



## IN-HOSPITAL MORTALITY IN MISSISSIPPI, 2010

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**Purpose:** In-hospital mortality (deaths that occur during the time of patient hospitalization) is an important outcome of hospital admission. The purpose of this report was to examine Mississippi hospitalizations associated with in-hospital death during 2010. Specifically, this report outlines the demography of patients whose hospital stays ended with in-hospital death as well as the clinical reasons for such an outcome. In addition, the patients' comorbid conditions were defined and the in-hospital mortality rates for some major medical procedures associated with high numbers of in-hospital deaths were calculated.

**Database:** The findings in this report are based on inpatient hospital discharge data from all reporting hospitals in Mississippi during 2010. Reporting hospitals are short-term general hospitals, specialty hospitals, and long-term healthcare facilities such as psychiatric hospitals and chemical dependency treatment facilities.<sup>1</sup>

**Methods:** For data management and statistical analysis two software products were used: the Clinical Classification Software developed by the Agency for Healthcare Quality and Research and the All Patients Refined Diagnoses Related Groups developed by 3M Health Information Systems.<sup>2</sup> The comorbidity level was determined by the use of the Charlson Comorbidity Index, a measuring scheme that accounts for the number and seriousness of comorbid diseases.<sup>3</sup>

### KEY FINDINGS

*There were 8,814 reported in-hospital deaths during 2010 in Mississippi and the annual prevalence rate of in-hospital mortality was 2.3%. Caucasian males had the highest overall in-hospital mortality rate at 2.9%. African-American infants (0.8%) had over twice the mortality rate of Caucasian infants (0.3%).*

*The average age of patients who died in a hospital was 71.2 years, their average length of stay was 11 days, and their average charges were \$63,423.*

*Diseases of the respiratory system and the circulatory system accounted for nearly half (46%) of all deaths.*

*The medical condition with the highest volume of deaths was septicemia (16%), followed by adult respiratory failure (9.5%), pneumonia (7.1%), acute cerebrovascular disease (5.7%), congestive heart failure (4.8%) and acute myocardial infarction (4.2%).*

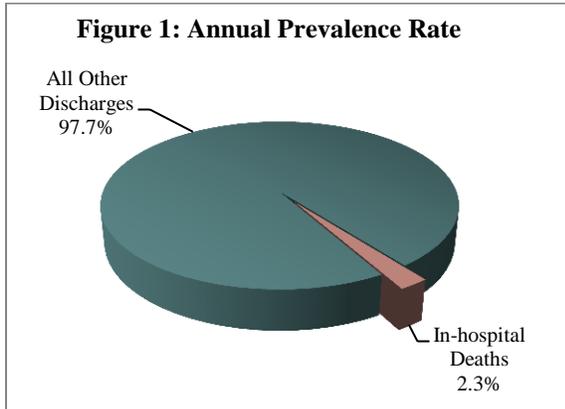
*Nearly one-fifth of all patients hospitalized with a primary diagnosis of adult respiratory failure or septicemia died during their hospital stay.*

*The majority of infants who died during their hospitalization were African-Americans (68.9%) and had low birth weights (73.8%). Publicly-funded insurers were responsible for the charges of 77.2% of all infant deaths.*

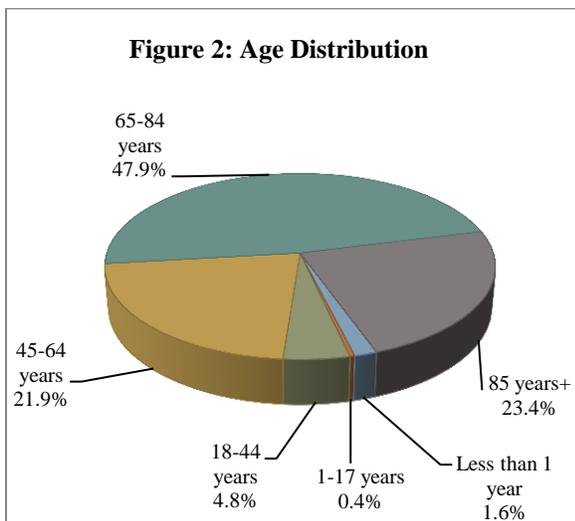
*Among the 8,634 adult patients who died in a hospital, 26.2% had coexisting congestive heart failure, 20.4% had coexisting chronic pulmonary disease, and 19.9% had coexisting diabetes mellitus.*

*Of all the primary procedures performed, respiratory intubation/mechanical ventilation, conversion of cardiac rhythm, and tracheostomy were associated with high numbers of deaths and high in-hospital mortality rates of 28%, 26.8%, and 21.5%, respectively.*

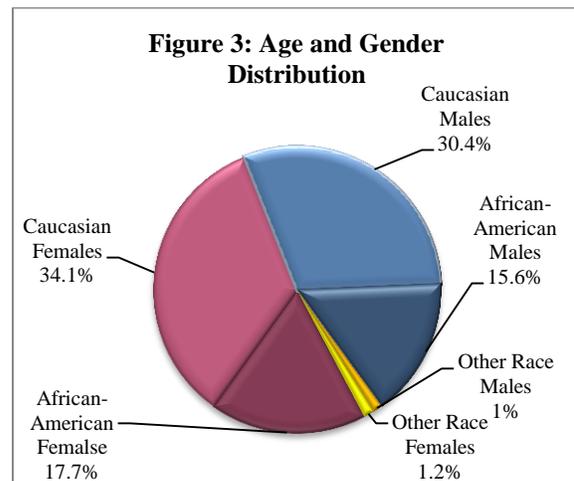
**Prevalence:** There were 8,814 recorded in-hospital deaths among the 377,528 recorded hospital discharges during 2010 in Mississippi, yielding an annual prevalence rate of in-hospital mortality of 2.3% (Figure 1).



**Demographics:** The average age of patients who died in a hospital was 71.2 years, while the average age of all other patients was 49.9 years. Patients between 65 and 84 years of age accounted for almost half of all in-hospital deaths (47.9%). Patients between 45 and 64 years of age and patients older than 85 years, each accounted for a little over of 20% of all hospitalizations associated with in-hospital deaths. Children between 1 and 17 years of age had the lowest number of in-hospital deaths (31 cases) and there were 145 recorded deaths among hospitalized infants (Figure 2).



Depicted in Figure 3 are the age and gender distribution of discharges associated with in-hospital death. More females (53%) than males (47%) died during their hospitalization and almost two thirds (64.5%) of all in-hospital fatalities occurred among Caucasian patients. Over one third of all deaths occurred among Caucasian females (34.1%), followed by Caucasian males (30.4%), African-American females (17.7%), and African-American males (15.6%).

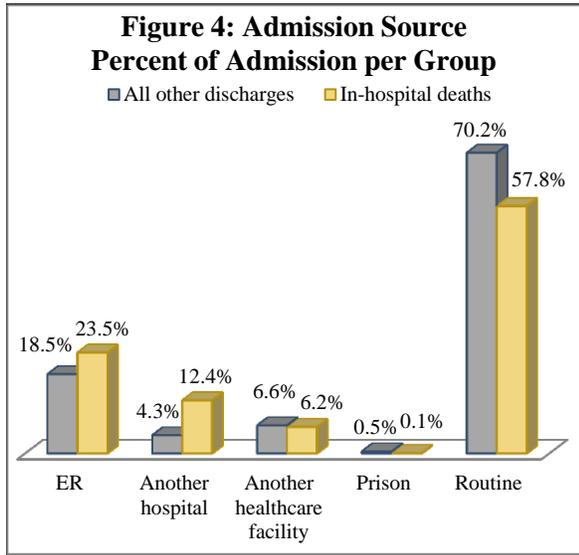


**Primary Expected Payer:** Medicare was the primary expected payer for the majority of patients with in-hospital death records (69.8%), followed by private insurances (12.6%), and Medicaid (8.4%).

**Admission Type:** Emergency-type hospital admissions accounted for 55.4% of hospitalizations associated with in-hospital death and for 42.5% among all other admissions. The distribution of the rest of the hospital admissions among the studied group was: 17.9% urgent, 23.7% elective and 3% other types.

**Admission Source:** Compared with all other discharges, patients who died during their hospitalization were more likely to be admitted via the emergency room route (23.5% versus 18.5%) and less likely to be routine admissions such as physician referral (57.8% versus 70.2%).

Patients who died during their hospitalization were also more likely to be transferred from another hospital than those who were discharged alive, respectively 12.4% and 4.3%. Other sources of admissions were similarly distributed among the two groups (Figure 4).



**Resource Utilization and Charges:** The average length of stay for patients who died in a hospital was 11 days (Table 1). In comparison, the average length of stay for patients who were discharged alive was 5.4 days. Infants who died in a hospital had the longest average length of stay (15.4 days), while older children had the shortest length of stay (6.2 days).

The average charges for hospitalizations associated with a death were \$63,423 while the average charges for patients discharged alive were \$24,595. Infants had the highest average charges (\$86,999) and charges for males were, on average, over \$4,000 more than for females. Average charges were higher for patients who died in long-term facilities and for those who died in facilities located in metro areas.

Patients who died in-hospital spent a total of 96,667 hospital days and the sum of their charges was \$559,009,576.

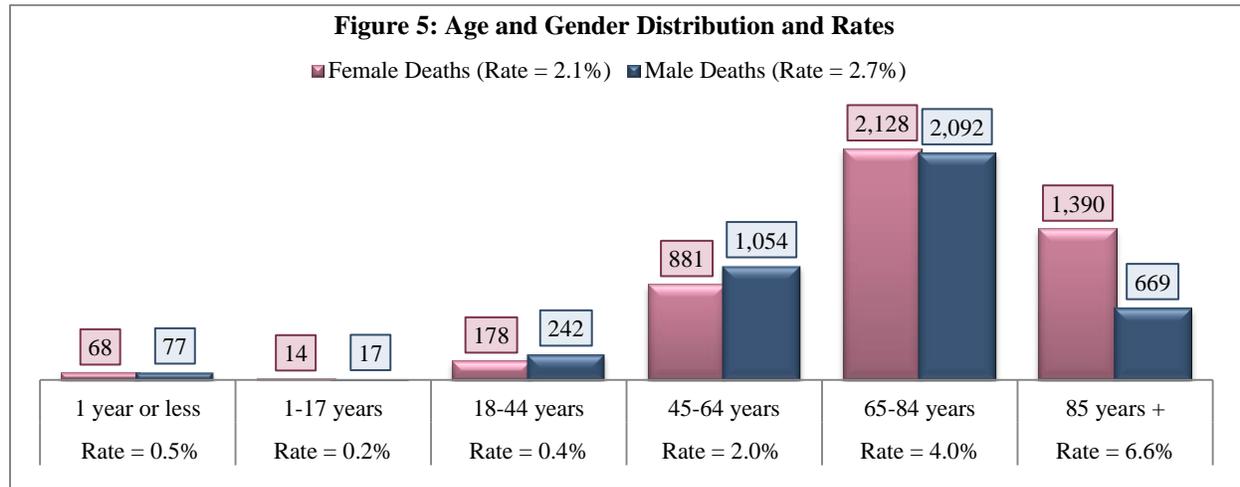
**Table 1: Resource Utilization and Charges for Hospitalizations Associated with In-hospital Death**

| CHARACTERISTIC           | DISCHARGES   |              | AVERAGE     |                 | SUM           |                      |
|--------------------------|--------------|--------------|-------------|-----------------|---------------|----------------------|
|                          | Number       | %            | LOS (days)  | Total Charges   | LOS (days)    | Total Charges        |
| <b>AGE GROUP*</b>        |              |              |             |                 |               |                      |
| Less than 1 year         | 145          | 1.6          | 15.4        | \$86,999        | 2,239         | \$12,614,877         |
| 1-17 years               | 31           | 0.4          | 6.2         | \$56,640        | 192           | \$1,755,852          |
| 18-44 years              | 420          | 4.8          | 8.8         | \$80,789        | 3,708         | \$33,931,531         |
| 45-64 years              | 1,935        | 22.0         | 10.7        | \$78,809        | 20,776        | \$152,495,556        |
| 65-84 years              | 4,220        | 47.9         | 10.2        | \$65,690        | 43,100        | \$277,211,808        |
| 85 years+                | 2,059        | 23.4         | 12.9        | \$39,268        | 26,647        | \$80,852,559         |
| <b>GENDER</b>            |              |              |             |                 |               |                      |
| Female                   | 4,663        | 52.9         | 12.0        | \$61,232        | 55,893        | \$285,525,139        |
| Male                     | 4,151        | 47.1         | 9.8         | \$65,884        | 40,774        | \$273,484,437        |
| <b>RACE</b>              |              |              |             |                 |               |                      |
| African-American         | 2,934        | 33.3         | 9.6         | \$66,113        | 28,188        | \$193,974,412        |
| Caucasian                | 5,680        | 64.4         | 11.8        | \$61,494        | 66,748        | \$349,285,254        |
| Other                    | 200          | 2.3          | 8.7         | \$78,750        | 1,731         | \$15,749,909         |
| <b>PAYER</b>             |              |              |             |                 |               |                      |
| Medicare                 | 6,148        | 69.8         | 9.4         | \$61,017        | 57,831        | \$375,132,932        |
| Medicaid                 | 741          | 8.4          | 26.0        | \$81,430        | 19,218        | \$60,339,746         |
| Private                  | 1,114        | 12.6         | 9.2         | \$70,603        | 10,198        | \$78,651,342         |
| Self-Pay                 | 255          | 2.9          | 21.1        | \$62,713        | 5,350         | \$15,991,863         |
| Other                    | 556          | 6.3          | 7.3         | \$51,967        | 4,070         | \$28,893,694         |
| <b>FACILITY LOCATION</b> |              |              |             |                 |               |                      |
| Metro Area               | 4,374        | 49.63        | 9.5         | \$81,743        | 41,510        | \$357,541,858        |
| Non-metro Area           | 4,440        | 50.37        | 12.4        | \$45,376        | 55,157        | \$201,467,718        |
| <b>FACILITY TYPE</b>     |              |              |             |                 |               |                      |
| Short-term               | 8,283        | 94.0         | 10.4        | \$60,118        | 86,324        | \$497,960,743        |
| Long-term                | 531          | 6.0          | 19.5        | \$114,970       | 10,343        | \$61,048,833         |
| <b>All</b>               | <b>8,814</b> | <b>100.0</b> | <b>11.0</b> | <b>\$63,423</b> | <b>96,667</b> | <b>\$559,009,576</b> |

\*There were four records with an invalid age and these records were not included in the data analysis for age group.

**Rates by Gender and Age:** Presented in Figure 5 are the numbers of deaths and the in-hospital death rates by gender and age group. Females had a slightly lower in-hospital mortality rate than males, 2.1% (4,663 cases) and 2.7% (4,151 cases) respectively. Patients over 85 years of age had the highest in-hospital death rate (6.6%).

Caucasian patients had an in-hospital death rate of 2.5%, while African-American patients had a rate of 2.1%. The in-hospital mortality rate was over twice as high for African-American infants (0.8%) as for Caucasian infants (0.3%). Caucasian females had higher in-hospital mortality rates than their African-American counterparts (2.3% versus 1.8%). African-American males had an in-hospital mortality rate of 2.5%, while Caucasian males had the highest overall in-hospital mortality rate of 2.9%.



**Table 2: In-hospital Mortality Rates by Age Group, Gender, and Race**

| RACE/AGE                 | ALL PATIENTS   |              |            | FEMALE         |              |            | MALE          |              |            |
|--------------------------|----------------|--------------|------------|----------------|--------------|------------|---------------|--------------|------------|
|                          | Discharges     | Deaths       | Rate (%)   | Discharges     | Deaths       | Rate (%)   | Discharges    | Deaths       | Rate (%)   |
| <b>Caucasian</b>         |                |              |            |                |              |            |               |              |            |
| Less than 1 year         | 16,744         | 43           | 0.3        | 7,948          | 26           | 0.3        | 8,788         | 17           | 0.2        |
| 1-17 years               | 8,046          | 13           | 0.2        | 4,105          | 7            | 0.2        | 3,941         | 6            | 0.2        |
| 18-44 years              | 47,958         | 163          | 0.3        | 34,779         | 61           | 0.2        | 13,179        | 102          | 0.8        |
| 45-64 years              | 54,894         | 1,034        | 1.9        | 28,401         | 463          | 1.6        | 26,493        | 571          | 2.2        |
| 65-84 years              | 74,865         | 2,928        | 3.9        | 41,751         | 1,452        | 3.5        | 33,113        | 1,476        | 4.5        |
| 85 years+                | 22,721         | 1,496        | 6.6        | 16,108         | 990          | 6.1        | 6,613         | 506          | 7.7        |
| <b>All</b>               | <b>225,228</b> | <b>5,677</b> | <b>2.5</b> | <b>133,092</b> | <b>2,999</b> | <b>2.3</b> | <b>92,127</b> | <b>2,678</b> | <b>2.9</b> |
| <b>African- American</b> |                |              |            |                |              |            |               |              |            |
| Less than 1 year         | 13,067         | 100          | 0.8        | 6,271          | 41           | 0.7        | 6,795         | 59           | 0.9        |
| 1-17 years               | 8,867          | 17           | 0.2        | 4,462          | 6            | 0.1        | 4,403         | 11           | 0.2        |
| 18-44 years              | 43,686         | 240          | 0.5        | 32,355         | 112          | 0.3        | 11,331        | 128          | 1.1        |
| 45-64 years              | 38,690         | 855          | 2.2        | 20,512         | 395          | 1.9        | 18,178        | 460          | 2.5        |
| 65-84 years              | 28,969         | 1,192        | 4.1        | 16,544         | 627          | 3.8        | 12,425        | 565          | 4.5        |
| 85 years+                | 8,094          | 529          | 6.5        | 5,938          | 375          | 6.3        | 2,156         | 154          | 7.1        |
| <b>All</b>               | <b>141,373</b> | <b>2,933</b> | <b>2.1</b> | <b>86,082</b>  | <b>1,556</b> | <b>1.8</b> | <b>55,288</b> | <b>1,377</b> | <b>2.5</b> |
| <b>Other Races</b>       |                |              |            |                |              |            |               |              |            |
| Less than 1 year         | 1,928          | 2            | 0.1        | 928            | 1            | 0.1        | 1,000         | 1            | 0.1        |
| 1-17 years               | 729            | 1            | 0.1        | 355            | 1            | 0.3        | 374           | 0            | 0.0        |
| 18-44 years              | 3,566          | 17           | 0.5        | 2,656          | 5            | 0.2        | 910           | 12           | 1.3        |
| 45-64 years              | 2,054          | 46           | 2.2        | 1,040          | 23           | 2.2        | 1,014         | 23           | 2.3        |
| 65-84 years              | 2,059          | 100          | 4.9        | 1,145          | 49           | 4.3        | 914           | 51           | 5.6        |
| 85 years+                | 591            | 34           | 5.8        | 420            | 25           | 6.0        | 171           | 9            | 5.3        |
| <b>All</b>               | <b>10,927</b>  | <b>200</b>   | <b>1.8</b> | <b>6,544</b>   | <b>104</b>   | <b>1.6</b> | <b>4,383</b>  | <b>96</b>    | <b>2.2</b> |

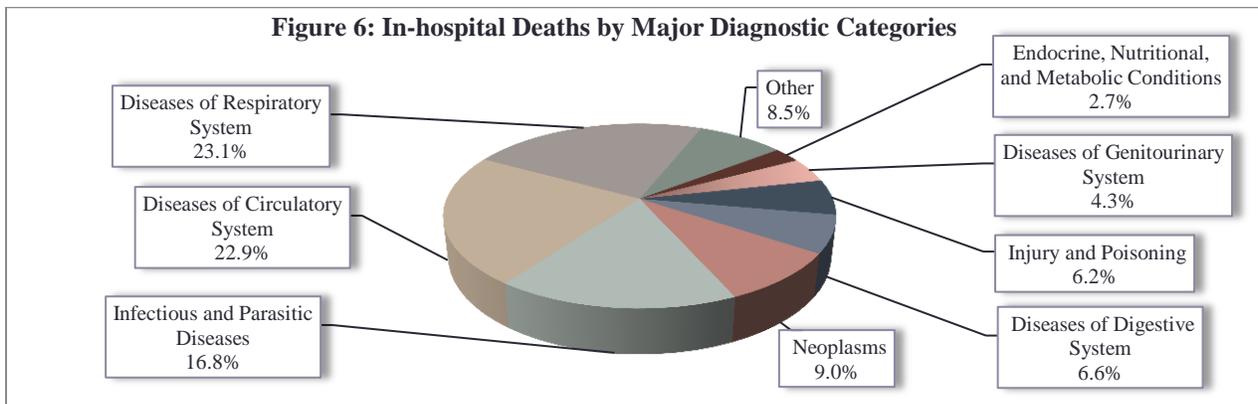
**Conditions Associated with In-hospital Deaths:** Primary diagnoses associated with in-hospital death were evaluated and ranked by major diagnostic categories and by specific clinical conditions. Note that the primary diagnosis is the chief condition established as responsible for the hospitalization.<sup>4</sup>

**Major Diagnostic Categories:** Depicted in Figure 6 are the major diagnostic categories associated with in-hospital death. Diseases of the respiratory system and the circulatory system were the two leading major diagnostic categories and they accounted for nearly half (46%) of all deaths. Infectious and parasitic diseases (16.8%) and malignancies (9%) were, respectively, the third and fourth leading major diagnostic categories of in-hospital deaths.

**The Top 10 Conditions:** The top ten diagnoses, presented in Table 3, accounted for 57.5% of all in-hospital deaths, but only for 18% of all

hospitalizations. The medical condition with the highest volume of deaths was, by far, septicemia, accounting for 16% of all in-hospital deaths. Septicemia was followed by two respiratory illnesses, adult respiratory failure (9.5%) and pneumonia (7.1%). All together, five out of the top ten conditions associated with in-hospital death were respiratory illnesses. Three circulatory system conditions, acute cerebrovascular disease (5.7%), congestive heart failure (4.8%), and acute myocardial infarction (4.2%) were the fourth, five, and six major reasons for in-hospital deaths during 2010.

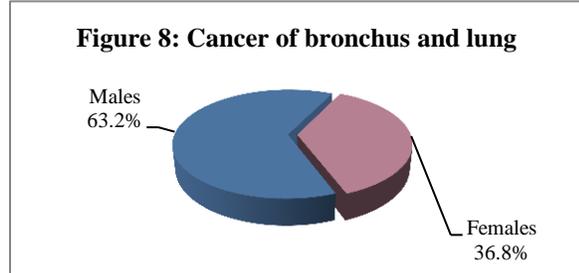
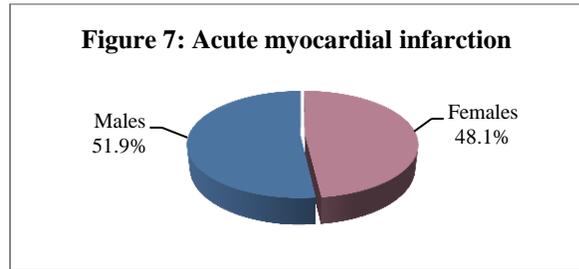
**Mortality Rates by Diagnosis:** Further analysis revealed that two medical conditions, adult respiratory failure and septicemia, were associated with very high in-hospital mortality rates (Table 3). Nearly one fifth of all patients hospitalized with a primary diagnosis of adult respiratory failure or septicemia died during their hospital stay during 2010 in Mississippi.



**Table 3: Top 10 Primary Diagnoses Associated with In-hospital Deaths**

| Rank | Primary Diagnosis                      | In-hospital Deaths |             | Hospitalizations |             | Mortality among all hospitalized for this condition (%) |
|------|--|--------------------|-------------|------------------|-------------|---|
|      |  | Died               | %           | Hospitalized     | %           |   |
| 1    | Septicemia                             | 1,406              | 16.0        | 7,388            | 2.0         | 19.0  |
| 2    | Adult respiratory failure              | 834                | 9.5         | 4,327            | 1.2         | 19.3  |
| 3    | Pneumonia                              | 629                | 7.1         | 14,160           | 3.8         | 4.4   |
| 4    | Acute cerebrovascular disease          | 498                | 5.7         | 6,330            | 1.7         | 7.9   |
| 5    | Congestive heart failure               | 421                | 4.8         | 11,230           | 3.0         | 3.7   |
| 6    | Acute myocardial infarction            | 374                | 4.2         | 6,218            | 1.7         | 6.0   |
| 7    | Aspiration pneumonitis                 | 275                | 3.1         | 1,885            | 0.5         | 14.6  |
| 8    | Acute and unspecified renal failure    | 233                | 2.6         | 3,993            | 1.1         | 5.8   |
| 9    | Cancer of bronchus and lung            | 209                | 2.4         | 1,418            | 0.4         | 14.7  |
| 10   | Chronic Obstructive Pulmonary Disease  | 183                | 2.1         | 9,760            | 2.6         | 1.9   |
|      | <b>Total for the top ten diagnoses</b> | <b>5,062</b>       | <b>57.5</b> | <b>66,709</b>    | <b>18.0</b> | <b>7.6</b>  |

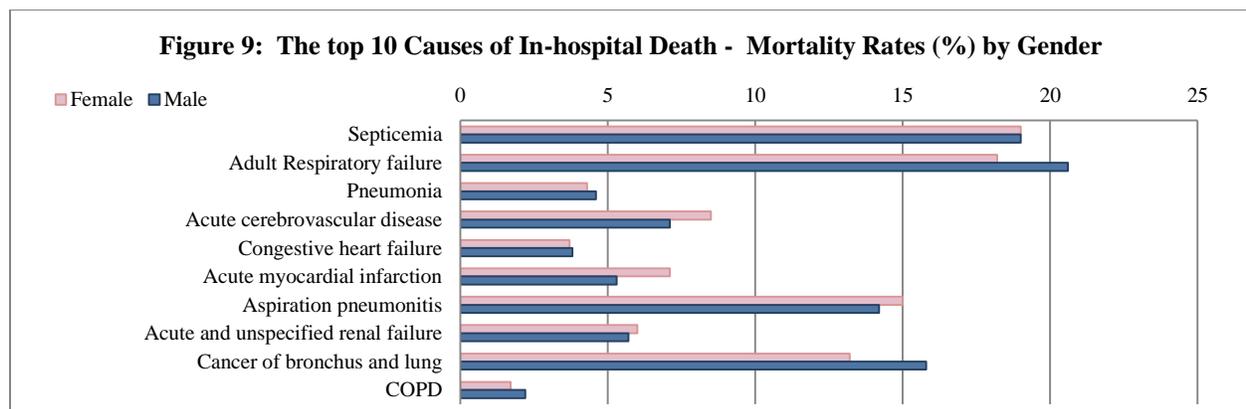
**Deaths by Condition and Gender:** Women had higher absolute numbers of in-hospital deaths for all conditions among the top ten causes, except for acute myocardial infarction, lung cancer, and aspiration pneumonitis (Figure 7 and Figure 8).



**Mortality Rates by Condition and Gender:** While more women than men died due to septicemia, the examination of the mortality rates by gender demonstrated that females and males had equal rates of septicemia-related deaths (Table 4 and Figure 9). Furthermore, while there were more males who died as result of myocardial infarction, females had a higher in-hospital mortality rate due to this condition. Women also had a higher in-hospital death rate due to acute cerebrovascular disease (stroke), aspiration pneumonitis, and acute and unspecified renal failure. The females, however, had lower rates for the rest of the top 10 diagnoses associated with in-hospital death, adult respiratory failure, pneumonia, congestive heart failure, lung cancer and chronic obstructive pulmonary disease (COPD). Lung cancer and adult-type respiratory failure had the greatest difference in the mortality rates between genders.

**Table 4: Numbers and Rates of In-hospital Mortality by Gender**

| Rank | Primary Diagnosis                   | In-hospital Deaths |       | Hospitalizations |       | Mortality Rate (%) |      |
|------|-------------------------------------|--------------------|-------|------------------|-------|--------------------|------|
|      |                                     | Females            | Males | Female           | Males | Female             | Male |
| 1    | Septicemia                          | 759                | 647   | 3,987            | 3,401 | 19.0               | 19.0 |
| 2    | Adult Respiratory failure           | 442                | 392   | 2,422            | 1,905 | 18.2               | 20.6 |
| 3    | Pneumonia                           | 331                | 298   | 7,669            | 6,490 | 4.3                | 4.6  |
| 4    | Acute cerebrovascular disease       | 290                | 208   | 3,416            | 2,914 | 8.5                | 7.1  |
| 5    | Congestive heart failure            | 225                | 196   | 6,066            | 5,164 | 3.7                | 3.8  |
| 6    | Acute myocardial infarction         | 180                | 194   | 2,527            | 3,691 | 7.1                | 5.3  |
| 7    | Aspiration pneumonitis              | 137                | 138   | 915              | 970   | 15.0               | 14.2 |
| 8    | Acute and unspecified renal failure | 124                | 109   | 2,064            | 1,929 | 6.0                | 5.7  |
| 9    | Cancer of bronchus and lung         | 77                 | 132   | 582              | 836   | 13.2               | 15.8 |
| 10   | COPD                                | 92                 | 91    | 5,538            | 4,222 | 1.7                | 2.2  |



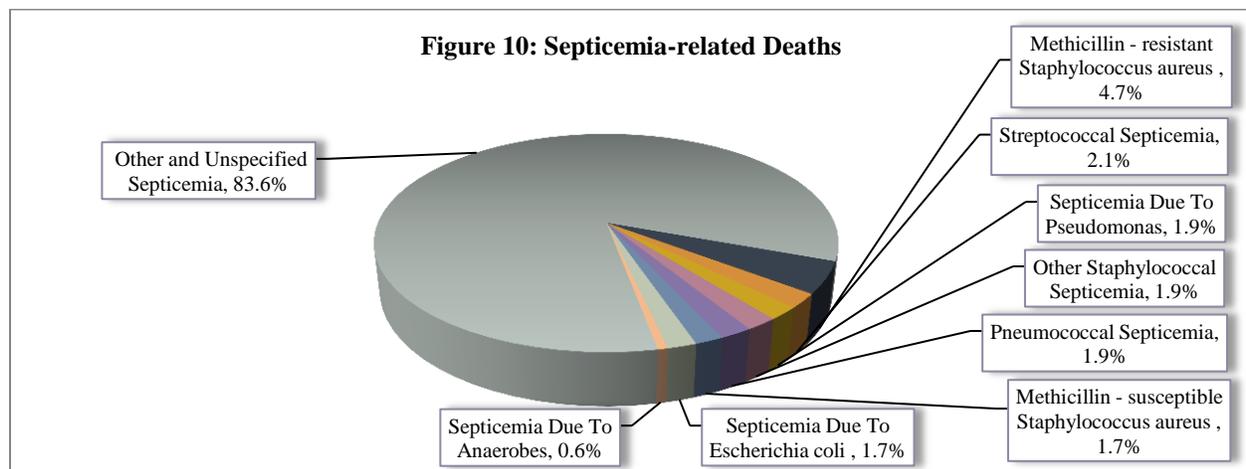
**In-hospital Mortality by Age:** For the purpose of this analysis, data were stratified into four age groups (Table 5). Septicemia was the leading cause of in-hospital death for every adult age group. For the majority of septicemia-related deaths (1,176), the infectious agent was not specified. Over eight percent of these deaths (116 cases) were due to *Staphylococcus* infections, and half of these (66 cases) were due

to methicillin-resistant *Staphylococcus aureus* (MRSA) infection (Figure 10). Adult respiratory failure and acute cerebrovascular disease were the other two common diagnoses among the top five for all adult age groups. Intracranial injuries were among the leading conditions associated with in-hospital death for the younger patients and the majority of HIV-related deaths (68.6%) occurred in patients between 18 and 44.

**Table 5: The Five Most Frequent Clinical Diagnoses Associated with In-hospital Death by Age Groups**

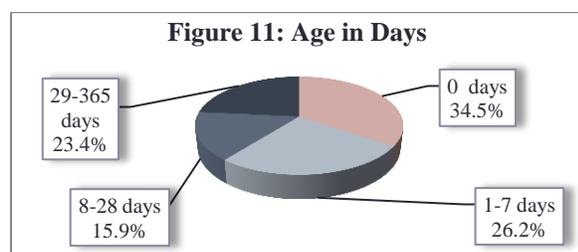
| Primary Diagnosis  | In-hospital deaths |                 |             |
|--|--------------------|-----------------|-------------|
|  | Number             | % of all deaths | % of group* |
| <b>0-17 years</b>  |                    |                 |             |
| Live birth   | 94                 | 1.1             | 100.0       |
| Short gestation; low birth weight; and fetal growth retardation                | 16                 | 0.2             | 100.0       |
| Septicemia   | 9                  | 0.1             | 0.6         |
| Intracranial injury  | 7                  | 0.1             | 5.9         |
| Other perinatal conditions   | 6                  | 0.1             | 100.0       |
| <b>18-44 years</b>   |                    |                 |             |
| Septicemia (except in labor)   | 71                 | 0.8             | 5.0         |
| Respiratory failure; insufficiency; arrest (adult)                             | 33                 | 0.4             | 4.0         |
| HIV infection  | 24                 | 0.3             | 68.6        |
| Acute cerebrovascular disease  | 23                 | 0.3             | 4.6         |
| Intracranial injury  | 22                 | 0.3             | 18.6        |
| <b>45-64 years</b>   |                    |                 |             |
| Septicemia (except in labor)   | 319                | 3.6             | 22.7        |
| Respiratory failure; insufficiency; arrest (adult)                             | 215                | 2.4             | 25.8        |
| Acute cerebrovascular disease  | 113                | 1.3             | 22.7        |
| Pneumonia (except that caused by tuberculosis or sexually transmitted disease) | 92                 | 1.0             | 14.6        |
| Acute myocardial infarction  | 73                 | 0.8             | 19.5        |
| <b>65 years+</b>   |                    |                 |             |
| Septicemia   | 1,007              | 11.4            | 71.6        |
| Respiratory failure; insufficiency; arrest (adult)                             | 581                | 6.6             | 69.7        |
| Pneumonia (except that caused by tuberculosis or sexually transmitted disease) | 514                | 5.8             | 81.7        |
| Acute cerebrovascular disease  | 361                | 4.1             | 72.5        |
| Congestive heart failure   | 348                | 3.9             | 82.7        |

\*This is the percent of all patients whose death was associated with the specific condition.

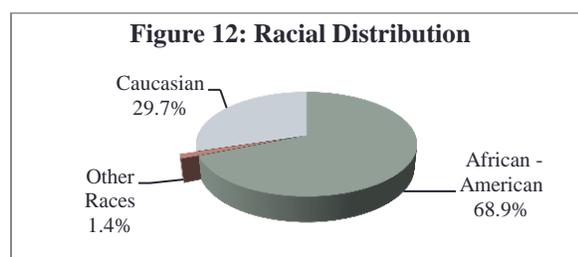


**Infant In-hospital Mortality:** In 2010, the infant mortality rate for Mississippi was 9.6 infants per 1,000 live births, the highest rate in the country.<sup>5</sup> While not all deaths occurred in inpatient hospital settings, hospital discharge data can add valuable information to our knowledge of the clinical conditions associated with infant deaths in the state. Note that this report focuses only on deaths that occurred in inpatient settings and, therefore, deaths reported in outpatient settings were not examined.

**Age in Days:** There were 145 reported infant in-hospital deaths during 2010 in Mississippi. Among them over one third died during the first day and over one quarter died during the next seven days (Figure 11).



**Race and Payer:** The majority (100 or 68.9%) of infants who died during their hospitalization were African-Americans (Table 12).



In terms of payer, Medicaid was the primary payer for 75.2% (109) and publicly-funded insurers were responsible for the charges of 77.2% of all infants who died in a hospital.

**Conditions Associated with Infant Deaths:** In addition to the Clinical Classification Software, causes of death in the infant age group were evaluated through the use of the All Patients Refined Diagnosis Related Groups (APR-DRGs) Software. These groups are built using primary and secondary diagnoses, procedures, patient's age and birth weight for neonates.

The findings, presented in Table 6 and 7, showed that a quarter of all infants that died weighed less than 500 grams or had a gestational age of less than 24 weeks. All together 73.8% (107 cases) of all infants who died in a hospital had a low birth weight and 48.3% (70 cases) of them weighed less than 1,000 grams at birth, indicating extreme prematurity.

**Table 6: Selected All-listed Conditions**

| Primary and Secondary Conditions Associated with Infant In-hospital Death | Deaths | % of deaths |
|---|--------|-------------|
| Low birth weight  | 107    | 73.8        |
| Septicemia  | 38     | 26.2        |
| Respiratory distress syndrome   | 36     | 24.8        |
| Congenital anomalies  | 34     | 23.5        |
| Hemolytic and perinatal jaundice  | 33     | 22.8        |
| Intrauterine hypoxia and birth asphyxia                                   | 13     | 9.0         |
| Birth trauma  | 6      | 4.1         |

Additional analysis, encompassing primary and secondary diagnoses (all-listed conditions), revealed that congenital anomalies were recorded for 34 (23.5%) and sepsis for 38 (26.1%) of all infants who died in-hospital.

**Table 7: Infant In-hospital Mortality by All Patients Refined Diagnoses Related Groups**

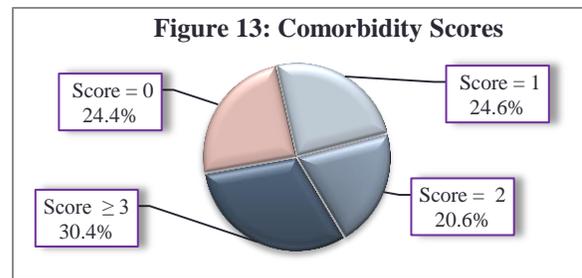
| All Patient Refined-Diagnosis Related Group                    | Number of Cases | Percent      |
|--|-----------------|--------------|
| Neonate birth weight < 500 grams or gestational age < 24 weeks | 37              | 25.5         |
| Neonate birth weight 500-749 grams without major procedure     | 19              | 13.1         |
| Neonate birth weight 750-999 grams without major procedure     | 14              | 9.7          |
| Neonate birth weight > 2499 grams with major anomaly           | 9               | 6.2          |
| Neonate birth weight 1500-1999 grams with major anomaly        | 7               | 4.8          |
| Neonate birth weight < 1500 grams with major procedure         | 6               | 4.1          |
| Other APR-DRGs   | 53              | 22.8         |
| <b>All Infant-related Diagnoses</b>                            | <b>145</b>      | <b>100.0</b> |

**Comorbidity (Secondary Diagnoses):** The causes of in-hospital mortality were determined by primary diagnoses. However, it is important to evaluate coexisting morbidity, which may have a significant impact on the hospital outcome. In order to account for such comorbid conditions, the Charlson Comorbidity Index was calculated. This index, developed as a predictor of mortality among chronically ill patients, is a scoring system based on 17 major chronic conditions. Each condition is assigned a score (weight) that is proportional to the disease-relative risk of death or the severity of the illness.<sup>6</sup> Table 7 lists the clinical conditions included in the Charlson Comorbidity Index, their scores, the number of patients with each clinical condition (comorbidity), and the percent of each comorbid condition among all patients who died in Mississippi's hospitals.<sup>7</sup>

**Table 8: Charlson Comorbidities**

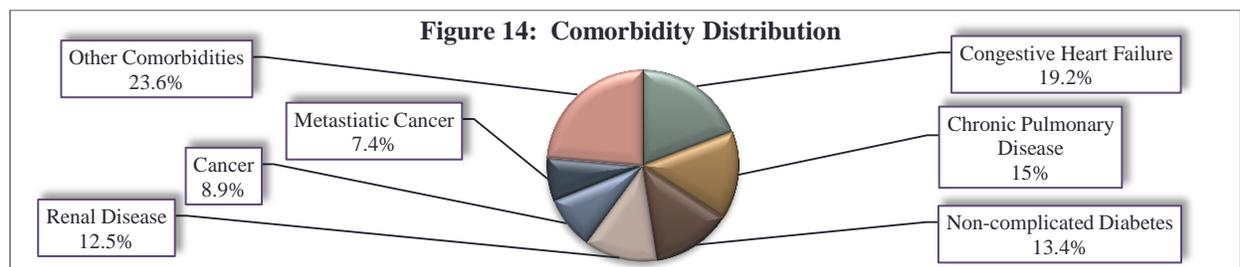
| Comorbid Condition             | Weight (Score) | Number of Comorbid Conditions | % of died |
|--------------------------------|----------------|-------------------------------|-----------|
| Acute Myocardial Infarction    | 1              | 704                           | 8.2       |
| Congestive Heart Failure       | 1              | 2,259                         | 26.2      |
| Peripheral Vascular Disease    | 1              | 432                           | 5.0       |
| Cerebral Vascular Accident     | 1              | 727                           | 8.4       |
| Dementia                       | 1              | 84                            | 1.0       |
| Chronic Pulmonary Disease      | 1              | 1,758                         | 20.4      |
| Connective Tissue Disorders    | 1              | 14                            | 0.2       |
| Peptic Ulcer                   | 1              | 53                            | 0.6       |
| Mild Liver Disease             | 1              | 176                           | 2.0       |
| Non-complicated Diabetes       | 1              | 1,574                         | 18.2      |
| Diabetes with Complication     | 2              | 147                           | 1.7       |
| Paraplegia                     | 2              | 160                           | 1.9       |
| Renal Disease                  | 2              | 1,473                         | 17.1      |
| Cancer                         | 2              | 1,051                         | 12.2      |
| Severe Liver Disease           | 3              | 260                           | 3.0       |
| Metastatic Cancer              | 6              | 867                           | 10.0      |
| AIDS                           | 6              | 20                            | 0.2       |
| <b>All Comorbidities</b>       |                | <b>11,759</b>                 |           |
| <b>Number of Deaths: 8,814</b> |                |                               |           |

**Charlson Comorbidity Scores:** Comorbidity scores were computed for each patient 18 years of age and older. Then, all individual scores were summed and the mean comorbidity score for the studied population was determined. The mean score for the patients who died in a hospital was 2.1, while the mean comorbidity score for all other patients was 1.1. Depicted in Figure 13 is the distribution of the Charlson Comorbidity Index among patients who died. The majority of the patients (69.6%) had a score of at least one and almost one third (30.4%) had a score of three or more.



**Individual Comorbidities:** The individual comorbidity analysis revealed that 26.2% of the 8,634 adult patients who died in a hospital had coexisting congestive heart failure, 20.4% had coexisting chronic pulmonary disease, and 19.9% had coexisting complicated or non-complicated diabetes (Table 7).

**Comorbidity Distribution:** The overall number of examined comorbidities was 11,759 and their distribution is displayed in Figure 14. Congestive heart failure and chronic pulmonary disease were the two leading conditions, together accounting for one third of all comorbidities.



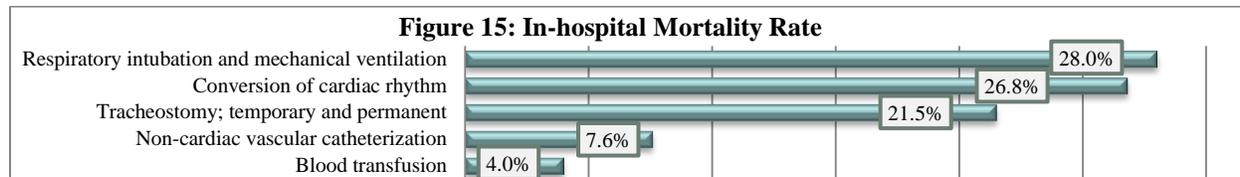
**The Top Five Principal Procedures:** The top five principal procedures listed for in-hospital deaths are depicted in Table 9. The percent of hospital deaths among all discharges for these procedures (in-hospital mortality rates) was also calculated (Figure 15). Note that these procedures were performed as a treatment or as diagnostic and exploratory tools. They were performed on seriously ill or critically-injured patients and the in-hospital deaths indicate the seriousness of the underlying condition and not necessarily the impact of the procedure. Respiratory intubation and mechanical

ventilation was the recorded primary procedure for 26.4% of all patients who died in hospital and the in-hospital mortality rate for patients who had this procedure was 28%. Patients undergoing conversion of cardiac rhythm, another procedure among the top five, also had a high mortality rate – 26.8% of all patients who underwent conversion of cardiac rhythm listed as a primary procedure died during their hospital stay. Finally, one fifth (21.5%) of all patients for whom tracheostomy was a primary procedure died during their hospitalization in 2010 in Mississippi.

**Table 9: The Top Five Principal Procedures among Patients who Died In-hospital**

| THE TOP FIVE PRIMARY PROCEDURES LISTED FOR IN-HOSPITAL DEATHS | In-hospital Deaths |                 | Hospitalizations |                     | Mortality Rate* |
|---|--------------------|-----------------|------------------|---------------------|-----------------|
|   | Number             | % of all deaths | Number           | % of all discharges |                 |
| Respiratory intubation and mechanical ventilation             | 2,327              | 26.4            | 8,315            | 2.2                 | 28.0            |
| Blood transfusion   | 449                | 5.1             | 11,326           | 3.0                 | 4.0             |
| Non-cardiac vascular catheterization                          | 445                | 5.1             | 5,840            | 1.6                 | 7.6             |
| Conversion of cardiac rhythm                                  | 200                | 2.3             | 747              | 0.2                 | 26.8            |
| Tracheostomy; temporary and permanent                         | 153                | 1.7             | 712              | 0.2                 | 21.5            |

\*The mortality rate is the percent of in-hospital deaths among all hospitalized patients who underwent this procedure.



**FROM ANALYSIS TO PREVENTION: THE EVIDENCE-BASED WAY**

**Septicemia:** This report revealed that the number one reason for in-hospital mortality was septicemia. Hospitalized patients are at increased risk for hospital-acquired infections and good hand hygiene in healthcare settings is the best prevention. Implementing inexpensive measures such as increased awareness and rigorous monitoring of hand washing compliance among medical personnel are ways to reduce hospital-acquired infections, including septicemia, and prevent deaths.<sup>8</sup> Reduced health care costs for the state and consumers are other long-term benefits of such initiatives.

**Infant Deaths:** This report also demonstrated the value of hospital discharge data as a tool for examining the clinical reasons associated with infant deaths. Important demographics, hospital characteristics, and insurance payment patterns are also included in these data and could be used to enhance existing state programs monitoring and combating infant death. Creating a statewide infant mortality surveillance system, encompassing and linking different data sources, is one way to reinforce the battle against infant mortality, a critical public health issue in Mississippi.

## Definitions

**Admission source:** The admission source (physician referral, emergency room, another hospital, another type of facility, and/or correction facility) is the point of patient origin for the admission.

**Admission type:** The admission type indicates the priority of the hospital admission and/or the conditions under which the patient was admitted. There are five major types of admission: emergency, urgent, elective, newborn (intramural), and trauma center.

**Diagnoses:** Diagnosis denotes a clinical condition and all diagnoses (conditions) are assigned ICD-9-CM codes. Each hospital stay has one primary and up to ten secondary diagnoses.

**Primary:** The primary diagnosis is the clinical condition established to be chiefly responsible for the admission.

**Secondary:** Secondary diagnoses are all coexisting clinical conditions at the time of admission or any conditions that develop during the hospitalization.

**Hospital Charges:** Hospital charges are the amount of money that the hospital bills for the entire hospital stay and for all the services and interventions performed during that stay. They may not represent the actual amount that the hospital collects or the actual cost of the services provided.

**Hospital Discharge:** Hospital discharge is a hospital stay that ends with the patient's release from the hospital (or with the patient's in-hospital death). A patient might have multiple discharges within a year. This term is used interchangeably with the term hospitalization or the term hospital admission throughout this report.

**In-hospital Mortality:** The in-hospital mortality rate is the percent of patients who died among all patients hospitalized for a given condition.

**Metropolitan Hospital:** We have defined any hospital located within a metropolitan area as a metropolitan hospital, regardless of its size and type. A metropolitan area contains a specific number of counties as defined by the United States Census Bureau.

**Neonatal Period:** The period from birth until 28 days of age.

**Primary Payer:** Primary payer is the expected source of payment. A hospital stay might have additional sources of payment (secondary payers).

**Procedure:** A surgical or non-surgical medical intervention. Each hospital stay can have multiple procedures. Discharge data has one primary (principal) and up to five secondary procedures.

## Notes and References

<sup>1</sup>Federal health care facilities are excluded from reporting requirements and their data are not included in this study.

<sup>2</sup> For further information please refer to the Agency for Healthcare Quality and Research website at [www.hcup-us.ahrq.gov](http://www.hcup-us.ahrq.gov).

<sup>3</sup>Charlson ME, Pompei P, Ales KL, Mackenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *Journal of Chronic Diseases*. 1987; 40: 373-383.

<sup>4</sup>For the purpose of this analysis only the principal diagnosis as a cause of death was utilized. While the principal diagnosis is the condition established to be chiefly responsible for the admission, the principal diagnosis may or may not be the direct cause of death and/or the sole cause of in-hospital death. The secondary diagnoses might contribute to the severity of illness; they can increase the risk of mortality or even be the main cause of death. The secondary diagnoses were evaluated under the section "Comorbidity" in this report.

<sup>5</sup>Date Source: Center for Disease Control and Prevention. Infant Mortality Rates by States: 2010. Information accessed at: [www.cdc.gov/nchs/pressroom/states/INFANT\\_MORTALITY\\_RATES\\_STATE\\_2010.pdf](http://www.cdc.gov/nchs/pressroom/states/INFANT_MORTALITY_RATES_STATE_2010.pdf).

<sup>6</sup>Deyo RA, Danial CC, Marcia AC. Adapting a clinical comorbidity index for use with ICD-9-CM administrative databases. *Journal of Clinical Epidemiology*. 1992; 45: 613-619.

<sup>7</sup>This report examines only comorbid conditions included in the Charlson Comorbidity Index.

<sup>8</sup>For more information about hand hygiene in healthcare settings and hand washing campaigns please visit the Center for Disease Control and Prevention's website at: <http://www.cdc.gov/handhygiene/Resources.html>.