Virginia Department of Health
Trauma Care Performance Improvement Report
Baseline – Calendar Year 2013 Data

Virginia Department of Health
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This report is based on the deliberations of the Trauma Performance Improvement Committee and analyses performed by OEMS staff.

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Core Objective 3 for the Trauma System Oversight & Management Committee (TSO&MC) states that the Committee will advise the Virginia Department of Health, Office of Emergency Medical Services on matters relating to maintaining a performance improvement process that supports the trauma center designation process, trauma triage plan, and improves trauma care throughout Virginia *(§ 32.1-111.3:B.3)*. The Trauma Performance Improvement Committee (TPIC) of the TSO&MC has been tasked with developing a performance improvement program for monitoring the quality of care, consistent with other components of the Emergency Medical Services Plan.

This inaugural annual analysis will focus on the frequency of (1) correct and incorrect triage in comparison to the total number of trauma patients delivered to hospitals by emergency medical services (EMS) agencies and (2) correct and incorrect interfacility transfer of trauma patients. The results reported here represent a high level summary of the findings. Specific instances of incorrect trauma triage or incorrect interfacility transfer will be provided to the appropriate EMS director or hospital, respectively. The provider will be given an opportunity to provide feedback which may explain special circumstances in which an exception occurred. The findings of this report and any feedback from providers will be used to drive education and improve the Trauma Triage Plan.

Trauma Triage by Emergency Medical Services Agencies

For the purpose of this report, *correct trauma triage* is defined as pre hospital cases that are deemed to be traumas (see Table 1) and where one or more of the Virginia Step 1 Field Trauma Triage Criteria (see Figure 1) were met, *and* the patient was transported to a Level I or Level II trauma center or was taken by ground ambulance to a landing zone or other such location for air EMS transport (presumably to a Level I or Level II trauma center). Since several EMS regions do not have a Level I or Level II trauma center within their boundaries, trauma patients that met one or more of the aforementioned criteria and who were transported to Level III trauma centers (under certain conditions described below) were also counted as being correctly triaged. *Incorrect trauma triage* is defined as pre hospital cases that are deemed to be traumas and where one or more of the Virginia Step 1 Field Trauma Triage Criteria were met, *but* the patient was not transported to a Level I or Level II trauma center or was not taken by ground ambulance to a landing zone or other such location for air EMS transport.

During calendar year 2013, only 5.2 percent (66,906/1,219,358) of the records in the Virginia Pre Hospital Information Bridge (VPHIB) were classified as trauma cases. Of these, 96.5 percent (64,543/66,906) were "True 911" situations (i.e., the type of service requested was a 911 scene response and the patient was treated and transported by EMS). Unfortunately, 42.2 percent (27,210/64,543) of the "True 911" trauma cases were missing systolic blood pressure (SBP), respiratory rate (RR), *and* Glasgow Coma Scale (GCS) values. This missing data means that it is not possible to report on the appropriateness of the triaging of these trauma patients. Figure 2 displays the impact of this missing information by EMS regions. The EMS region with

the most complete reporting of the necessary vital signs data was Peninsulas (89.0 percent) and Tidewater, its nearby neighboring EMS region, had the least complete reporting of this important information (43.6 percent). The lack of complete documentation will be incorporated into the individual EMS agency reports.

Table 1. Definition of Trauma Patients for VPHIB Data

*NOTE: Both the **Complaint Reported by Dispatch** and the **Provider's Primary Impression** must be listed below in order to classify the record as a trauma case.*

Complaint Reported by Dispatch	
Assault	Hemorrhage/Laceration
Assault – Sexual	Industrial Accident/Inaccessible Incident/
Auto vs. Pedestrian	Other Entrapments (Non-Vehicle)
Burns	Ingestion/Poisoning
CO Poisoning/Hazmat	Machine/Equipment Injury
Drowning	MCI (Multiple Casualty Incident)
Electrocution	Stab/Gunshot Wound
Eye Problem / Injury	Traffic/Transportation Accident
Fall Victim	Traumatic Injury
Provider's Primary Impression	
Bleeding	Smoke Inhalation
Electrocution	Toxic Exposure
Inhalation Injury (Toxic Gas)	Traumatic Injury
Poisoning/Drug Ingestion	

Figure 1. Virginia Field Trauma Triage Decision Scheme

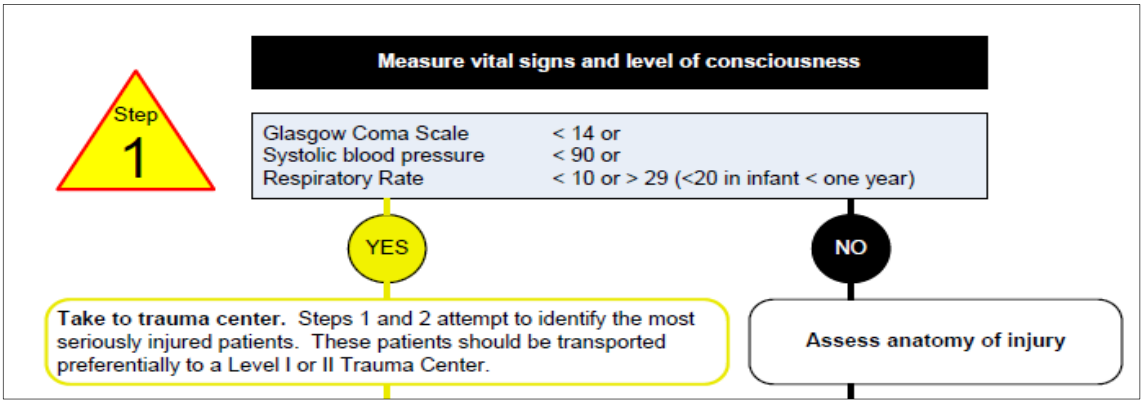
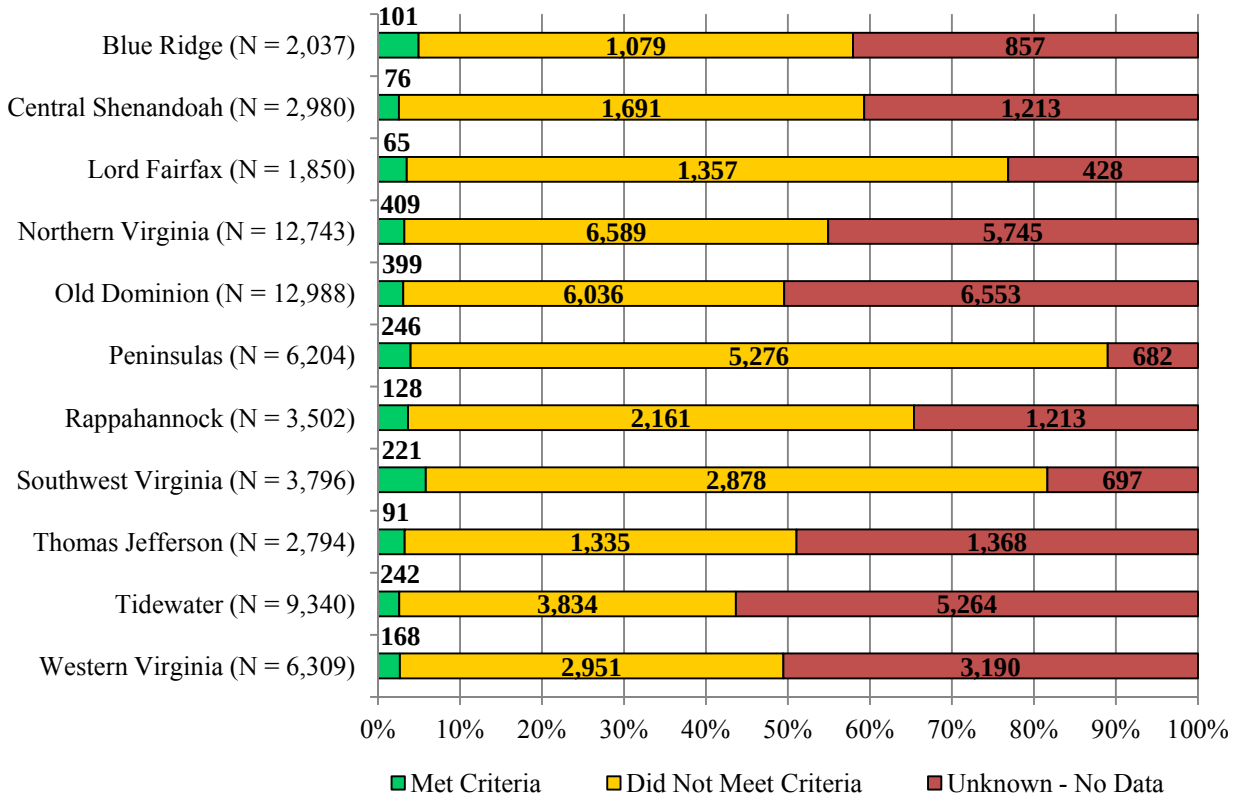


Figure 2. Virginia Step 1 Trauma Triage Criteria Status for Pre Hospital Patients by EMS Council Regions

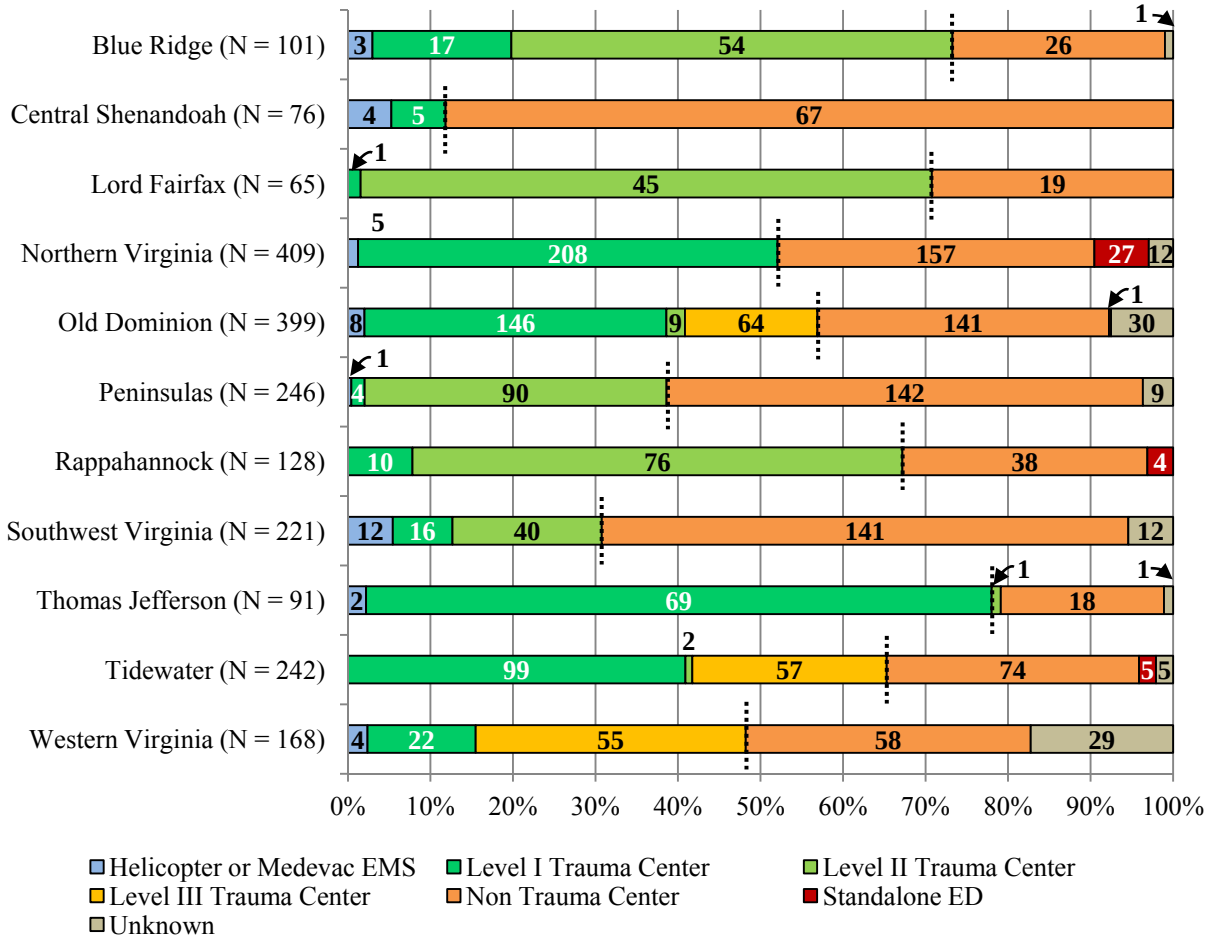
Includes All VPHIB Trauma Cases (N = 64,543)



The remaining 57.8 percent (37,333/64,543) "True 911" trauma cases had one or more of the vital sign values needed to determine if the patient met at least one of the Virginia Step 1 Field Trauma Triage Criteria. Only 5.7 percent (2,146/37,333) of these trauma patients met one or more of the Virginia Step 1 Field Trauma Triage Criteria. See Figure 3 for a breakdown of this information by Virginia EMS regions. The vertical dotted lines represent the boundary between correct (to the left) and incorrect (to the right) triage. The dotted line placement differs by EMS region because the access to trauma centers varies within the boundaries of each segment of the state. Appendix A shows a map of the 11 EMS regions and the locations of trauma centers in Virginia as well as in bordering states; non trauma center hospitals in Virginia are also included. Only two EMS regions, Northern Virginia and Thomas Jefferson, were thought to be capable of having all trauma patients who met one or more of the Virginia Step 1 Field Trauma Triage Criteria transported to a Level I trauma center. In Western Virginia, Old Dominion, and Tidewater only, Level III trauma centers were also considered acceptable destinations for this patient population. Geography (i.e., rivers in the eastern and mountains in the western parts of the state), as well as the actual locations of Virginia's Level I and Level II trauma centers, were factored into the decision to include Level III trauma centers as appropriate destinations. Level II trauma centers were used as the boundary for the remaining six EMS regions. Central

Shenandoah and Southwest Virginia have no trauma centers within their EMS regions but are reasonably close to a Level II trauma center in another EMS region or state. In addition, parts of Central Shenandoah are close to one of two Virginia Level I trauma centers. Lord Fairfax and Rappahannock have a Level II trauma center within their EMS regions as do Blue Ridge and Peninsulas. The latter two EMS regions, however, also have Level I trauma centers nearby.

Figure 3. Destinations of Pre Hospital Patients Meeting One or More Virginia Step 1 Trauma Triage Criteria by Virginia EMS Region *(N = 2,146)*



The dotted lines in the figure above indicate the border between correct and incorrect trauma center destinations. In some areas of the state, the nearest trauma center carries a Level III designation rather than a Level I or Level II designation.

In recent years, the number of standalone emergency departments (EDs) has increased considerably. One potentially worrisome finding of this analysis was that 2.8 percent (1,833/64,543) of the trauma cases were transported to a standalone ED. Of these, 2.0 percent (37/1.833) met one or more, and 57.9 percent (1,061/1,833) did not meet any, of the Virginia Step 1 Field Trauma Triage Criteria. The remaining 40.1 percent (735/1,833) trauma cases transported to standalone EDs did not have any SBP, RR, or GCS values and therefore could not

be classified as meeting (or not meeting) one or more of the Virginia Step 1 Field Trauma Triage Criteria. While the numbers are small, this is a trend that should be monitored in the future.

Numerous patient and other factors may influence the decision regarding to which facility a patient is transported. It was noted above that the availability of trauma center resources are not equally distributed across the state. Appendix B shows the accessibility of Adult Level I and Level II trauma centers within 45 minutes by helicopter or ambulance. In some areas (Southwest Virginia and Northern Virginia) out of state resources are available. In the Lord Fairfax EMS Region, residents of West Virginia and Maryland are included in the catchment area for Winchester Medical Center, one of Virginia's Level II trauma centers. Despite having a total of 9 Level I and Level II trauma centers (combined) and access to several other similar facilities in Tennessee and Washington, DC, large areas of the state are not covered. The situation appears even more grim when only ground ambulance transport is considered (Appendix C). Although a solution to this problem is beyond the scope of this report, the variability of resources, which is often compounded by geographic and – especially in the case of Helicopter or Medevac EMS – weather factors need to be considered when comparing the outcomes of pre hospital trauma patients in Virginia.

Interfacility Transfer of Trauma Patients

Correct and incorrect interfacility transfer of trauma patients is a much more difficult concept to operationalize. The *Virginia Department of Health Prehospital and Interhospital State Trauma Triage Plan* outlines several groups of factors to take into account with respect to the correctness of interfacility transfer of adult trauma patients (see Table 2). While some of these considerations can be translated into database queries, many cannot be evaluated because some of the crucial information is not available in the Virginia Statewide Trauma Registry (VSTR). With the exception of the Central Nervous System Triage Criterion of *GCS < 13* (discussed below), missing information was not an issue in this analysis.

Figure 4 provides graphical summaries of the interfacility transfer results outlined below. The dotted lines are used to differentiate between patients who met the specific criterion and were either admitted directly to a Level I or Level II trauma center (green) or who were later transferred to one of these facilities (gold) from those who did not receive care at a Level I or Level II trauma center (maroon and violet). *Incorrect interfacility transfer of trauma patients* is defined as the sum of the patients that were admitted elsewhere and were either transferred elsewhere or not transferred at all. Table 3 contains a summary of this information.

Respiratory Triage. The only criteria in this section that can be evaluated with the data available in the VSTR are *Significant unilateral injuries in patients under age 60* and *Flail chest*. The ICD-9-CM codes for these diagnoses (see the Appendix D) were used to create a flag variable which carries a value of "1" if the diagnosis code was present and "0" if it was not. Multiple occurrences of relevant ICD-9-CM diagnosis codes were counted only once. Only 83 records (0.3 percent) were excluded because of missing age data. Approximately one in 20 of VSTR cases met this criterion (1,694/31,472 = 5.4 percent). The vast majority of these patients (80.8 percent) were admitted directly to a Level I or Level II trauma center and 12.2 percent were admitted to other facilities and not transferred elsewhere. Of the 119 patients that were

transferred, 95 (79.8 percent) were sent to a Level I or Level II trauma center; the remaining 24 (20.2 percent) patients went to other facilities.

Table 2. Adult Criteria

Based on the *Resources for Optimal Care of the Injured Patient: 1999* (American College of Surgeons, 1999) and adapted by the TSO&MC

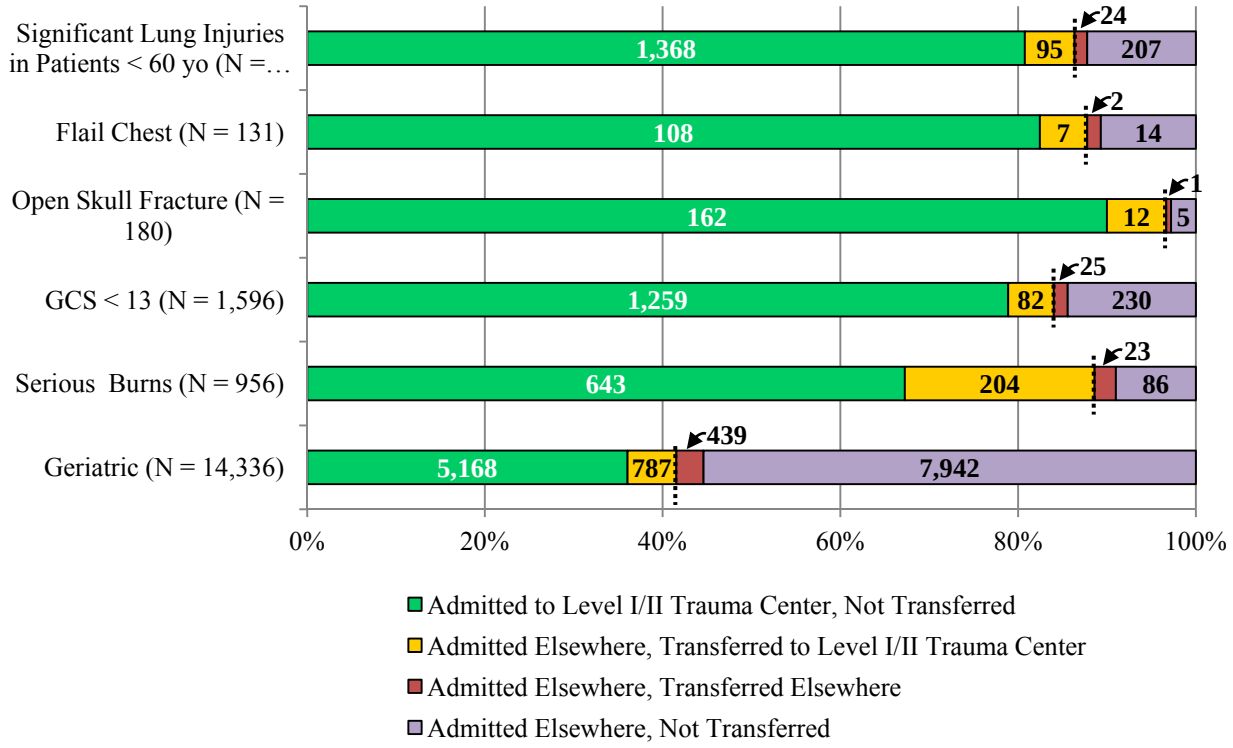
Respiratory	**Cardiovascular**
Bilateral thoracic injuries	Hemodynamic instability as determined by the treating physician
Significant unilateral injuries in patients under age 60 (e.g. pneumothorax, hemo-pneumothorax, pulmonary contusion, >5 rib fractures)	Persistent hypotension
Significant unilateral injuries in patients with pre-existing cardiac and/or respiratory disease	Systolic B/P (<100) without immediate availability of surgical team
Respiratory compromise requiring intubation	**Injuries**
Flail chest	Any penetrating injury to the head, neck, torso or extremities proximal to the elbow or knee without a surgical team immediately available.
Central Nervous System	Serious burns/burns with trauma
Unable to follow commands	Significant abdominal to thoracic injuries in patients where the physician in charge feels treatment of injuries would exceed capabilities of the medical center
Open skull fracture	**Special Considerations**
Extra-axial hemorrhage on CT, or any intracranial blood	Trauma in pregnancy (≥ 24 weeks gestation)
Paralysis	Special needs individuals
Focal neurological deficits	Geriatric
Glasgow Coma Scale (GCS) ≤ 12	Bariatric

Less than 1 percent of the cases represented patients with *Flail chest* (108/31,472 = 0.4 percent). The percentages of patients that were admitted directly to a Level I or Level II trauma center (82.4 percent) or were admitted to other facilities and not transferred elsewhere (10.7 percent) were similar to those described in the previous paragraph. Comparable distributions were also noted for patients transferred to a Level I or Level II trauma center (7/9 = 77.8 percent) or those transferred to other facilities (2/9 = 22.2 percent).

Central Nervous System Triage. It is not possible to evaluate the inability to follow commands, extra-axial hemorrhage on CT, or any intracranial blood, paralysis, and focal neurological deficits with the data available. However, the presence of an *Open skull fracture* should be discernible using ICD-9-CM diagnosis codes (see Appendix B) and cases with a *GCS < 13* should be identifiable from the patient's initial vital signs. During 2013, 90.0 percent (N = 165) of trauma patients with open skull fractures were admitted to a Level I or Level II trauma center. Of the remaining 18 patients that were admitted to other facilities, 12 (66.7 percent) were

transferred to a Level I or Level II trauma center, 1 (5.6 percent) was transferred to elsewhere, and the remaining 5 patients (27.8 percent) were not transferred.

Figure 4. Admission and Transfer Status for Trauma Registry Cases *(N = 31,472)* Meeting Any of the Adult Triage Criteria for Interfacility Transfer



The dotted lines in the figure above indicate the border between correct initial admissions and subsequent transfers to a Level I or Level II trauma center and incorrect transfers or lack of transfers to a Level I or Level II trauma center.

Unfortunately, 23.3 percent (7,324/31,472) of the VSTR records were missing the initial GCS value, so it was not possible to use *GCS < 13* as a means of determining whether or not these patients should be transferred. Approximately 1 in 15 (1,596/24,148 = 6.6 percent) of the remaining patients had an initial GCS value equal to or less than 12. The majority of these patients were admitted to a Level I or Level II trauma center (78.9 percent). Of the 337 patients admitted to other facilities, 68.2 percent were not transferred, 24.3 percent were transferred to a Level I or Level II trauma center, and the remaining 7.4 percent were transferred elsewhere.

Cardiovascular Triage. It was not possible to operationalize any of the Cardiovascular Criteria.

Injuries Triage. The only criterion from this group that can be evaluated with the available data is *Serious Burns*. The Appendix B contains a list of the ICD-9-CM diagnosis codes that were used to identify patients with severe thermal injury. Approximately 3 percent of the patients in the VSTR (956/31,742) had burns that were serious enough to warrant care at a

burn center. The majority of these patients were admitted to a Level I or Level II trauma center (643/956 = 67.3 percent). Of the 313 patients admitted elsewhere, 21.3 percent were transferred to a Level I or Level II trauma center, 2.4 percent were transferred to other facilities, and the remaining 9.0 percent were not transferred.

Table 3. Percentage Values for the Four Possible Patient Scenarios

	Patients Initially Taken to a Level I or Level II Trauma Center (Ideal)	Patients Initially Taken Elsewhere, But Were: Trans-ferred to a Level I or Level II Trauma Center (Correct)	Trans-ferred Elsewhere (Incorrect)	Not Trans-ferred (Incorrect)	Overall Incorrect
Significant Lung Injuries in Patients < 60 yo	80.8	5.6	12.2	1.4	13.6
Flail Chest	82.4	5.3	10.7	1.5	12.2
Open Skull Fracture	90.0	6.7	2.8	0.6	3.3
GCS < 13	78.9	5.1	14.4	1.6	16.0
Serious Burns *	59.7	22.5	14.9 **	2.9	17.8
Geriatric	36.0	5.5	55.4	3.1	58.5

* Values for *Serious Burns* use ***burn centers*** rather than *Level I or Level II trauma centers*

** Approximately half of the serious burn patients that were transferred elsewhere were transferred to a Level I or Level II trauma center

Somewhat similar results were noted when a destination of a burn center was used in place of a Level I or Level II trauma center. Most of the patients with serious burns were taken directly to a burn center (571/956 = 59.7 percent). Of the remaining 385 patients that were taken to other facilities, 215 (55.8 percent) were transferred to a burn center, 28 (7.3 percent) were transferred elsewhere, and 142 (36.9 percent) remained at the facility to which they were originally admitted. Approximately half (72/142 = 50.7 percent) of these patients had been admitted to a Non burn center Level I or Level II trauma center.

Special Considerations Triage. The only criterion in this category that could be assessed was *Geriatric*. An age of 65 years or older was used to define this group. All but 83 of records had a patient age (31,389/31,472 = 99.7 percent); only those cases with an age were included in the analysis. Geriatric patients represented the largest group of triage criteria met; almost one in two (14,336/31,472 = 45.6 percent) of all trauma patients were 65 years of age or

older. However, unlike the other triage criteria noted above, only about one-third (5,168/14,336 = 36.0 percent) were admitted to a Level I or Level II trauma center. Of the 9,168 geriatric patients admitted to other facilities, 7,942 (86.6 percent) were not transferred elsewhere. Of those patients that were transferred, almost twice as many were transferred to a Level I or Level II trauma center (787/9,168 = 8.6 percent) as were transferred elsewhere (439/9,168 = 4.8 percent).

Observations. According to the sources cited in the *Virginia Department of Health Prehospital and Interhospital State Trauma Triage Plan,* patients who are transferred to a Level I or Level II trauma center when indicated tend to have better outcomes both in terms of morbidity and mortality. Despite the results reported in Figure 3 and Table 3, Virginia compares well with other states for overall injury deaths per 100,000 (see Appendix E). Virginia shares the lowest death rate quintile with California, Connecticut, Hawaii, Illinois, Massachusetts, Minnesota, New Hampshire, New Jersey, and New York. While the overall injury death rate per 100,000 for Virginia is 52.59, the values of individual counties and cities across the state range from a low of 25.04 to a high of 141.14. Appendix F contains a map of Virginia by city/county using the same color scheme as in Appendix E. While Virginia compares well to other states overall, there is a nearly six-fold variation in injury death rates per 100,000 among the cities and counties. Loudoun County has both the minimum injury death rate for the state and the nation, while Dickenson County has the maximum value for the state and is in the 99th percentile for the country. Only 33 counties of the 2,941 with reportable data nationwide had higher injury death rates than Dickenson County. The wide range of values for injury deaths per 100,000 made us wonder if something similar was happening with overall deaths per 100,000. Appendix G shows this information using the same color scheme as Appendix F. The similarities in several areas of the state were striking. An informal comparison of the percentage of deaths due to injury by city/county population revealed some trends toward higher population areas having lower percentages of death due to injury. A detailed analysis of this phenomenon is beyond the scope of this report but would be interesting to explore in future reports.

Conclusions

Trauma Triage by Emergency Medical Services Agencies. The large amount of missing vital signs data is an obvious place to begin improvement efforts. It may be reasonable to not record vital signs information in some situations. For example, no patient may be found by the ambulance crew, the patient may be dead on scene, or the patient may refuse evaluation and/or care. However, all of the patient cases included in this analysis were "True 911" calls in which the patient was treated and transported to a hospital. It is difficult to imagine a scenario in which two out of every five patients (42.2 percent) had no recorded SBP, RR, or GCS. Since this report is based on 2013 data and is being submitted as 2014 comes to a close, it would make sense to rerun the analysis once the 2014 data are complete (February 2015) to determine if the lack of submission of vital signs data has changed. The 2014 results can be used to provide reports to individual agencies as well as to their EMS regions.

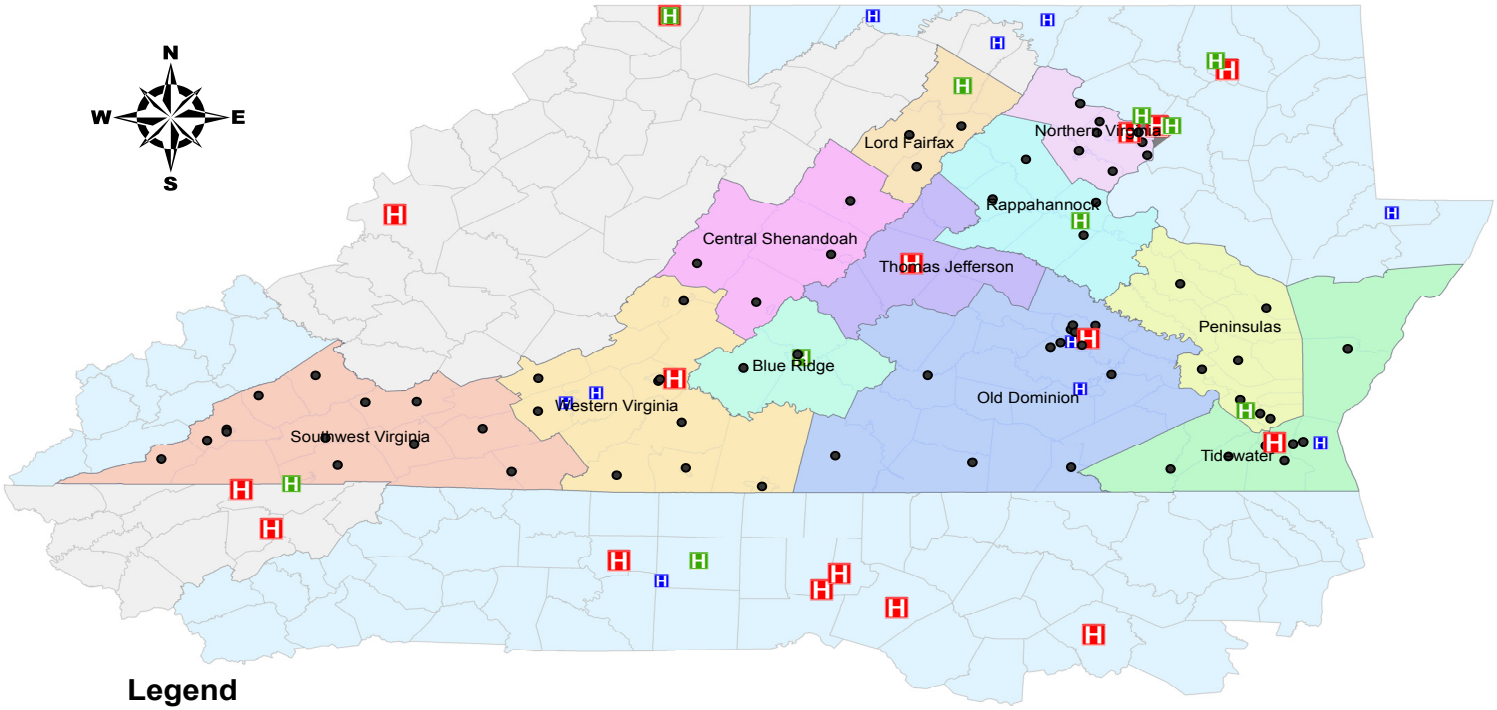
It is hoped that the give and take of providing specific agency level data to the providers, along with encouraging constructive feedback, will help to determine some of the other less

obvious explanatory issues. This information should allow for the development of a performance improvement plan for the triage of pre hospital trauma patients.

Interfacility Transfer of Trauma Patients. Based on the few interfacility triage criteria that could be evaluated, the rates of incorrect interfacility transfers of trauma patients had a minimum of 3.3 percent *(Open Skull Fracture)* maximum of 58.5 percent *(Geriatric).* The remaining four values ranged between 12.2 percent and 17.8 percent. While there is room for improvement overall, special attention will be focused on learning more about the reasons for the incorrect interfacility transfers for trauma patients meeting the *Geriatric* and *Serious Burns* criteria.

As was the case with the VPHIB data, missing vital signs – predominantly GCS values – were also a problem in the VSTR. The prevention of missing data will be another area of focus for improvement in the coming year. New VSTR software was put into place as of January 1, 2014. Past experience has taught that the initial year of implementing a large statewide database can result in some data quality issues. However, the enhanced dataset being collected and the ability to provide complex evaluations of the validity of data as they are submitted should mitigate this problem. It is hoped that the feedback provided on an ongoing basis will result in more complete and better quality data for the VSTR.

Appendix A. Location of Trauma Centers and Hospitals in Virginia and Nearby Trauma Centers in Surrounding States



Legend

Hospitals

- Non Trauma Centers

Trauma Center Designation

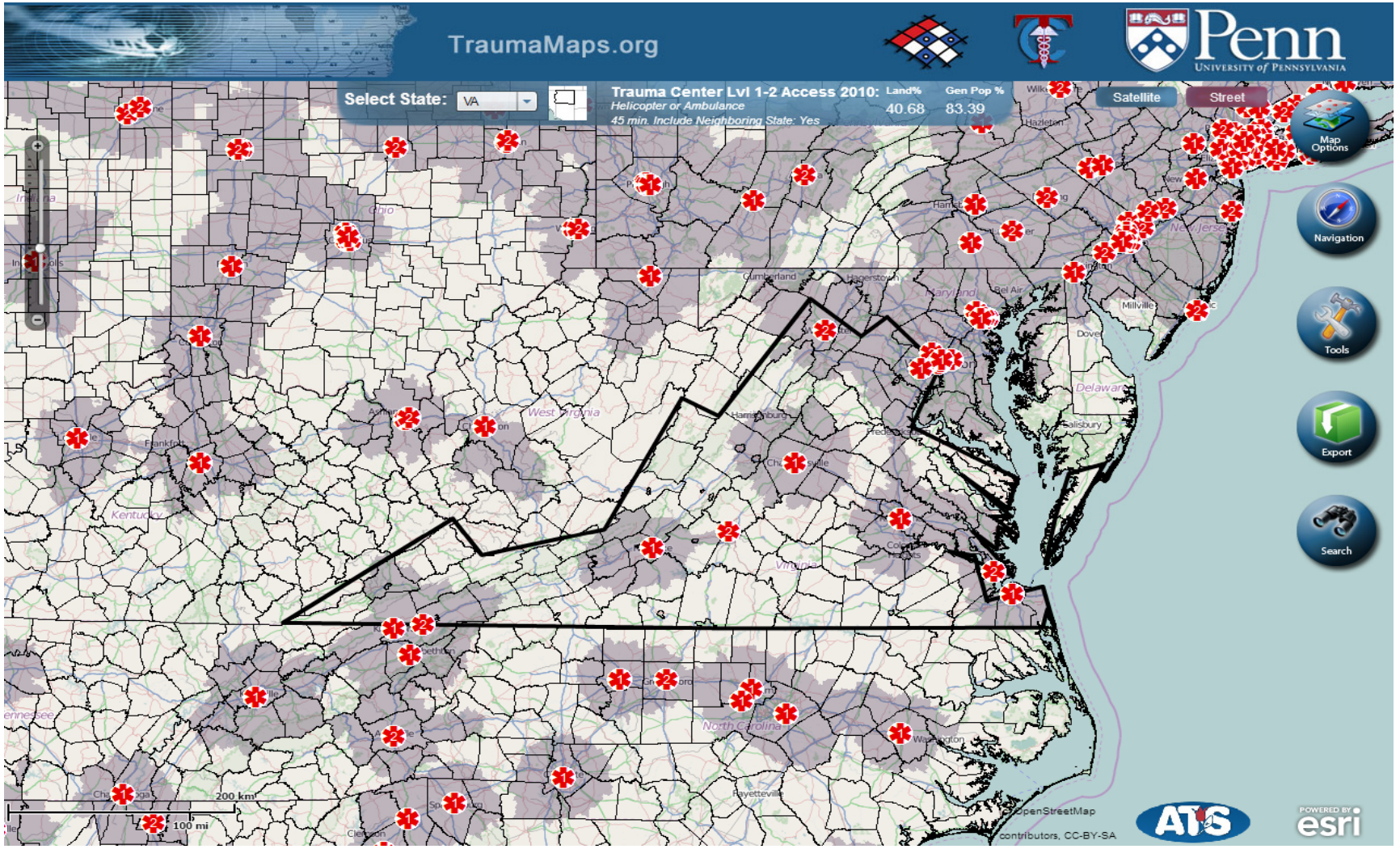
- Level I
- Level II
- Level III

EMS Regions

Names of Regions

- Blue Ridge
- Central Shenandoah
- Lord Fairfax
- Northern Virginia
- Old Dominion
- Peninsulas
- Rappahannock
- Southwest Virginia
- Thomas Jefferson
- Tidewater
- Western Virginia

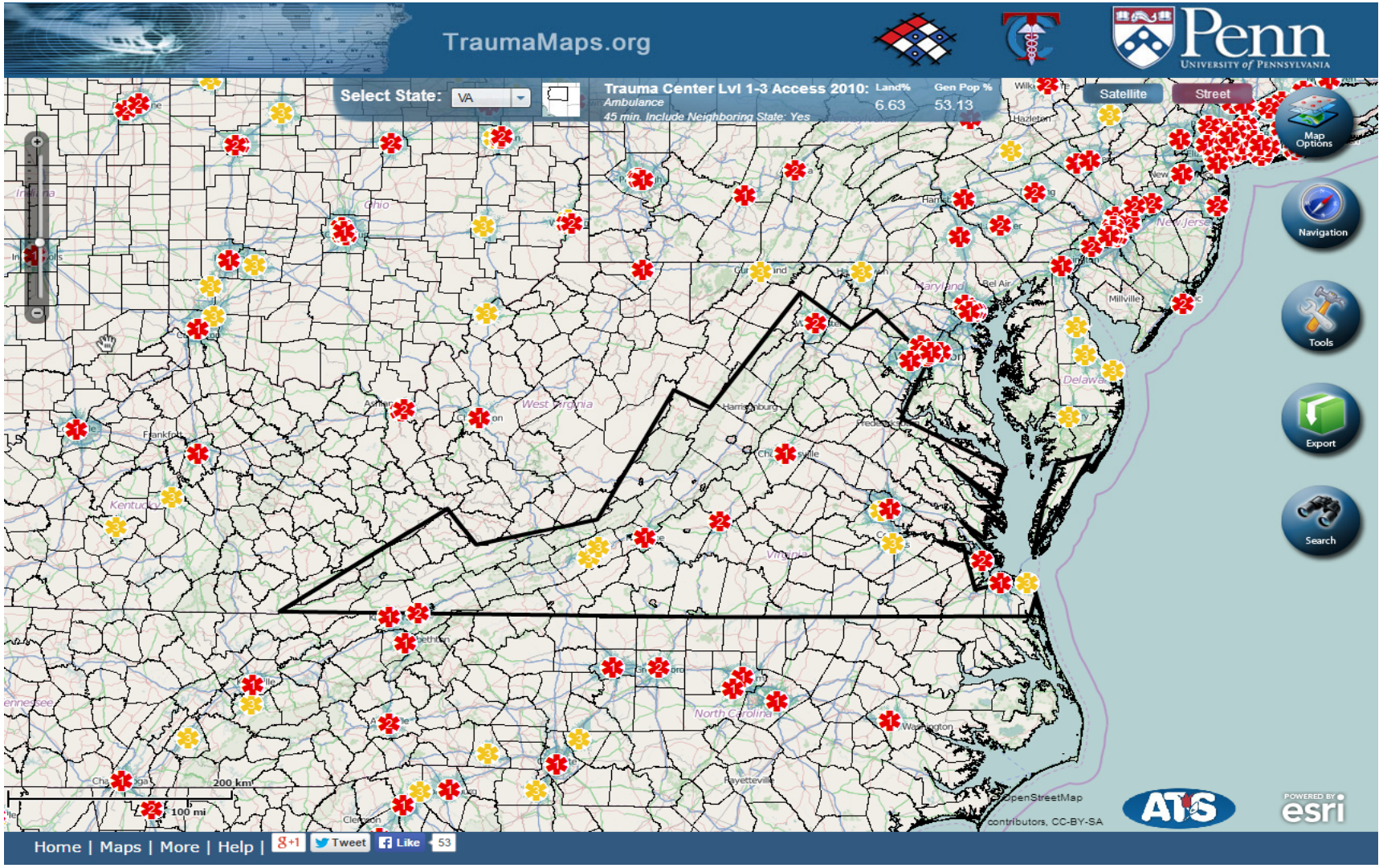
Appendix B. Adult Level I and II Trauma Centers within 45 Minutes Access Time via Helicopter or Ambulance for Virginia and Neighboring States



Source: www.traumamaps.org, accessed 12/04/2014

Note: Mary Washington Hospital (Level 2, Fredericksburg) is missing

Appendix C. Adult Level I - III Trauma Centers within 45 Minutes Access Time via Ambulance Only for Virginia and Neighboring States



Source: www.traumamaps.org, accessed 12/04/2014

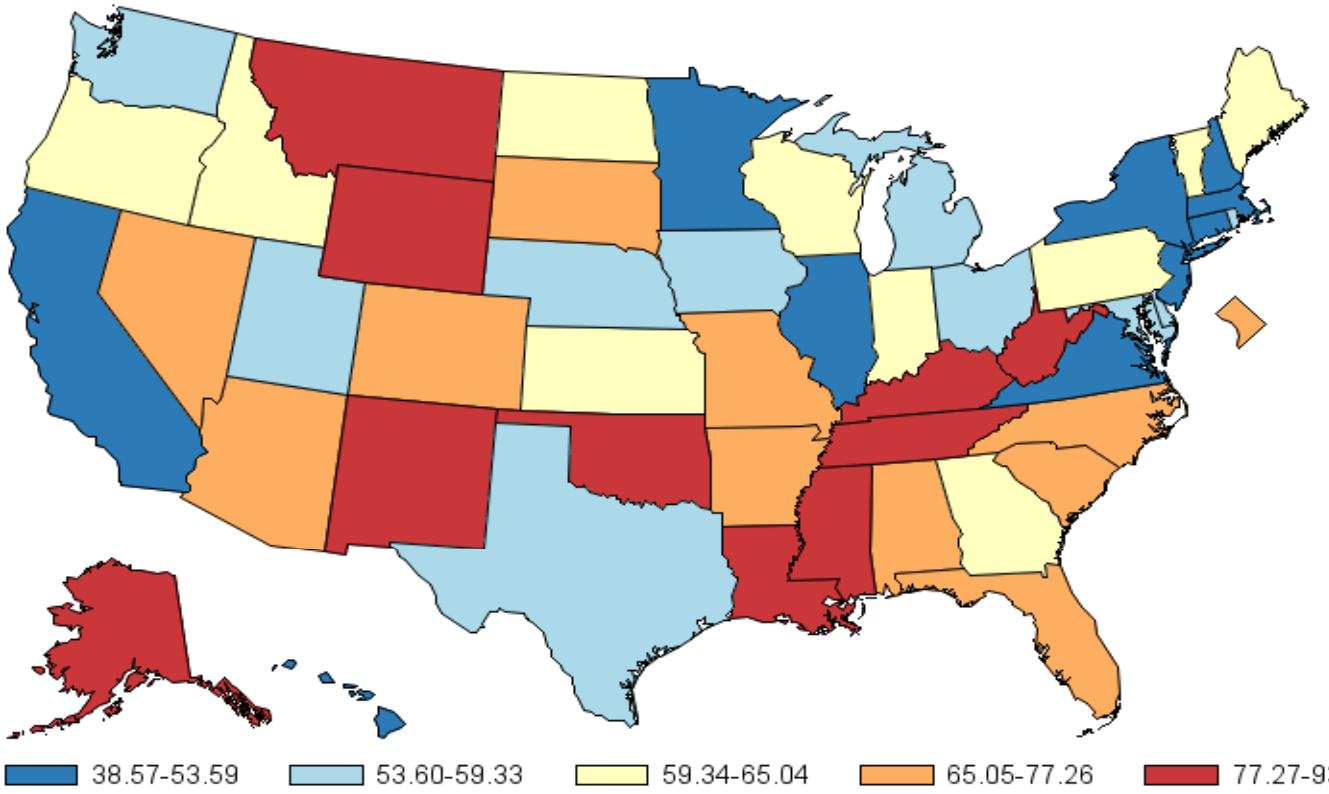
Note: Mary Washington Hospital (Level 2, Fredericksburg) is missing

APPENDIX D:
ICD-9-CM Diagnosis Codes Used for Incorrect Interfacility Transfer of Trauma Patients

Respiratory Criteria				
807.06	807.09	807.18	860	860.5
807.07	807.16	807.19	860.1	861.21
807.08	807.17	807.4	860.4	861.31
Skull Fracture Criteria				
800.5	800.9	801.8	803.7	804.6
800.51	800.91	801.81	803.71	804.61
800.52	800.92	801.82	803.72	804.62
800.53	800.93	801.83	803.73	804.63
800.54	800.94	801.84	803.74	804.64
800.55	800.95	801.85	803.75	804.65
800.56	800.96	801.86	803.76	804.66
800.59	800.99	801.89	803.79	804.69
800.6	801.5	801.9	803.8	804.7
800.61	801.51	801.91	803.81	804.71
800.62	801.52	801.92	803.82	804.72
800.63	801.53	801.93	803.83	804.73
800.64	801.54	801.94	803.84	804.74
800.65	801.55	801.95	803.85	804.75
800.66	801.56	801.96	803.86	804.76
800.69	801.59	801.99	803.89	804.79
800.7	801.6	803.5	803.9	804.8
800.71	801.61	803.51	803.91	804.81
800.72	801.62	803.52	803.92	804.82
800.73	801.63	803.53	803.93	804.83
800.74	801.64	803.54	803.94	804.84
800.75	801.65	803.55	803.95	804.85
800.76	801.66	803.56	803.96	804.86
800.79	801.69	803.59	803.99	804.89
800.8	801.7	803.6	804.5	804.9
800.81	801.71	803.61	804.51	804.91
800.82	801.72	803.62	804.52	804.92
800.83	801.73	803.63	804.53	804.93
800.84	801.74	803.64	804.54	804.94
800.85	801.75	803.65	804.55	804.95
800.86	801.76	803.66	804.56	804.96
800.89	801.79	803.69	804.59	804.99

Severe Burns Criteria							
940	941.29	942.25	943.35	944.18	944.58	946.5	948.71
940.1	941.3	942.29	943.36	944.2	945.2	947	948.72
940.2	941.31	942.3	943.39	944.21	945.21	947.1	948.73
940.3	941.32	942.31	943.4	944.22	945.22	947.2	948.74
940.4	941.33	942.32	943.41	944.23	945.23	947.3	948.75
940.5	941.34	942.33	943.42	944.24	945.24	947.4	948.76
940.9	941.35	942.34	943.43	944.25	945.25	947.8	948.77
941	941.36	942.35	943.44	944.26	945.26	947.9	948.8
941.01	941.37	942.39	943.45	944.27	945.29	948	948.81
941.02	941.38	942.4	943.46	944.28	945.3	948.11	948.82
941.03	941.39	942.41	943.49	944.3	945.31	948.2	948.83
941.04	941.4	942.42	943.5	944.31	945.32	948.21	948.84
941.05	941.41	942.43	943.51	944.32	945.33	948.22	948.85
941.06	941.42	942.44	943.52	944.33	945.34	948.3	948.86
941.07	941.43	942.45	943.53	944.34	945.35	948.31	948.87
941.08	941.44	942.49	943.54	944.35	945.36	948.32	948.88
941.09	941.45	942.5	943.55	944.36	945.39	948.33	948.9
941.1	941.46	942.51	943.56	944.37	945.4	948.4	948.91
941.11	941.47	942.52	943.59	944.38	945.41	948.41	948.92
941.12	941.48	942.53	944	944.4	945.42	948.42	948.93
941.13	941.49	942.54	944.01	944.41	945.43	948.43	948.94
941.14	941.5	942.55	944.02	944.42	945.44	948.44	948.95
941.15	941.51	942.59	944.03	944.43	945.45	948.5	948.96
941.16	941.52	943.2	944.04	944.44	945.46	948.51	948.97
941.17	941.53	943.21	944.05	944.45	945.49	948.52	948.98
941.18	941.54	943.22	944.06	944.46	945.5	948.53	948.99
941.19	941.55	943.23	944.07	944.47	945.51	948.54	949.2
941.2	941.56	943.24	944.08	944.48	945.52	948.55	949.3
941.21	941.57	943.25	944.1	944.5	945.53	948.6	949.4
941.22	941.58	943.26	944.11	944.51	945.54	948.61	949.5
941.23	941.59	943.29	944.12	944.52	945.55	948.62	
941.24	942.2	943.3	944.13	944.53	945.56	948.63	
941.25	942.21	943.31	944.14	944.54	945.59	948.64	
941.26	942.22	943.32	944.15	944.55	946.2	948.65	
941.27	942.23	943.33	944.16	944.56	946.3	948.66	
941.28	942.24	943.34	944.17	944.57	946.4	948.7	

Appendix E. 2004-2010, United States
Death Rates per 100,000 Population
All Injury, All Intents, All Races, All Ethnicities, Both Sexes, All Ages
Annualized Crude Rate for United States: 58.92

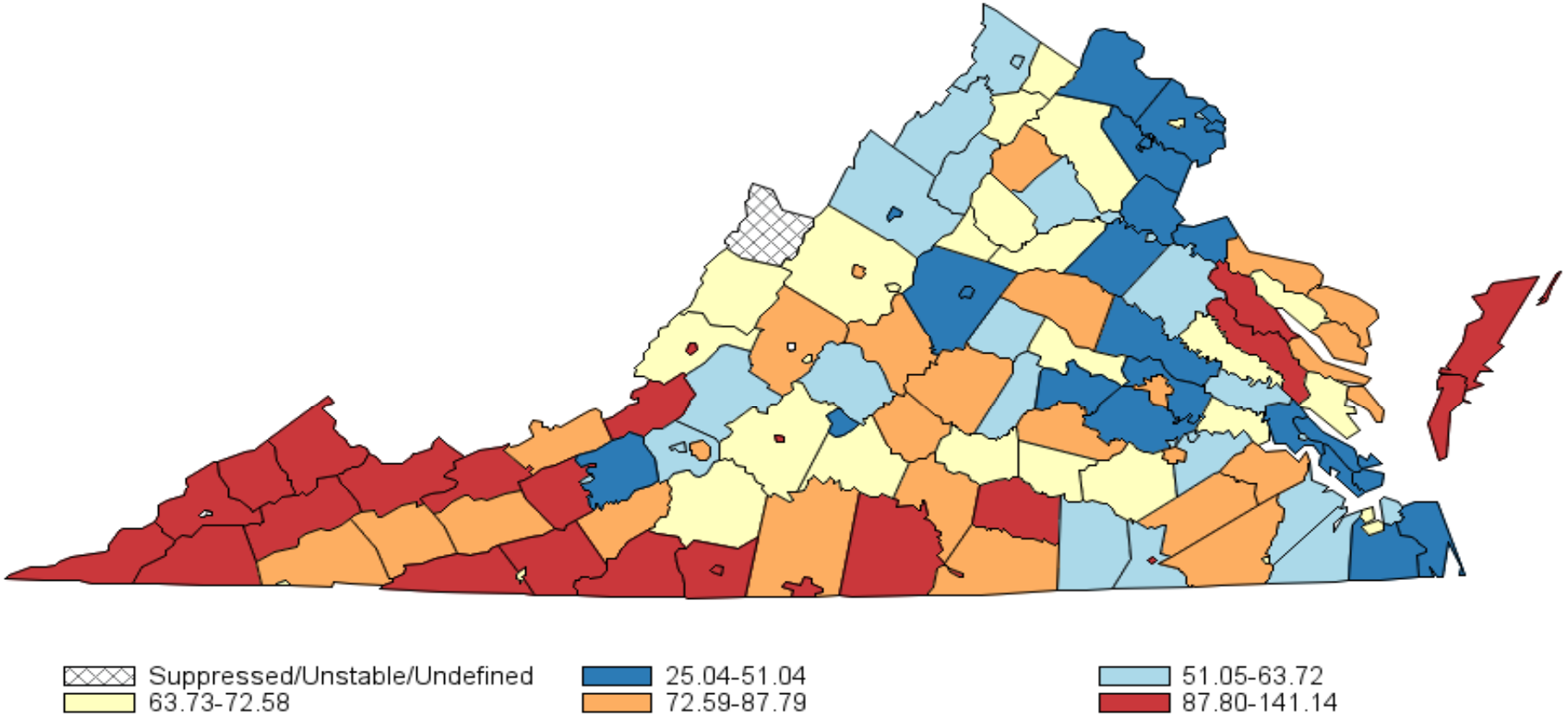


Reports for All Ages include those of unknown age.
* Rates based on 20 or fewer deaths may be unstable. States with these rates are cross-hatched in the map (see legend above). Such rates have an asterisk

Produced by: the Statistics, Programming & Economics Branch, National Center for Injury Prevention & Control, CDC
Data Sources: NCHS National Vital Statistics System for numbers of deaths; US Census Bureau for population estimates.

Source: http://wisqars.cdc.gov:8080/cdcMapFramework/mapModuleInterface.jsp, accessed 12/04/2014

Appendix F. 2004-2010, Virginia
Death Rates per 100,000 Population
All Injury, All Intents, All Races, All Ethnicities, Both Sexes, All Ages
Annualized Crude Rate for Virginia: 52.59

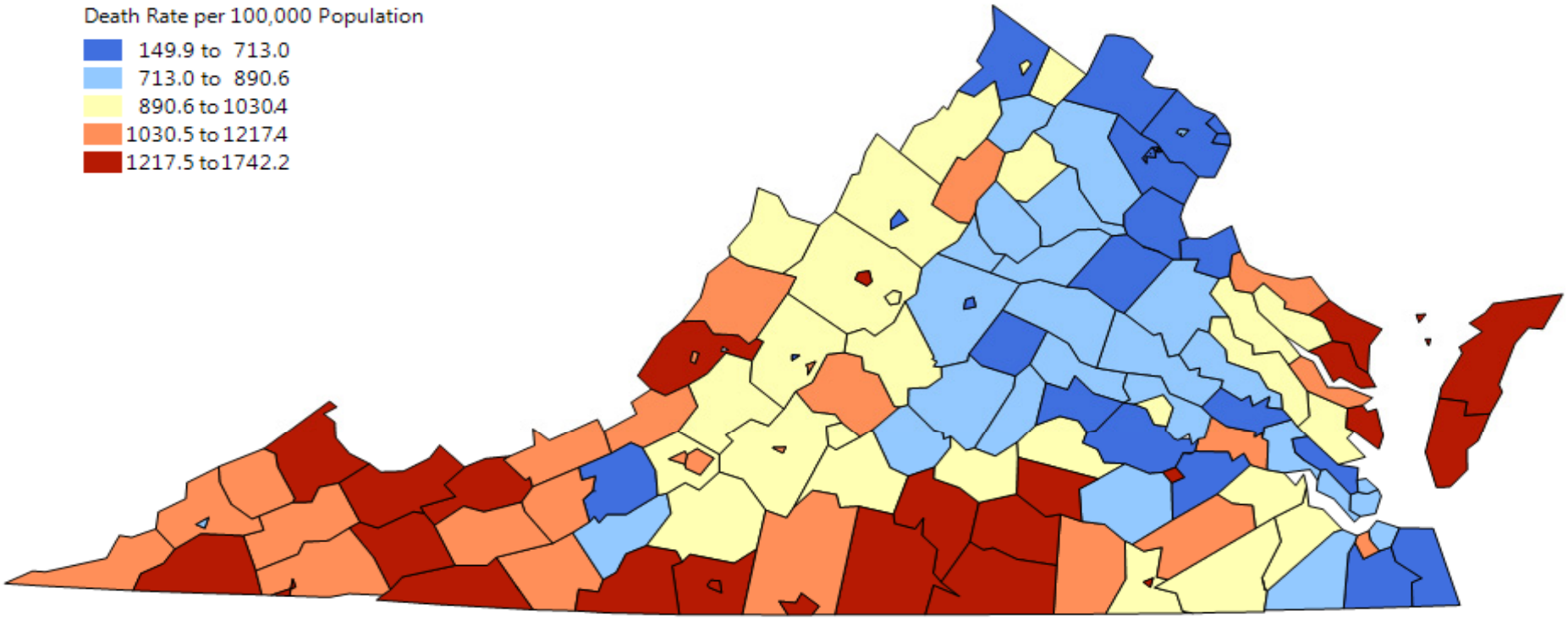


Reports for All Ages include those of unknown age.
* Rates based on 20 or fewer deaths may be unstable. These rates are suppressed for counties (see legend above); such rates in the title have an asterisk.

Produced by: the Statistics, Programming & Economics Branch, National Center for Injury Prevention & Control, CDC
Data Sources: NCHS National Vital Statistics System for numbers of deaths; US Census Bureau for population estimates.

Source: http://wisqars.cdc.gov:8080/cdcMapFramework/mapModuleInterface.jsp, accessed 12/04/2014

Appendix G. Virginia Comprehensive Death Rates per 100,000 Population for 2013



Data Source: http://www.census.gov/popest/data/counties/totals/2013/files/CO-EST2013-Alldata.csv, accessed 12/04/2014