

# **TBI: Mortality and Nonfatal Hospitalization**

## **Data Analysis Report**

**Minnesota 2006**

**Prepared by:**

**Anna Gaichas, MS  
Leslie Seymour, MD MPH  
Jon Roesler, MS  
Ayo Adeniyi, MPH MBBS  
Mark Kinde, MPH**

**Minnesota Department of Health  
St. Paul, Minnesota**

**For the**

**Centers for Disease Control and Prevention**

**As part of**

**TBI Extended Surveillance Program (TBIES) / PA 05027, Award Number 524800-01**

**October 30, 2008**

## Table of Contents

|   |   |
|---|---|
| Text Overview.....  | 1 |
| Table 1: TBI Mortality Number and Rate by Gender, Age Group, and Leading Causes, Minnesota 2006.....          | 2 |
| Figure 1: TBI Mortality Rate by Year, Minnesota 1998-2006.....  | 3 |
| Table 2: Nonfatal Hospitalized TBI Number and Rate by Gender, Age Group, and Leading Causes, Minnesota 2006.. | 4 |
| Figure 2: Nonfatal Hospitalized TBI Rate by Year, Minnesota 1993-2006.....                                    | 5 |

Suggested citation: Gaichas A, Seymour L, Roesler J, Adeniyi A, Kinde M. *TBI: Mortality and Nonfatal Hospitalization Data Analysis Report, Minnesota 2006*. St. Paul: Minnesota Department of Health, October 2008.

## Text Overview

**Background:** Minnesota is one of only four states funded by the CDC to conduct surveillance of Emergency Department (ED)-treated traumatic brain injury (TBI) for the 2005-2010 data period.

**Methods:** Electronic, centralized discharge data from death certificates, the Minnesota TBI/Trauma Registry and the Minnesota Hospital Association were analyzed using the CDC's TBI case definition. Analysis for this report was limited to Minnesota residents.

**Results:** In 2006, there were 856 TBI deaths, an adjusted rate of 16.0 per 100,000 population. This rate is similar to those of the previous three years. The number of nonfatal hospitalized (NH) TBIs in 2006 was 4,867, yielding an adjusted rate of 92.8 per 100,000 population. The data show an increasing trend. Comparison with 1993-1997 is difficult because of changes in case identification methods.

The TBI mortality data show a bi-modal curve, with peaks among adolescents/young adults and the elderly. The TBI-NH data show a tri-modal curve, with peaks among the infants, adolescents/young adults, and the elderly. Both the TBI mortality and TBI-NH peaks occur in older adults, with the highest rates among persons age 85 and above (101.10 per 100,000 population for mortality and 454.3 per 100,000 population for TBI-NH). The TBI mortality and TBI-NH rates for males were consistently higher than those for females, with male rates among infants and adolescents/young adults approximately twice that of the female rates. Male TBI mortality rates were approximately three times that of the female rates for elders 80-84 and male TBI-NH rates were about three times higher than female rates for young adults age 20-29. Some age- and gender-specific TBI mortality rates were not calculated due to small numbers.

The leading causes of TBI mortality were firearms, especially self-inflicted, unintentional falls, and motor vehicle traffic (MVT). The leading causes of TBI-NH were unintentional falls, MVT, and assault. TBI deaths from firearms were concentrated around middle-aged adults, while MVT fatalities were most prevalent in teens and young adults and unintentional fall deaths most often occurred in older adults. For TBI-NH, unintentional fall rates showed a bi-modal curve with the highest rates among older adults 65 years and above with a smaller peak in infants age < 1. MVT and assault TBI-NH rates were highest for adolescents/young adults, ages 15-24 for MVT and ages 20-29 for assault.

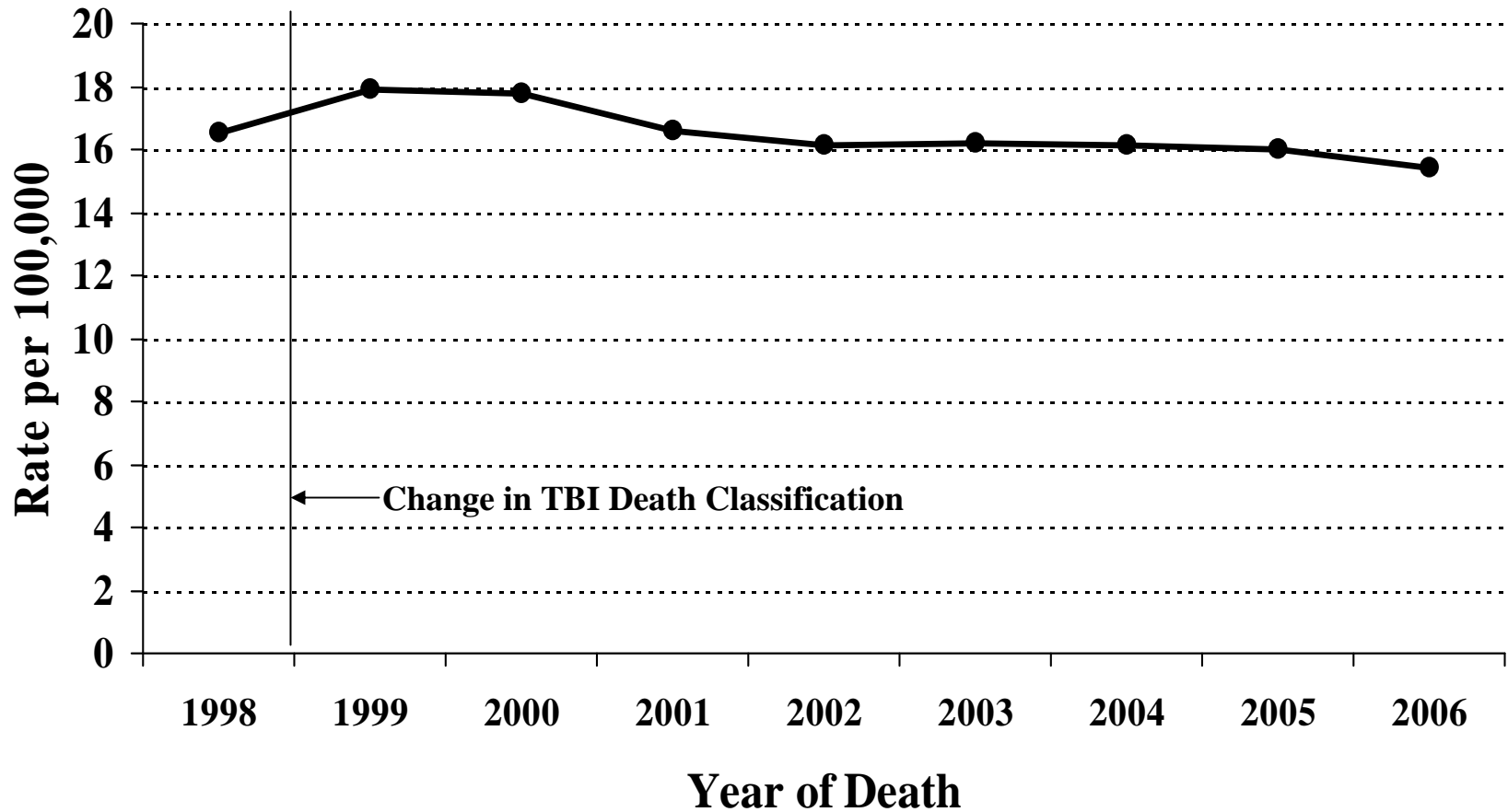
**Discussion:** Data in this report show the importance of TBI as a public health problem. Population-based information regarding TBI deaths and hospitalizations can be useful in assessing the effect of prevention efforts. Additionally, abstracted data will yield important information on demographic features (e.g., race/ethnicity), modifiable risk factors (e.g., alcohol use), and circumstances at time of injury (e.g., specific activity in which the individual was engaged at time of injury) that in turn can be used to guide intervention activities.

**Table 1: TBI Mortality Number and Rate by Gender, Age Group, and Leading Causes, Minnesota 2006**

|               | All causes |       | Firearm |      |                |      | Fall,         |      | Motor vehicle traffic |      |          |      |
|---------------|------------|-------|---------|------|----------------|------|---------------|------|-----------------------|------|----------|------|
|               | total      |       | Total   |      | Self-inflicted |      | unintentional |      | Total                 |      | Occupant |      |
| Total         | N          | Rate  | N       | Rate | N              | Rate | N             | Rate | N                     | Rate | N        | Rate |
| All Ages      | 819        | 15.4  | 223     | 4.3  | 193            | 3.7  | 241           | 4.4  | 223                   | 4.2  | 138      | 2.6  |
| <1            | 6          | .     | 0       | .    | 0              | .    | 0             | .    | 3                     | .    | 3        | .    |
| 1-4           | 12         | .     | 0       | .    | 0              | .    | 2             | .    | 1                     | .    | 0        | .    |
| 5-9           | 6          | .     | 0       | .    | 0              | .    | 0             | .    | 2                     | .    | 0        | .    |
| 10-14         | 12         | .     | 3       | .    | 2              | .    | 0             | .    | 9                     | .    | 6        | .    |
| 15-19         | 50         | 13.4  | 10      | .    | 7              | .    | 1             | .    | 33                    | 8.9  | 26       | 7.0  |
| 20-24         | 58         | 15.5  | 18      | .    | 11             | .    | 1             | .    | 34                    | 9.1  | 16       | .    |
| 25-29         | 51         | 14.5  | 27      | 7.7  | 20             | 5.7  | 1             | .    | 17                    | .    | 11       | .    |
| 30-34         | 36         | 11.1  | 13      | .    | 11             | .    | 2             | .    | 16                    | .    | 12       | .    |
| 35-39         | 43         | 12.0  | 17      | .    | 15             | .    | 7             | .    | 6                     | .    | 2        | .    |
| 40-44         | 50         | 12.5  | 24      | 6.0  | 23             | 5.7  | 5             | .    | 14                    | .    | 3        | .    |
| 45-49         | 67         | 15.9  | 25      | 6.0  | 21             | 5.0  | 13            | .    | 16                    | .    | 10       | .    |
| 50-54         | 53         | 14.3  | 23      | 6.2  | 21             | 5.7  | 10            | .    | 11                    | .    | 10       | .    |
| 55-59         | 63         | 20.1  | 17      | .    | 16             | .    | 16            | .    | 17                    | .    | 10       | .    |
| 60-64         | 30         | 13.5  | 6       | .    | 6              | .    | 12            | .    | 4                     | .    | 3        | .    |
| 65-69         | 30         | 17.5  | 9       | .    | 9              | .    | 5             | .    | 11                    | .    | 7        | .    |
| 70-74         | 39         | 28.2  | 8       | .    | 8              | .    | 23            | 16.6 | 6                     | .    | 4        | .    |
| 75-79         | 53         | 44.1  | 13      | .    | 13             | .    | 29            | 24.1 | 6                     | .    | 5        | .    |
| 80-84         | 67         | 70.1  | 7       | .    | 7              | .    | 43            | 45.0 | 10                    | .    | 5        | .    |
| 85+           | 93         | 91.5  | 3       | .    | 3              | .    | 71            | 69.9 | 7                     | .    | 5        | .    |
| <b>Male</b>   |            |       |         |      |                |      |               |      |                       |      |          |      |
| All Ages      | 590        | 23.7  | 203     | 7.9  | 182            | 7.2  | 135           | 5.9  | 150                   | 5.8  | 88       | 3.4  |
| <1            | 4          | .     | 0       | .    | 0              | .    | 0             | .    | 1                     | .    | 1        | .    |
| 1-4           | 9          | .     | 0       | .    | 0              | .    | 1             | .    | 1                     | .    | 0        | .    |
| 5-9           | 1          | .     | 0       | .    | 0              | .    | 0             | .    | 1                     | .    | 0        | .    |
| 10-14         | 7          | .     | 3       | .    | 2              | .    | 0             | .    | 4                     | .    | 2        | .    |
| 15-19         | 34         | 17.9  | 8       | .    | 5              | .    | 1             | .    | 20                    | 10.5 | 17       | .    |
| 20-24         | 45         | 23.6  | 16      | .    | 11             | .    | 0             | .    | 24                    | 12.6 | 10       | .    |
| 25-29         | 43         | 23.6  | 24      | 13.2 | 19             | .    | 1             | .    | 12                    | .    | 7        | .    |
| 30-34         | 31         | 18.8  | 13      | .    | 11             | .    | 2             | .    | 12                    | .    | 10       | .    |
| 35-39         | 36         | 19.8  | 15      | .    | 13             | .    | 5             | .    | 5                     | .    | 1        | .    |
| 40-44         | 43         | 21.3  | 23      | 11.4 | 22             | 10.9 | 5             | .    | 10                    | .    | 1        | .    |
| 45-49         | 53         | 25.1  | 20      | 9.5  | 18             | .    | 9             | .    | 13                    | .    | 8        | .    |
| 50-54         | 46         | 24.7  | 21      | 11.3 | 21             | 11.3 | 8             | .    | 8                     | .    | 7        | .    |
| 55-59         | 48         | 30.7  | 16      | .    | 16             | .    | 13            | .    | 12                    | .    | 6        | .    |
| 60-64         | 24         | 22.0  | 5       | .    | 5              | .    | 9             | .    | 4                     | .    | 3        | .    |
| 65-69         | 24         | 29.2  | 8       | .    | 8              | .    | 4             | .    | 7                     | .    | 5        | .    |
| 70-74         | 28         | 43.9  | 8       | .    | 8              | .    | 15            | .    | 4                     | .    | 2        | .    |
| 75-79         | 39         | 74.6  | 13      | .    | 13             | .    | 16            | .    | 5                     | .    | 4        | .    |
| 80-84         | 36         | 96.2  | 7       | .    | 7              | .    | 18            | .    | 5                     | .    | 4        | .    |
| 85+           | 39         | 125.6 | 3       | .    | 3              | .    | 28            | 90.2 | 2                     | .    | 0        | .    |
| <b>Female</b> |            |       |         |      |                |      |               |      |                       |      |          |      |
| All Ages      | 229        | 7.7   | 20      | 0.7  | 11             | .    | 106           | 3.2  | 73                    | 2.7  | 50       | 1.8  |
| <1            | 2          | .     | 0       | .    | 0              | .    | 0             | .    | 2                     | .    | 2        | .    |
| 1-4           | 3          | .     | 0       | .    | 0              | .    | 1             | .    | 0                     | .    | 0        | .    |
| 5-9           | 5          | .     | 0       | .    | 0              | .    | 0             | .    | 1                     | .    | 0        | .    |
| 10-14         | 5          | .     | 0       | .    | 0              | .    | 0             | .    | 5                     | .    | 4        | .    |
| 15-19         | 16         | .     | 2       | .    | 2              | .    | 0             | .    | 13                    | .    | 9        | .    |
| 20-24         | 13         | .     | 2       | .    | 0              | .    | 1             | .    | 10                    | .    | 6        | .    |
| 25-29         | 8          | .     | 3       | .    | 1              | .    | 0             | .    | 5                     | .    | 4        | .    |
| 30-34         | 5          | .     | 0       | .    | 0              | .    | 0             | .    | 4                     | .    | 2        | .    |
| 35-39         | 7          | .     | 2       | .    | 2              | .    | 2             | .    | 1                     | .    | 1        | .    |
| 40-44         | 7          | .     | 1       | .    | 1              | .    | 0             | .    | 4                     | .    | 2        | .    |
| 45-49         | 14         | .     | 5       | .    | 3              | .    | 4             | .    | 3                     | .    | 2        | .    |
| 50-54         | 7          | .     | 2       | .    | 0              | .    | 2             | .    | 3                     | .    | 3        | .    |
| 55-59         | 15         | .     | 1       | .    | 0              | .    | 3             | .    | 5                     | .    | 4        | .    |
| 60-64         | 6          | .     | 1       | .    | 1              | .    | 3             | .    | 0                     | .    | 0        | .    |
| 65-69         | 6          | .     | 1       | .    | 1              | .    | 1             | .    | 4                     | .    | 2        | .    |
| 70-74         | 11         | .     | 0       | .    | 0              | .    | 8             | .    | 2                     | .    | 2        | .    |
| 75-79         | 14         | .     | 0       | .    | 0              | .    | 13            | .    | 1                     | .    | 1        | .    |
| 80-84         | 31         | 53.3  | 0       | .    | 0              | .    | 25            | 43.0 | 5                     | .    | 1        | .    |
| 85+           | 54         | 76.5  | 0       | .    | 0              | .    | 43            | 60.9 | 5                     | .    | 5        | .    |

Rates are per 100,000 population. Total rates are adjusted to the U.S. 2000 standard population.

# Figure 1: TBI Mortality Rate by Year Minnesota 1998-2006



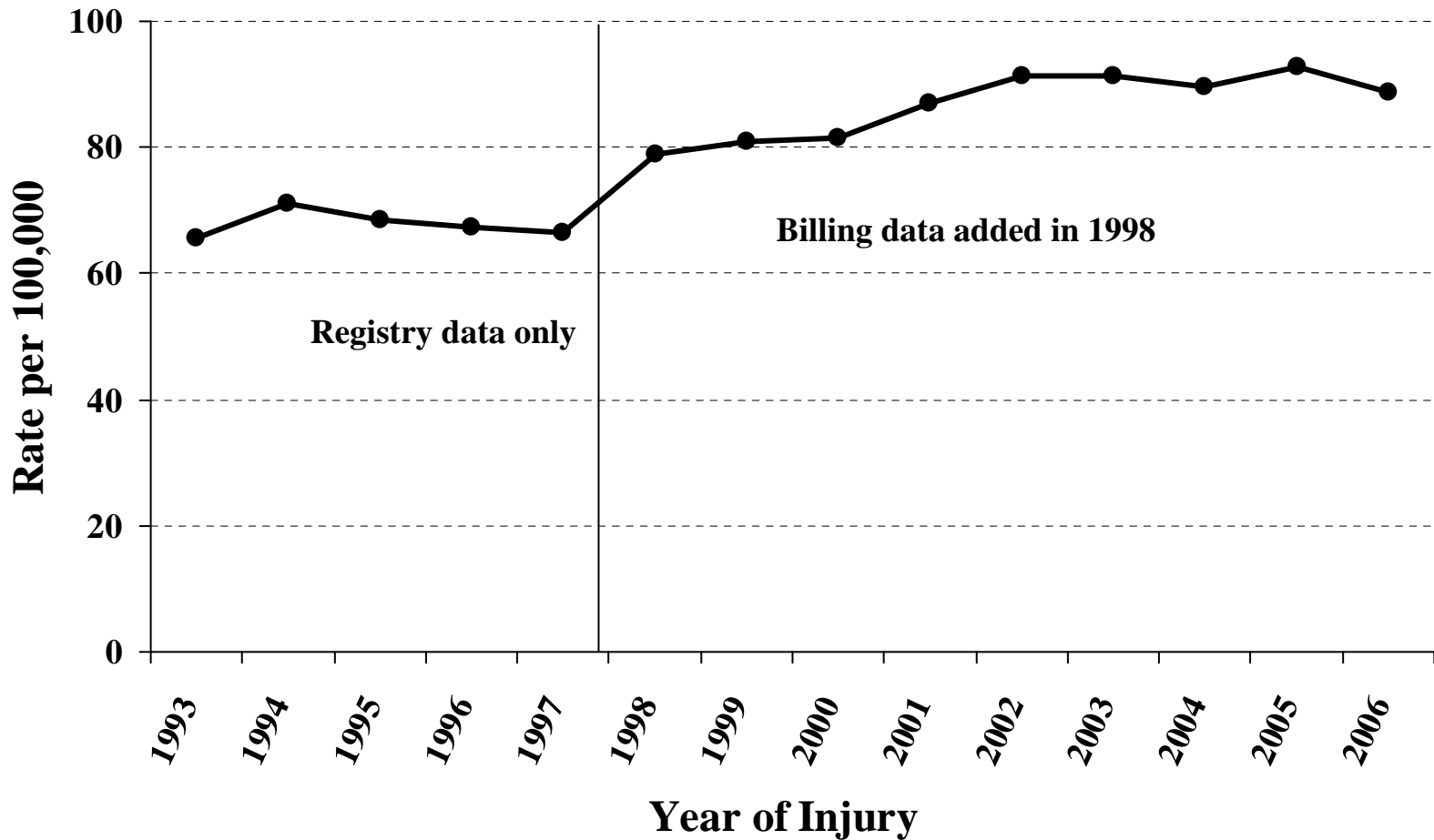
Rates are adjusted to the U.S. 2000 standard population.

**Table 2: Nonfatal Hospitalized TBI Number and Rate by Gender, Age Group, and Leading Causes, Minnesota 2006**

| Total         | All causes |             | Fall, unintentional |             | Motor vehicle traffic |             |          |             | Assault  |             |                      |             |
|---------------|------------|-------------|---------------------|-------------|-----------------------|-------------|----------|-------------|----------|-------------|----------------------|-------------|
|               | total      |             |                     |             | Total                 |             | Occupant |             | Total    |             | Struck by or against |             |
|               | N          | Rate        | N                   | Rate        | N                     | Rate        | N        | Rate        | N        | Rate        | N                    | Rate        |
| All Ages      | 4,662      | 88.6        | 2,039               | 38.3        | 1,334                 | 25.6        | 944      | 18.1        | 373      | 7.1         | 248                  | 4.7         |
| <1            | 87         | 118.3       | 57                  | 77.5        | 4                     | .           | 4        | .           | 12       | .           | 0                    | .           |
| 1-4           | 111        | 40.9        | 67                  | 24.7        | 16                    | .           | 13       | .           | 5        | .           | 0                    | .           |
| 5-9           | 135        | 40.5        | 51                  | 15.3        | 39                    | 11.7        | 19       | .           | 1        | .           | 0                    | .           |
| 10-14         | 174        | 49.4        | 44                  | 12.5        | 46                    | 13.1        | 20       | 5.7         | 0        | .           | 0                    | .           |
| 15-19         | 470        | 126.1       | 51                  | 13.7        | 247                   | 66.3        | 206      | 55.3        | 45       | 12.1        | 32                   | 8.6         |
| 20-24         | 395        | 105.6       | 43                  | 11.5        | 187                   | 50.0        | 147      | 39.3        | 76       | 20.3        | 58                   | 15.5        |
| 25-29         | 281        | 80.0        | 47                  | 13.4        | 126                   | 35.9        | 91       | 25.9        | 55       | 15.7        | 36                   | 10.2        |
| 30-34         | 199        | 61.2        | 26                  | 8.0         | 96                    | 29.5        | 69       | 21.2        | 36       | 11.1        | 20                   | 6.2         |
| 35-39         | 230        | 64.2        | 61                  | 17.0        | 80                    | 22.3        | 52       | 14.5        | 32       | 8.9         | 25                   | 7.0         |
| 40-44         | 281        | 70.1        | 88                  | 22.0        | 96                    | 23.9        | 63       | 15.7        | 27       | 6.7         | 19                   | .           |
| 45-49         | 273        | 64.9        | 86                  | 20.5        | 92                    | 21.9        | 52       | 12.4        | 37       | 8.8         | 25                   | 6.0         |
| 50-54         | 236        | 63.7        | 94                  | 25.4        | 70                    | 18.9        | 38       | 10.3        | 27       | 7.3         | 17                   | .           |
| 55-59         | 223        | 71.1        | 112                 | 35.7        | 65                    | 20.7        | 39       | 12.4        | 7        | .           | 7                    | .           |
| 60-64         | 172        | 77.4        | 98                  | 44.1        | 42                    | 18.9        | 28       | 12.6        | 5        | .           | 5                    | .           |
| 65-69         | 189        | 110.1       | 125                 | 72.8        | 35                    | 20.4        | 28       | 16.3        | 4        | .           | 2                    | .           |
| 70-74         | 187        | 135.3       | 137                 | 99.1        | 26                    | 18.8        | 20       | 14.5        | 1        | .           | 0                    | .           |
| 75-79         | 261        | 217.0       | 211                 | 175.4       | 23                    | 19.1        | 20       | 16.6        | 1        | .           | 1                    | .           |
| 80-84         | 300        | 313.9       | 239                 | 250.1       | 28                    | 29.3        | 21       | 22.0        | 1        | .           | 1                    | .           |
| 85+           | 458        | 450.6       | 402                 | 395.5       | 16                    | .           | 14       | .           | 1        | .           | 0                    | .           |
| <b>Male</b>   | <b>N</b>   | <b>Rate</b> | <b>N</b>            | <b>Rate</b> | <b>N</b>              | <b>Rate</b> | <b>N</b> | <b>Rate</b> | <b>N</b> | <b>Rate</b> | <b>N</b>             | <b>Rate</b> |
| All Ages      | 2,929      | 117.1       | 1,115               | 47.2        | 865                   | 33.0        | 570      | 21.8        | 302      | 11.3        | 212                  | 7.9         |
| <1            | 53         | 141.4       | 33                  | 88.0        | 2                     | .           | 2        | .           | 8        | .           | 0                    | .           |
| 1-4           | 60         | 43.3        | 30                  | 21.6        | 10                    | .           | 8        | .           | 2        | .           | 0                    | .           |
| 5-9           | 82         | 48.1        | 32                  | 18.8        | 21                    | 12.3        | 9        | .           | 1        | .           | 0                    | .           |
| 10-14         | 115        | 63.6        | 32                  | 17.7        | 29                    | 16.0        | 10       | .           | 0        | .           | 0                    | .           |
| 15-19         | 325        | 171.0       | 37                  | 19.5        | 151                   | 79.4        | 118      | 62.1        | 41       | 21.6        | 29                   | 15.3        |
| 20-24         | 311        | 163.1       | 30                  | 15.7        | 139                   | 72.9        | 111      | 58.2        | 67       | 35.1        | 54                   | 28.3        |
| 25-29         | 213        | 116.7       | 37                  | 20.3        | 94                    | 51.5        | 69       | 37.8        | 42       | 23.0        | 29                   | 15.9        |
| 30-34         | 139        | 84.2        | 14                  | .           | 63                    | 38.2        | 40       | 24.2        | 29       | 17.6        | 17                   | .           |
| 35-39         | 165        | 90.9        | 42                  | 23.1        | 51                    | 28.1        | 29       | 16.0        | 27       | 14.9        | 22                   | 12.1        |
| 40-44         | 187        | 92.8        | 64                  | 31.8        | 55                    | 27.3        | 36       | 17.9        | 21       | 10.4        | 15                   | .           |
| 45-49         | 188        | 88.9        | 62                  | 29.3        | 62                    | 29.3        | 28       | 13.2        | 26       | 12.3        | 17                   | .           |
| 50-54         | 155        | 83.2        | 59                  | 31.7        | 46                    | 24.7        | 21       | 11.3        | 20       | 10.7        | 14                   | .           |
| 55-59         | 150        | 95.8        | 71                  | 45.4        | 44                    | 28.1        | 23       | 14.7        | 6        | .           | 6                    | .           |
| 60-64         | 106        | 97.4        | 58                  | 53.3        | 25                    | 23.0        | 13       | .           | 5        | .           | 5                    | .           |
| 65-69         | 113        | 137.3       | 73                  | 88.7        | 19                    | .           | 12       | .           | 4        | .           | 2                    | .           |
| 70-74         | 103        | 161.4       | 70                  | 109.7       | 17                    | .           | 12       | .           | 0        | .           | 0                    | .           |
| 75-79         | 140        | 267.7       | 108                 | 206.5       | 13                    | .           | 12       | .           | 1        | .           | 1                    | .           |
| 80-84         | 156        | 417.0       | 122                 | 326.1       | 17                    | .           | 11       | .           | 1        | .           | 1                    | .           |
| 85+           | 168        | 540.9       | 141                 | 454.0       | 7                     | .           | 6        | .           | 1        | .           | 0                    | .           |
| <b>Female</b> | <b>N</b>   | <b>Rate</b> | <b>N</b>            | <b>Rate</b> | <b>N</b>              | <b>Rate</b> | <b>N</b> | <b>Rate</b> | <b>N</b> | <b>Rate</b> | <b>N</b>             | <b>Rate</b> |
| All Ages      | 1,733      | 61.5        | 924                 | 30.5        | 469                   | 18.1        | 374      | 14.4        | 71       | 2.7         | 36                   | 1.4         |
| <1            | 34         | 94.4        | 24                  | 66.6        | 2                     | .           | 2        | .           | 4        | .           | 0                    | .           |
| 1-4           | 51         | 38.3        | 37                  | 27.8        | 6                     | .           | 5        | .           | 3        | .           | 0                    | .           |
| 5-9           | 53         | 32.6        | 19                  | .           | 18                    | .           | 10       | .           | 0        | .           | 0                    | .           |
| 10-14         | 59         | 34.5        | 12                  | .           | 17                    | .           | 10       | .           | 0        | .           | 0                    | .           |
| 15-19         | 145        | 79.4        | 14                  | .           | 96                    | 52.6        | 88       | 48.2        | 4        | .           | 3                    | .           |
| 20-24         | 84         | 45.8        | 13                  | .           | 48                    | 26.2        | 36       | 19.6        | 9        | .           | 4                    | .           |
| 25-29         | 68         | 40.3        | 10                  | .           | 32                    | 18.9        | 22       | 13.0        | 13       | .           | 7                    | .           |
| 30-34         | 60         | 37.5        | 12                  | .           | 33                    | 20.7        | 29       | 18.1        | 7        | .           | 3                    | .           |
| 35-39         | 65         | 36.8        | 19                  | .           | 29                    | 16.4        | 23       | 13.0        | 5        | .           | 3                    | .           |
| 40-44         | 94         | 47.1        | 24                  | 12.0        | 41                    | 20.6        | 27       | 13.5        | 6        | .           | 4                    | .           |
| 45-49         | 85         | 40.7        | 24                  | 11.5        | 30                    | 14.4        | 24       | 11.5        | 11       | .           | 8                    | .           |
| 50-54         | 81         | 43.9        | 35                  | 19.0        | 24                    | 13.0        | 17       | .           | 7        | .           | 3                    | .           |
| 55-59         | 73         | 46.5        | 41                  | 26.1        | 21                    | 13.4        | 16       | .           | 1        | .           | 1                    | .           |
| 60-64         | 66         | 58.3        | 40                  | 35.3        | 17                    | .           | 15       | .           | 0        | .           | 0                    | .           |
| 65-69         | 76         | 85.0        | 52                  | 58.2        | 16                    | .           | 16       | .           | 0        | .           | 0                    | .           |
| 70-74         | 84         | 113.0       | 67                  | 90.1        | 9                     | .           | 8        | .           | 1        | .           | 0                    | .           |
| 75-79         | 121        | 178.0       | 103                 | 151.6       | 10                    | .           | 8        | .           | 0        | .           | 0                    | .           |
| 80-84         | 144        | 247.6       | 117                 | 201.2       | 11                    | .           | 10       | .           | 0        | .           | 0                    | .           |
| 85+           | 290        | 410.9       | 261                 | 369.8       | 9                     | .           | 8        | .           | 0        | .           | 0                    | .           |

Rates are per 100,000 population. Total rates are adjusted to the U.S. 2000 standard population.

# Figure 2: Nonfatal Hospitalized TBI Rate by Year Minnesota 1993-2006



Rates are adjusted to the U.S. 2000 standard population.