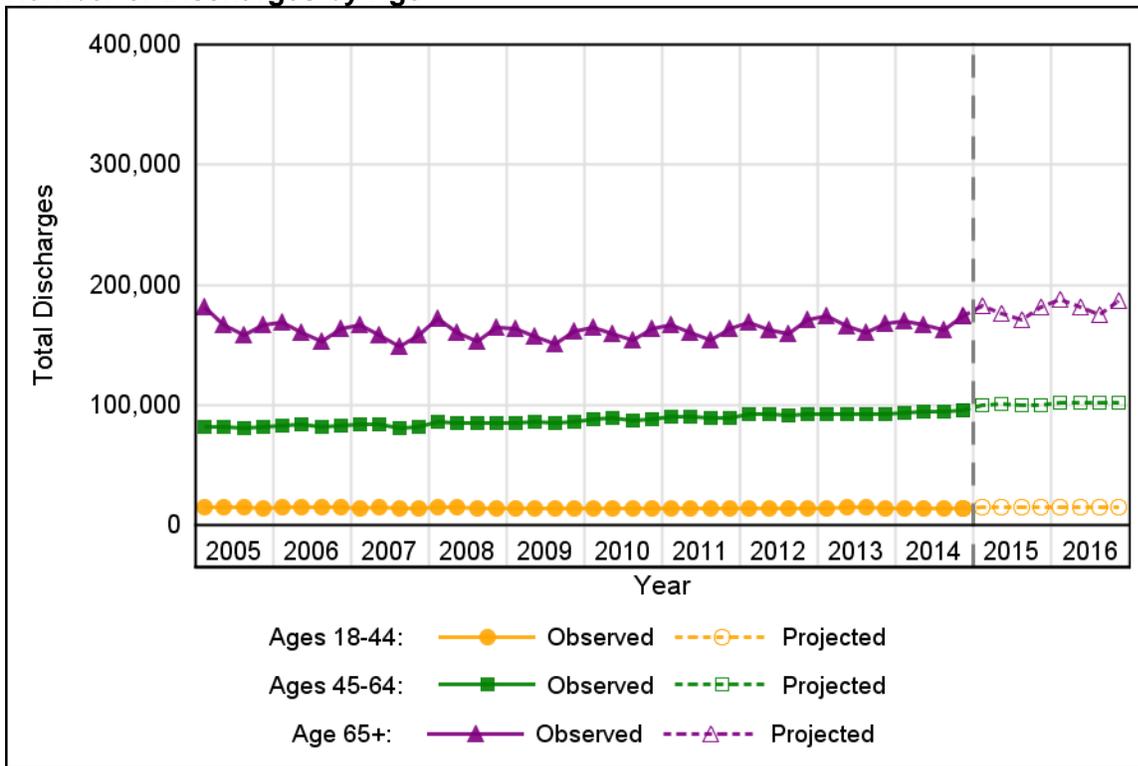
- The number of discharges for AMI or acute stroke was relatively stable over time, vacillating around 264,500 discharges per quarter between 2005 and 2014. The number of discharges is projected to be 306,000 at the end of 2016.
- Adults aged 65 years and older had the highest number of discharges, remaining relatively stable between 2005 and 2014 at about 163,000 discharges per quarter. Adults aged 45–64 years had the next highest number of discharges, at about 81,500 discharges per quarter in 2005 and increasing to 94,500 discharges per quarter in 2014. Adults aged 18–44 years had the lowest number of discharges, remaining relatively stable over time at about 14,500 discharges per quarter.
- Males had about 21,500 more discharges per quarter than did females between 2005 and 2014. Males had a relatively stable number of discharges over time at about 143,000 discharges per quarter. Females also had a relatively stable number of discharges over time at about 121,500 discharges per quarter.

#### Number of Discharges for All Adults

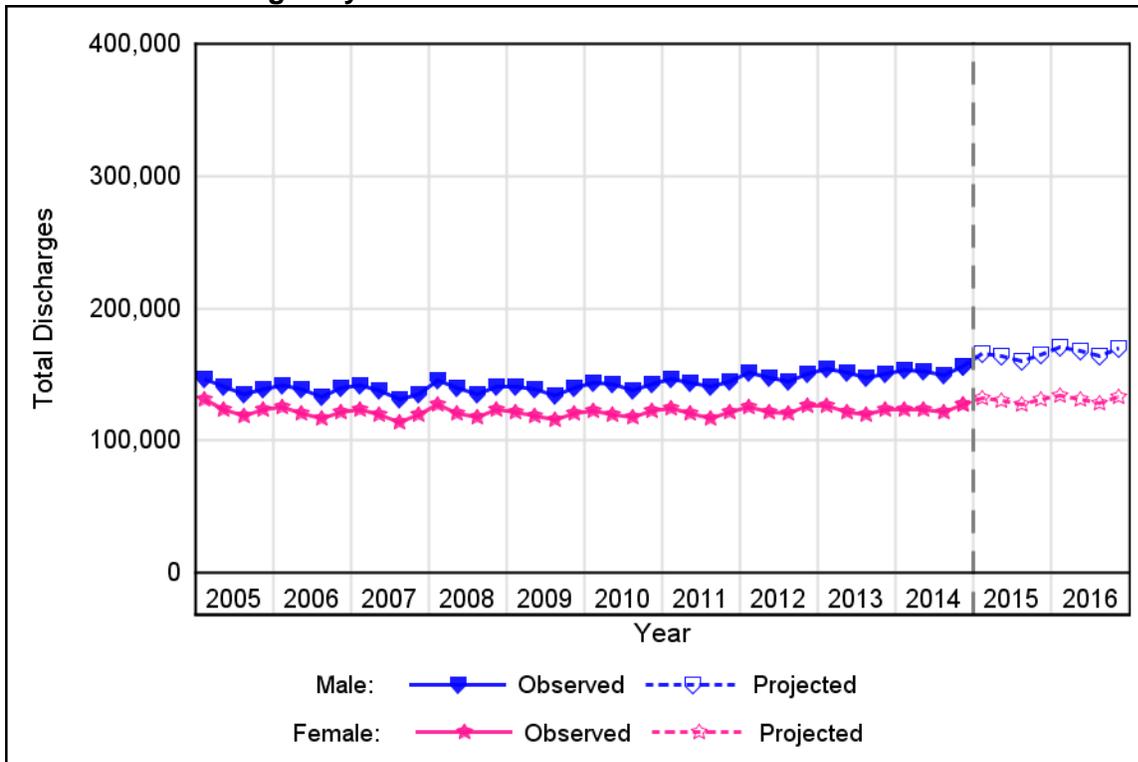


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Number of Discharges by Age



Number of Discharges by Sex



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

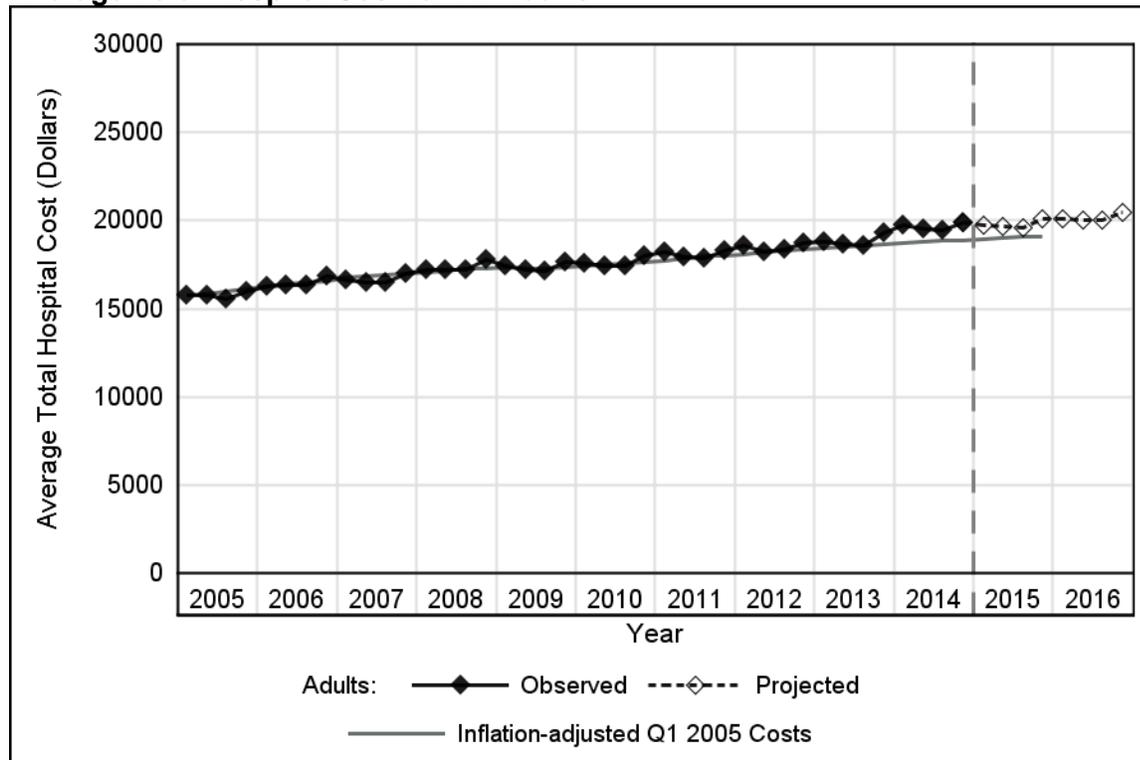
## AMI or Acute Stroke for Adults

### Average Total Hospital Cost

#### Key Findings:

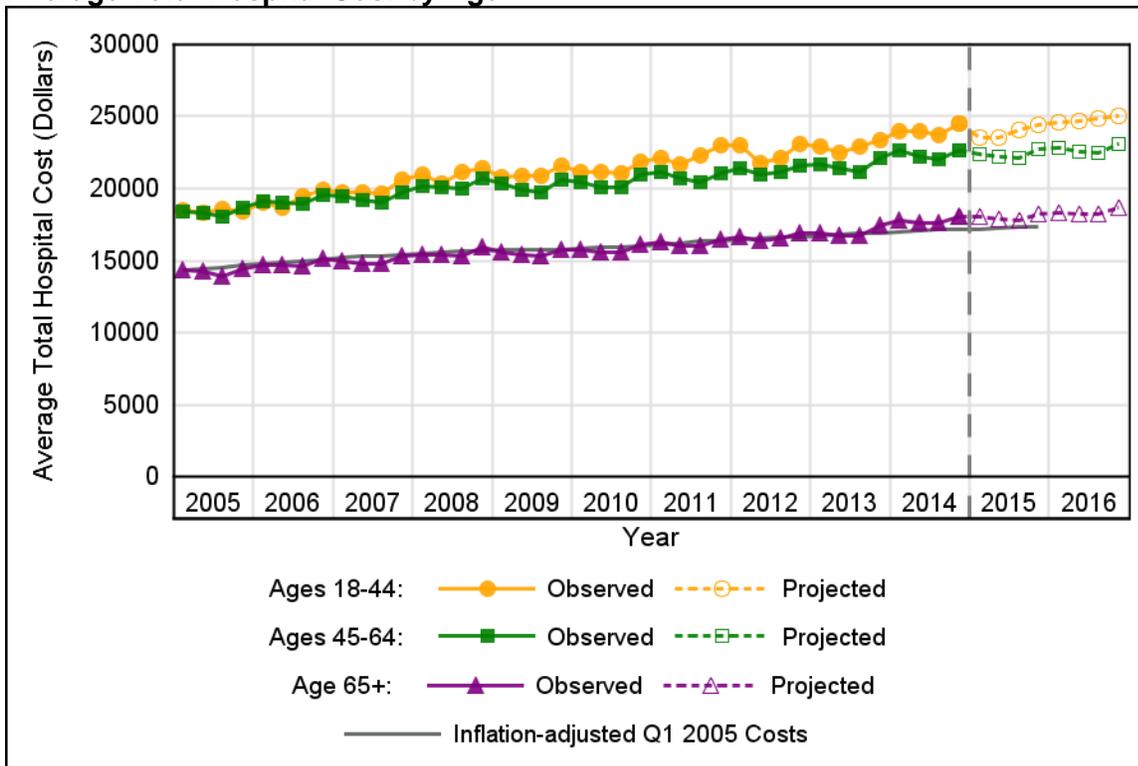
- The average hospital cost for discharges with AMI or acute stroke increased from about \$15,500 in 2005 to \$19,500 in 2014. The average hospital cost is projected to be \$20,500 at the end of 2016.
- The two youngest age groups had similar average hospital costs, increasing from about \$18,500 in 2005 to \$23,000 in 2014. Adults aged 65 years and older had the lowest average hospital cost, increasing from about \$14,000 in 2005 to \$18,000 in 2014.
- The average hospital cost was about \$3,000 higher for males than for females between 2005 and 2014. Males had an average hospital cost that increased from about \$17,000 in 2005 to \$21,000 in 2014. Females had an average hospital cost that increased from about \$14,500 in 2005 to \$18,000 in 2014.
- Using the Gross Domestic Product (GDP) price index, a cost of \$15,500 in 2005 would be equivalent to a cost of \$19,000 at the end of 2014. The average hospital cost through 2014 remained relatively consistent with the cost expected by inflation alone.

#### Average Total Hospital Cost for All Adults

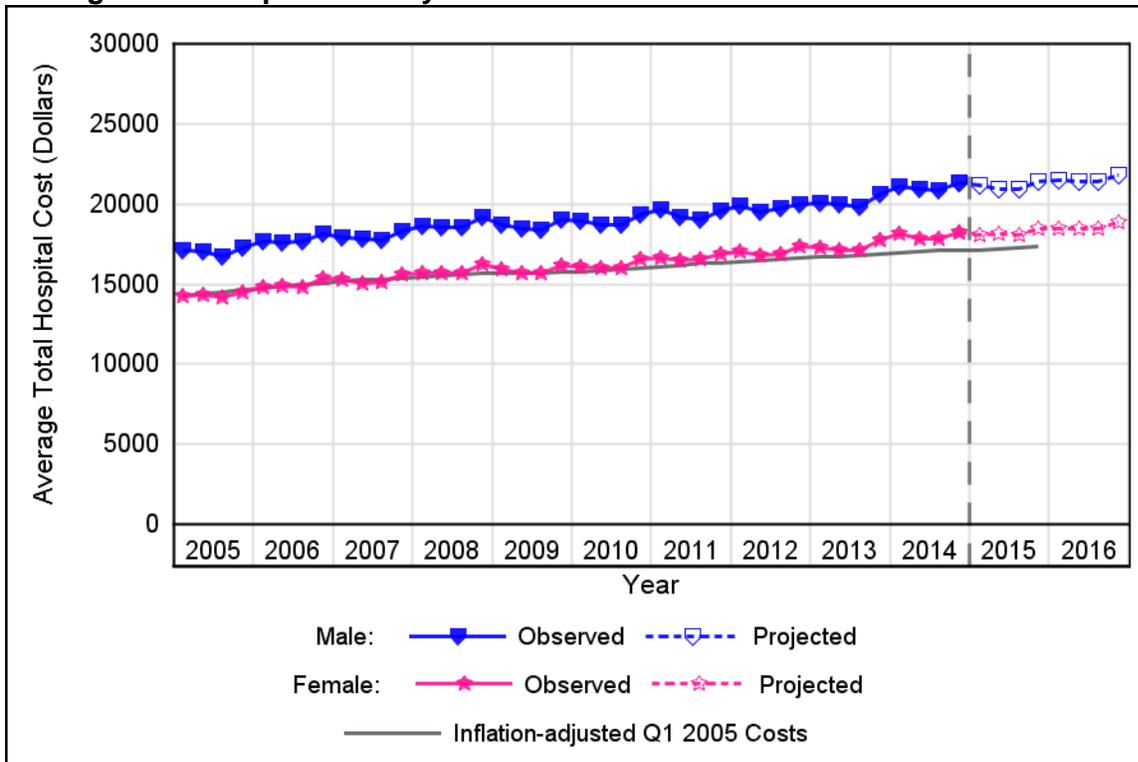


Inflation-adjusted Q1 2005 Costs: Cost per admission in the first quarter of 2005, adjusted for economy-wide inflation.  
Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Average Total Hospital Cost by Age



Average Total Hospital Cost by Sex



Inflation-adjusted Q1 2005 Costs: Cost per admission in the first quarter of 2005, adjusted for economy-wide inflation.  
Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)  
HCUP (06/01/16) 29 AMI and Acute Stroke Projections

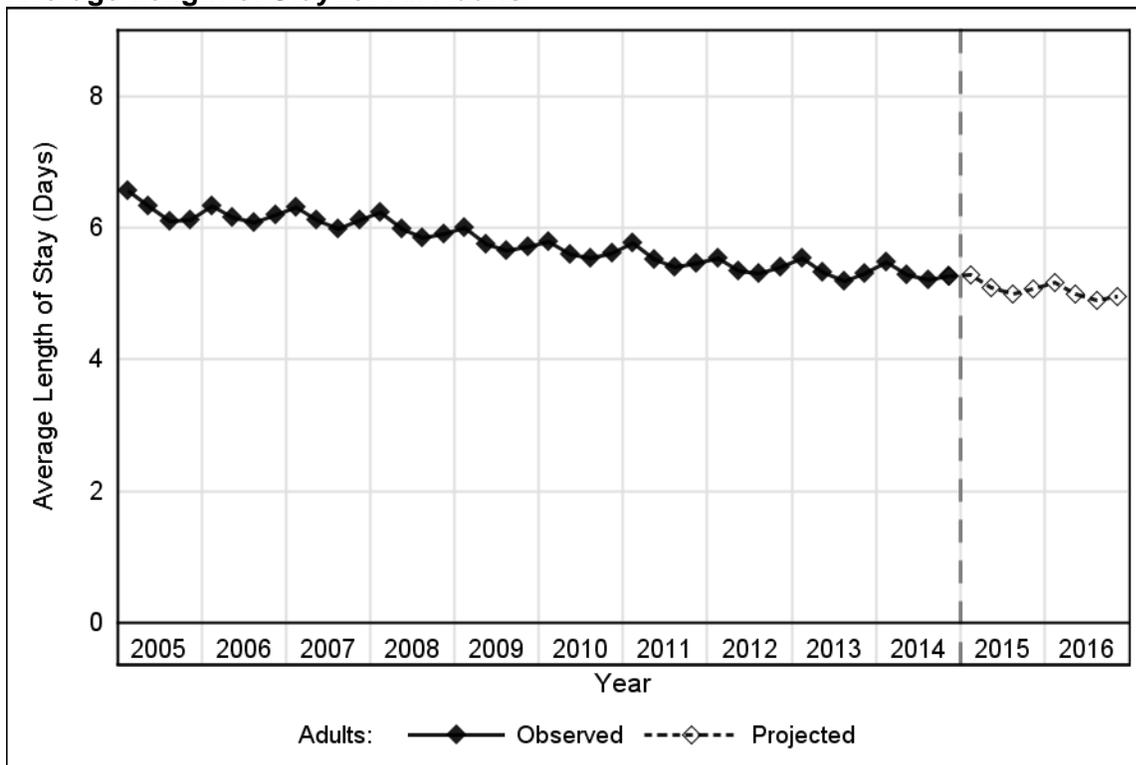
## AMI or Acute Stroke for Adults

### Average Length of Stay

#### Key Findings:

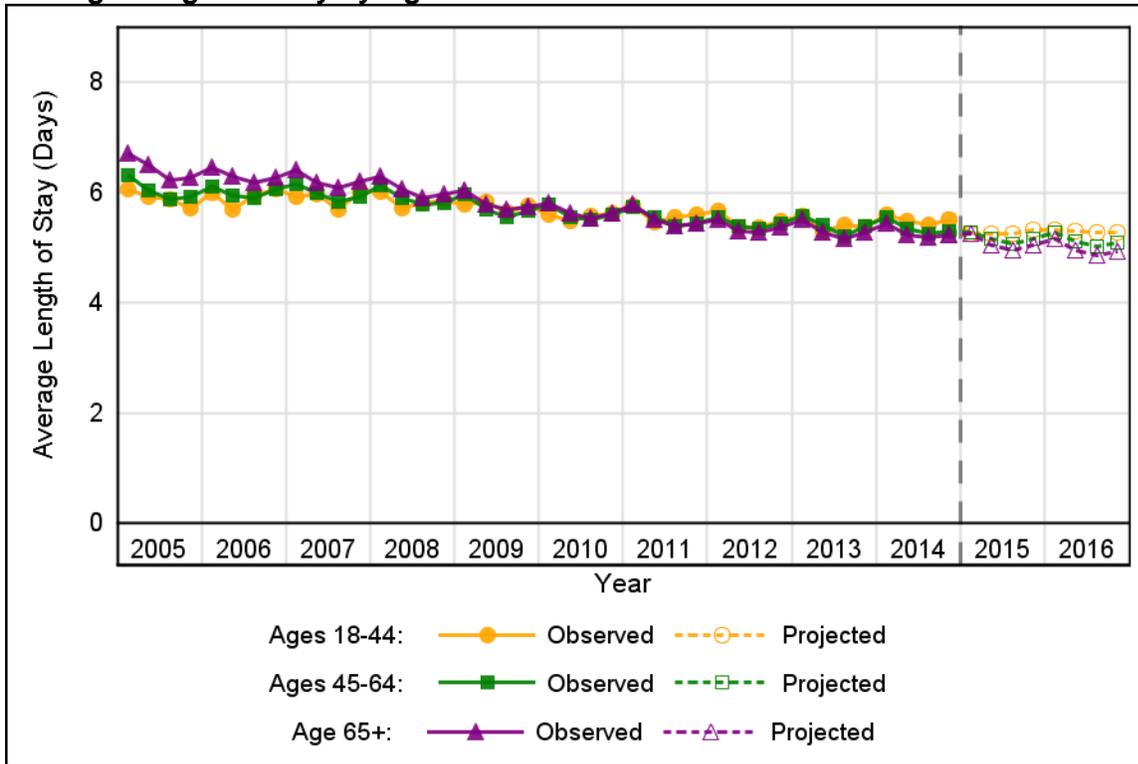
- The length of stay for discharges with AMI or acute stroke decreased over time, from 6.3 days in 2005 to 5.3 days in 2014. The length of stay is projected to be 5.0 days at the end of 2016.
- Length of stay was similar for all ages, decreasing from around 6.3 days in 2005 to 5.3 days in 2014.
- Length of stay was similar for males and females, decreasing from around 6.3 days in 2005 to 5.3 days in 2014.

#### Average Length of Stay for All Adults

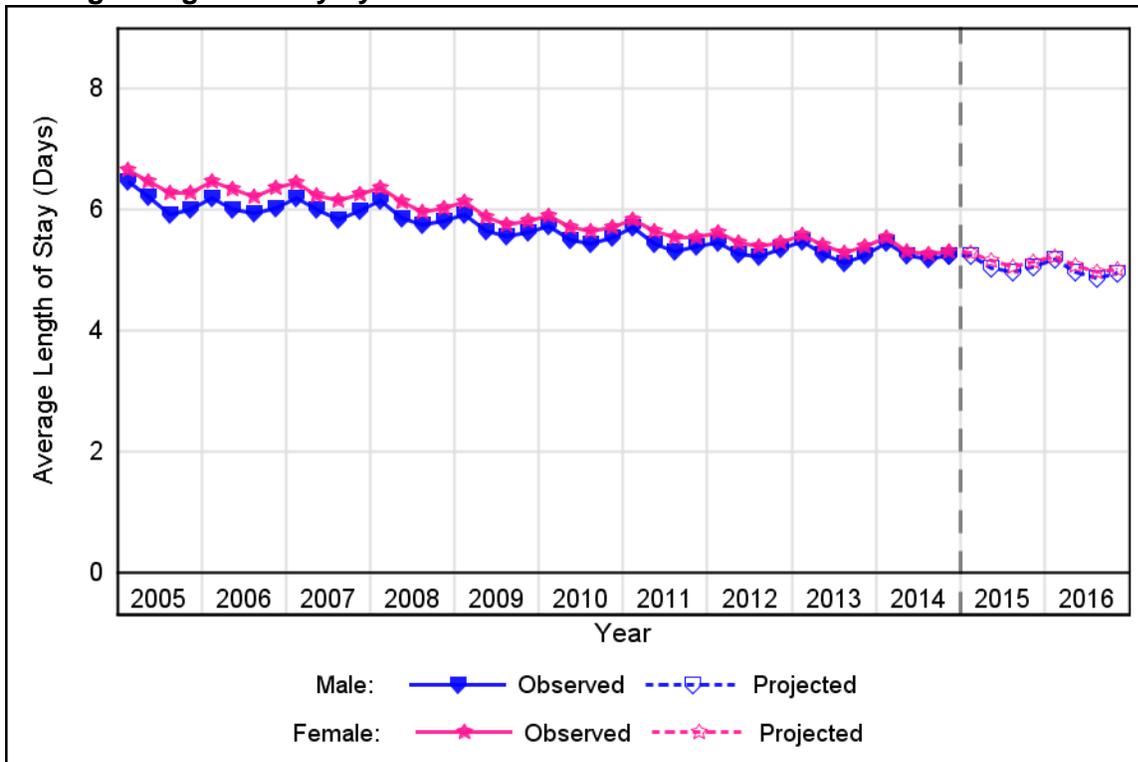


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

Average Length of Stay by Age



Average Length of Stay by Sex



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

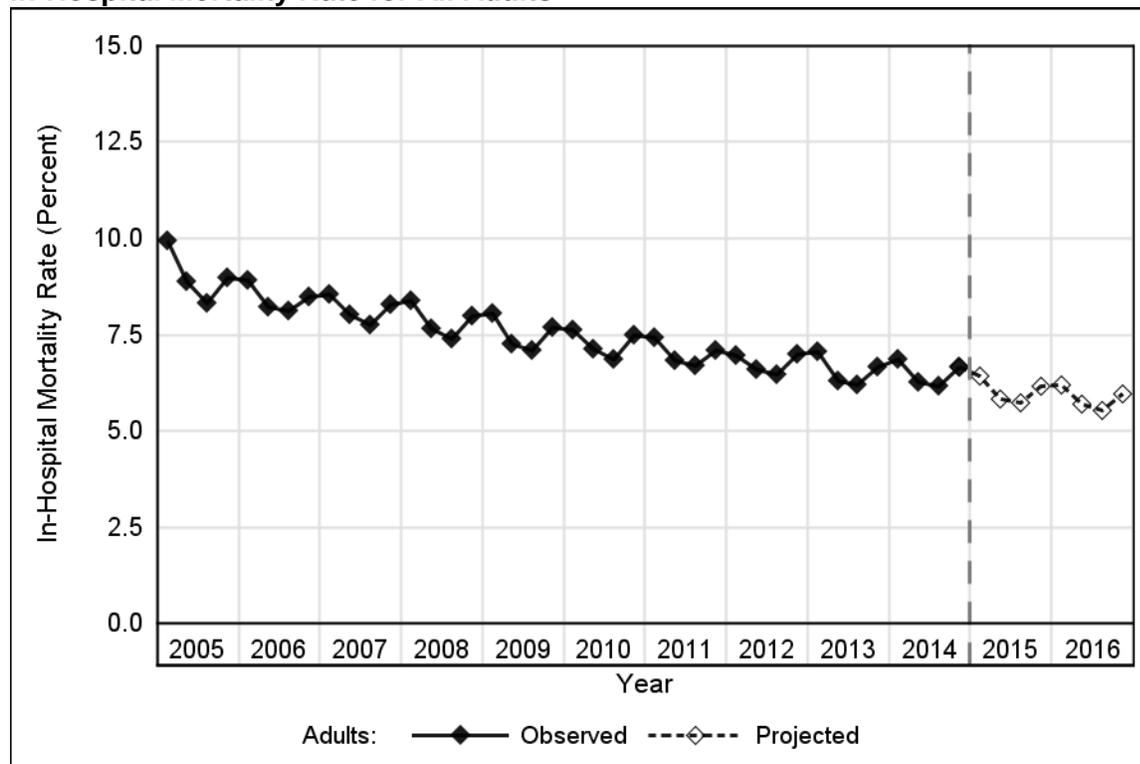
## AMI or Acute Stroke for Adults

### In-Hospital Mortality Rate

#### Key Findings:

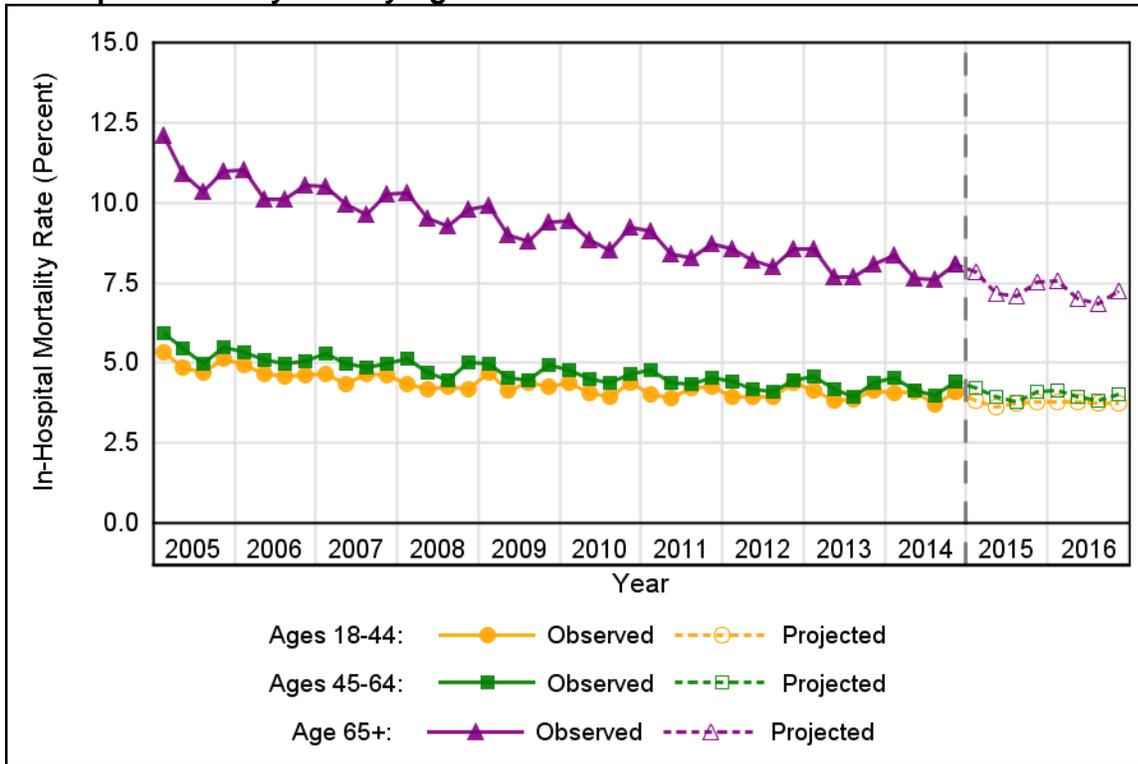
- The mortality rate for discharges with AMI or acute stroke decreased over time, from 9.0 percent in 2005 to 6.4 percent in 2014. The mortality rate is projected to be 6.0 percent at the end of 2016.
- Adults aged 65 years and older had the highest mortality rate, at 11.1 percent in 2005 and decreasing to 7.9 percent in 2014. The two youngest age groups had similar mortality rates, decreasing from around 5.2 percent in 2005 to 4.1 percent in 2014.
- The mortality rate was 1.7 percentage points higher for females than for males between 2005 and 2014. Females had a mortality rate that decreased from 10.1 percent in 2005 to 7.2 percent in 2014. Males had a mortality rate that decreased from 8.1 percent in 2005 to 5.9 percent in 2014.

#### In-Hospital Mortality Rate for All Adults

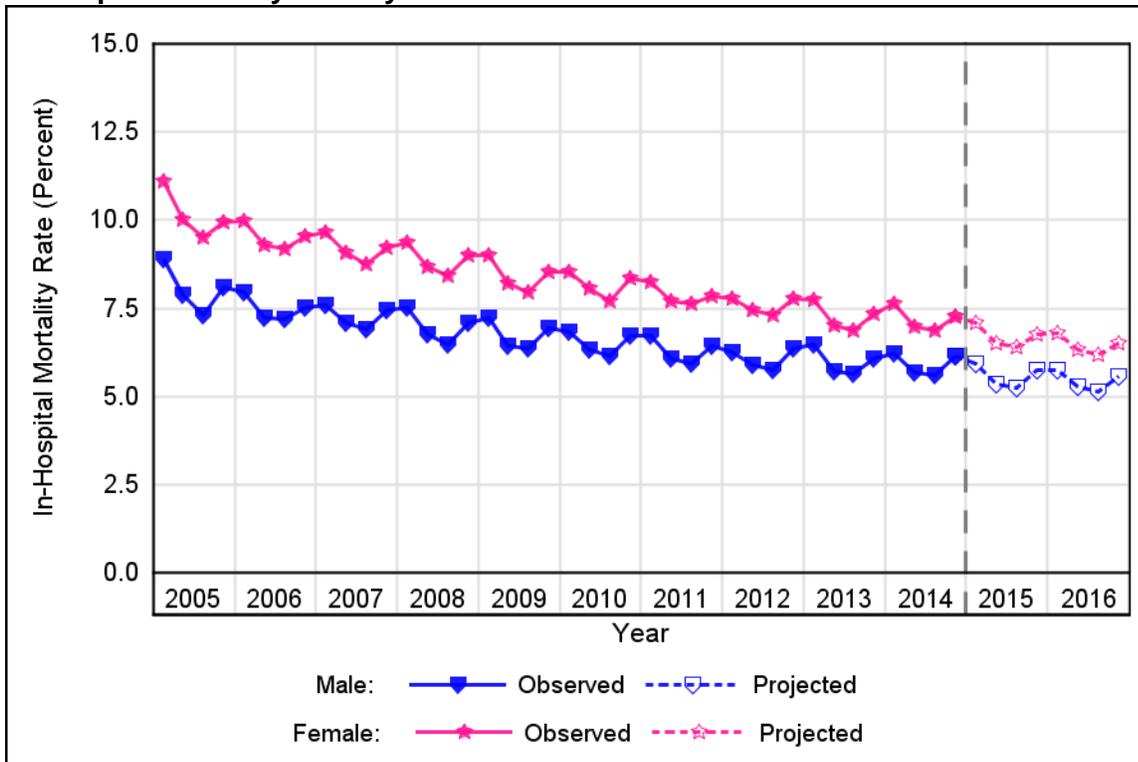


Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

**In-Hospital Mortality Rate by Age**



**In-Hospital Mortality Rate by Sex**



Source: Agency for Healthcare Research and Quality (AHRQ), Center for Delivery, Organization, and Markets, Healthcare Cost and Utilization Project (HCUP), State Inpatient Databases (SID)

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## Appendix I: HCUP Data Partners

**Alaska** State Hospital and Nursing Home Association

**Arizona** Department of Health Services

**Arkansas** Department of Health

**California** Office of Statewide Health Planning and Development

**Colorado** Hospital Association

**Connecticut** Hospital Association

**District of Columbia** Hospital Association

**Florida** Agency for Health Care Administration

**Georgia** Hospital Association

**Hawaii** Health Information Corporation

**Illinois** Department of Public Health

**Indiana** Hospital Association

**Iowa** Hospital Association

**Kansas** Hospital Association

**Kentucky** Cabinet for Health and Family Services

**Louisiana** Department of Health and Hospitals

**Maine** Health Data Organization

**Maryland** Health Services Cost Review Commission

**Massachusetts** Center for Health Information and Analysis

**Michigan** Health & Hospital Association

**Minnesota** Hospital Association

**Mississippi** Department of Health

**Missouri** Hospital Industry Data Institute

**Montana** MHA - An Association of Montana Health Care Providers

**Nebraska** Hospital Association

**Nevada** Department of Health and Human Services

**New Hampshire** Department of Health & Human Services

**New Jersey** Department of Health

**New Mexico** Department of Health

**New York** State Department of Health

**North Carolina** Department of Health and Human Services

**North Dakota** (data provided by the Minnesota Hospital Association)

**Ohio** Hospital Association

**Oklahoma** State Department of Health

**Oregon** Association of Hospitals and Health Systems

**Oregon** Office of Health Analytics

**Pennsylvania** Health Care Cost Containment Council

**Rhode Island** Department of Health

**South Carolina** Revenue and Fiscal Affairs Office

**South Dakota** Association of Healthcare Organizations

**Tennessee** Hospital Association

**Texas** Department of State Health Services

**Utah** Department of Health

**Vermont** Association of Hospitals and Health Systems

**Virginia** Health Information

**Washington** State Department of Health

**West Virginia** Health Care Authority

**Wisconsin** Department of Health Services

**Wyoming** Hospital Association

## Appendix II: Definitions for Acute Myocardial Infarction (AMI) and Acute Stroke

This section includes the coding criteria used to identify adult discharges with acute myocardial infarction (AMI) and acute stroke. Coding criteria is based on either International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes or the HCUP Clinical Classifications Software (CCS). CCS categorizes ICD-9-CM diagnoses and procedures into a manageable number of clinically meaningful categories.<sup>10</sup> This "clinical grouper" makes it easier to quickly understand patterns of diagnoses and procedures.

AMI and acute stroke are identified using the principal diagnosis, which is the condition established to be chiefly responsible for the patient's admission to the hospital.

Outcomes of interest include the following:

- Discharge counts:  
Number of discharges that meet the AMI or acute stroke coding criteria, excluding discharges transferred out to another acute care hospital
- Average total hospital cost:  
$$\frac{\text{Total cost for discharges that meet the AMI or acute stroke coding criteria, including transfers}}{\text{Discharge counts (definition above)}}$$
- Average length of stay:  
$$\frac{\text{Total days for discharges that meet the AMI or acute stroke coding criteria, including transfers}}{\text{Discharge counts (definition above)}}$$
- Mortality rate:  
$$\frac{\text{Number of discharges that meet the AMI or acute stroke coding criteria, with discharge disposition of died}}{\text{Discharge counts (definition above)}}$$

Outcome of interest also reported by adult age group (18–44, 45–64, and 65 years and above) and by sex.

<sup>10</sup> HCUP Clinical Classifications Software (CCS) for ICD-9-CM. Healthcare Cost and Utilization Project (HCUP). April 2016. U.S. Agency for Healthcare Research and Quality, Rockville, MD. <http://www.hcup-us.ahrq.gov/toolssoftware/ccs/ccs.jsp>. Accessed May 4, 2016.

## Appendix II: Definitions for Acute Myocardial Infarction (AMI) and Acute Stroke

<b>Acute Myocardial Infarction (AMI)</b>	
Coding criteria:	Adult discharge (age 18 and older) with a principal diagnosis of CCS 100 <i>Acute myocardial infarction</i> (equivalent to ICD-9-CM principal diagnosis code of 410**)

<b>Acute Stroke</b>	
Coding criteria:	<p>Adult discharge (age 18 and older) with an ICD-9-CM principal diagnosis of one of the following:</p> <ul style="list-style-type: none"> <li>• 430 Subarachnoid hemorrhage</li> <li>• 431 Intracerebral hemorrhage</li> <li>• 433.01 Occlusion and stenosis of basilar artery with cerebral infarction</li> <li>• 433.11 Occlusion and stenosis of carotid artery with cerebral infarction</li> <li>• 433.21 Occlusion and stenosis of vertebral artery with cerebral infarction</li> <li>• 433.31 Occlusion and stenosis of multiple and bilateral precerebral arteries with cerebral infarction</li> <li>• 433.81 Occlusion and stenosis of other specified precerebral artery with cerebral infarction</li> <li>• 433.91 Occlusion and stenosis of unspecified precerebral artery with cerebral infarction</li> <li>• 434.00 Cerebral thrombosis without mention of cerebral infarction</li> <li>• 434.01 Cerebral thrombosis with cerebral infarction</li> <li>• 434.10 Cerebral embolism without mention of cerebral infarction</li> <li>• 434.11 Cerebral embolism with cerebral infarction</li> <li>• 434.90 Cerebral artery occlusion, unspecified without mention of cerebral infarction</li> <li>• 434.91 Cerebral artery occlusion, unspecified with cerebral infarction</li> <li>• 436 Acute, but ill-defined, cerebrovascular disease</li> </ul>

<b>AMI or Acute Stroke</b>	
Coding criteria:	Adult discharge (age 18 and older) with a principal diagnosis of AMI or acute stroke (as defined above)

## Appendix III: Methods

This appendix describes the methods for projecting national outcomes of inpatient stays using the HCUP State Inpatient Databases (SID). The methodology leverages the breadth of more than 45 States and longitudinal data (up to ten years) to improve the timeliness of estimates of inpatient statistics. The following factors make this initiative possible:

- the longitudinal nature of HCUP State databases
- the breadth of the databases across 37 to 46 States depending on the data year
- the capacity of our HCUP Partners to provide timely quarterly data
- the modeling expertise among HCUP staff, both Federal and contract
- the use of recently-released SAS Econometric Time Series® Software
- the automated assembly of analytic results into a streamlined, ready-to-deliver report.

HCUP includes the largest collection of longitudinal hospital care data in the United States, with all-payer, encounter-level information beginning in 1988. The number of HCUP Partners has expanded over the years to include an ever-larger percentage of hospital discharges nationwide. In fact, the HCUP State Inpatient Databases (SID) encompass about 97 percent of all U.S. community hospital discharges, made possible by the data collection efforts of State data organizations, hospital associations, private data organizations, and the Federal government. The list of statewide data organizations that contribute to HCUP databases is available in Appendix I. Although full-year administrative hospital data typically lag the current calendar year by nine to 15 months, some HCUP Partner organizations can now produce quarterly data files within four to six months following the close of a quarter. This “early” data is used to inform the projection models.

Discharges from the SID were limited to those from hospitals that were open during any part of each calendar year and were designated as community hospitals by the American Hospital Association (AHA) Annual Survey of Hospitals, excluding rehabilitation hospitals. The definition of a community hospital was that used by the AHA: "all nonfederal short-term general and other specialty hospitals, excluding hospital units of institutions."

Projected outcomes include the following:

- Counts of inpatient discharges
- Average total hospital costs
- Average length of stay
- In-hospital mortality rate

## Appendix III: Methods

Total hospital charges were converted to costs using HCUP cost-to-charge ratios based on hospital accounting reports from the Centers for Medicare & Medicaid Services (CMS).<sup>11</sup> Costs reflect the actual expenses incurred in the production of hospital services, such as wages, supplies and utility costs, while charges represent the amount a hospital billed for the case. For each hospital, a hospital-wide cost-to-charge ratio is used. Hospital charges reflect the amount the hospital billed for the entire hospital stay and does not include professional (physician) fees. Inflation adjustments were not applied to the observed total cost. Projected total costs will estimate inflated charges. In HCUP, the length of stay counts nights spent in the hospital. If a patient is admitted and discharged on the same day, the length of stay is zero. Each outcome is projected for the measures specified in Appendix II: Definitions.

Projections were generated using the SAS Time Series Forecasting System™ (Version 9.4).<sup>12</sup> Projections were calculated first by State and then weighted proportionally to the nine Census divisions and the nation. For each State, the software automatically selected from among 40 different time series models the model with the lowest mean absolute percentage error (MAPE) for that State.

National quarterly trends were calculated by weighting State-level quarterly trends within each division. Total counts of discharges (excluding births) in each State and year were from the AHA Hospital Survey. HCUP discharges were weighted to totals within stratum defined by the following hospital characteristics: teaching status, size based on the number of beds, urban-rural location, and control. These AHA-based weights were used throughout the period, 2005–2014. For 2015, we had early quarterly data for 17 States. The 2015 projections incorporated observed rates for these 17 States and incorporated rates estimated from time series models for the remaining States. For 2016, the projections were entirely based on rates estimated from time series models.

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<sup>11</sup> HCUP Cost-to-Charge Ratio Files (CCR). Healthcare Cost and Utilization Project (HCUP). 2001–2012. U.S. Agency for Healthcare Research and Quality, Rockville, MD. Updated November 2015. <http://www.hcup-us.ahrq.gov/db/state/costtocharge.jsp>. Accessed May 4, 2016.

<sup>12</sup> *Large-Scale Automatic Forecasting Using Inputs and Calendar Events*. White Paper, SAS Institute Inc., 2009.