

National Sample Program

Arrival Year 2010

National Trauma Data Bank[©] (NTDB[©])
National Sample Program

November 2011

**NTDB,
American College of Surgeons
633 N. Saint Clair
Chicago, IL 60611
www.ntdb.org/nsp**

ACKNOWLEDGEMENT

The American College of Surgeons Committee on Trauma thanks the Centers for Disease Control and Prevention (CDC) for their support of the NTDB.

TERMS OF USE

The American College of Surgeons (ACS) was awarded a contract from the National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention (CDC) to develop a nationally-representative sample of U.S. trauma centers that provides data on treated trauma patients. This National Sample Program (NSP) is intended to enhance the ACS National Trauma Data Bank (NTDB) by providing data from a probabilistic sample of trauma center hospitals nationwide to meet the broad range of trauma care assessment, clinical outcomes research, and injury surveillance needs.

The American College of Surgeons, Committee on Trauma collects and maintains the NTDB NSP. Therefore, use of any information from these must include a prominent credit line. That line is to read as follows: *Committee on Trauma, American College of Surgeons, NTDB NSP 20XX,, Chicago, IL. The content reproduced from the NTDB NSP remains the full and exclusive copyrighted property of the American College of Surgeons. The American College of Surgeons is not responsible for any claims arising from works based on the original Data, Text, Tables, or Figures.*

Specific Terms of Agreement:

Limited license is granted to use said Information from the NTDB from the American College of Surgeons, Committee on Trauma, provided the Requester agrees to the following provisions:

1. Treat the information received from The American College of Surgeons, Committee on Trauma as non-public health data. The data may never be used by Requester as a basis for legal, administrative or other actions that can directly affect an individual whose medical or personal information is included in a case in the data.
2. Use the information received under the provisions of this Agreement only for the following not-for-profit purposes: research, advocacy, medical education, patient education, or other trauma care-related activities supported by not-for-profit organizations.
3. All Information derived from the NTDB NSP from The American College of Surgeons, Committee on Trauma shall remain the full and copyrighted property of The American College of Surgeons, Committee on Trauma and shall be so noted in educational material, website presentations, and publications.
4. Warrant that The American College of Surgeons, Committee on Trauma is not responsible for any claims arising from works based on the original Data, Text, Tables, or Figures.
5. Indemnify the American College of Surgeons, its Committee on Trauma and their employees, agents, and contributors from any and all liability, loss, or damage suffered as a result of claims, demands, costs, or judgments arising out of use of NTDB NSP information.
6. Requestor may not sublease or permit other parties to use NTDB NSP data without advance written approval of ACS COT.

The Requester's obligations hereunder shall remain in full force and effect and survive the completion of the Requester's defined project described herein above. The terms of this Agreement shall be binding upon the Requester and the organization through which his/her project is conducted.

TABLE OF CONTENTS

Section	Page
ACKNOWLEDGEMENT	4
BACKGROUND AND DESCRIPTION OF NSP	7
NTDB CONFIDENTIALITY POLICY	8
CURRENT LIMITATIONS OF NSP DATA.....	8
1. Data quality in NTDB.....	8
2. Selection bias in NTDB.....	8
3. Missing data in NTDB.....	9
GETTING STARTED WITH NSP DATA	9
FREQUENTLY ASKED QUESTIONS.....	11
PUBLICATIONS.....	16
CONTACT INFORMATION.....	17

APPENDICES

APPENDIX A: VARIABLE LIST AND CLASSIFICATION	18
APPENDIX B: SELECTED ESTIMATES USING NSP	44
APPENDIX C: SAMPLE DESIGN AND MAINTENANCE.....	48
APPENDIX D: SAMPLE SAS SOURCE CODE	55
APPENDIX E: SAMPLE STATA SOURCE CODE.....	58

BACKGROUND AND DESCRIPTION OF NSP

The American College of Surgeons (ACS) was awarded a contract from the National Center for Injury Prevention and Control (NCIPC), Centers for Disease Control and Prevention (CDC) to develop a nationally representative sample of U.S. trauma centers that provides data on treated trauma patients. This National Sample Program (NSP) is intended to enhance the ACS National Trauma Data Bank (NTDB) by providing data from a probabilistic sample of trauma centers nationwide to meet the broad range of trauma care assessment, clinical outcomes research, and injury surveillance needs.

The NTDB is the largest compilation of traumatic injury data ever assembled. It contains over 3 million records voluntarily provided by over 900 U.S. trauma centers. The information contained in the NTDB has implications for many areas including epidemiology, injury control, research, education, acute care, and resource allocation. The goal of the NTDB is to collect data on every patient in every trauma center in the U.S and inform the medical community, the public, and decision makers about a wide variety of issues that characterize the current state of care for injured persons in our country. Since the NTDB does not yet collect data from every trauma center in the U.S., the data do not allow one to make national estimates of rates for clinical measures of trauma care. The NSP, which will collect data stratified by region and level of care, will provide baseline data and allow reliability in computing national estimates with high confidence. The NSP will allow researchers to make statistically valid inferences about patients cared for in Level I and II trauma centers in the U.S. by improving the NTDB's data quality based on a representative sample of 100 hospital trauma centers. While other national probability samples of hospital inpatient and outpatient settings exist, the NSP will provide detailed clinical indicators and other trauma care information that are not available in other data systems.

The National Sample Program (NSP) is intended to (1) create a traumatic injury database from a nationally representative sample of trauma hospitals; (2) collect a wide variety of diagnostic and clinical indicators complementary to the NTDB; and (3) produce national baseline estimates of variables and indices associated with hospitalized traumatic injuries such as prehospital diagnosis and management, trauma outcomes, and other variables that characterize the dimensions of trauma treatment. It is also intended to help characterize the circumstances of the injury incident (e.g., external causes of injury) and injured patients treated in trauma centers in the United States.

The NTDB National Sample is a stratified sample of 100 hospitals, with sample hospitals drawn based on probability-proportional-to-size methodology, using number of ER visits from AHA 2005 data as the size measure. The sampling universe used to create the NTDB National Sample was the 453 level I or II trauma centers based on TIEP 2003 data. The strata used for the sampling were: 1) NTDB participation (NTDB, non-NTDB), 2) Trauma Level I or II, and 3) Region – Northeast, Midwest, West, and South.

The NTDB National Sample consists of incident-level records, hospital information and weights. Appendix A consists of the data elements that are found in the NTDB National

Sample. Note that all records from the sample hospitals are provided with sample weights and data are not excluded due to low quality or incompleteness. Currently data are available for admission years 2003 to 2010.

NTDB CONFIDENTIALITY POLICY

NTDB data are maintained in a secure database with limited internal access. External users must gain permission to the database and data are then supplied at the aggregate level only. Use of NTDB data is in strict compliance with the Health Insurance Portability and Accountability Act of 1996 (HIPAA). The NTDB does not distribute or report hospital information in any manner that allows the reporting hospital to be identified without the express written permission of the hospital. The dataset collected by NTDB is considered a limited dataset under HIPAA, and the research dataset that ACS releases is a de-identified dataset.

CURRENT LIMITATIONS OF NSP DATA

The data in the National Sample is based on NTDB data and therefore inherent the same limitations that are present in the NTDB. The sample weights have been reviewed and edited carefully by NTDB for accuracy. However, data are not excluded due to low quality or incompleteness. Researchers should note that these data are submitted to the NTDB voluntarily from trauma centers and the inclusion/exclusion criteria for records may vary among trauma centers.

1. Data quality in NTDB

NTDB has worked hard to improve data quality and introduced a new standardized data set. However, the data quality of NTDB is dependent on how well the National Trauma Data Standard (NTDS) is implemented for the data submitted by the individual hospitals. The NTDB is continually cleaning and standardizing the data to improve data quality. Data files received from contributing hospitals are screened upon submission by the Validator, NTDB's edit check program (see Appendix of the NTDS Data Dictionary). Any files receiving a level 1 or 2 error are rejected, but can be resubmitted after corrections. Other errors are shown on reports generated by the Validator to provide information about the data submission.

2. Selection bias in NTDB

The NTDB data are submitted voluntarily from hospitals and by definition cases not admitted to a hospital will not be included in the NTDB, including injury victims who die before they can be transported to a hospital. Hospitals may have differing criteria for including deaths on admission, deaths in the Emergency Department, or other cases,

which should be evaluated before making comparisons. The American College of Surgeons Committee on Trauma has been trying to standardize the inclusion criteria among trauma registries, however, there is still some variability in trauma registry inclusion criteria across the country. Selection bias refers to an apparent difference between two groups that is actually caused by different inclusion criteria. For example, if one trauma center includes isolated hip fractures in its registry and another does not, and if mortality for this injury is lower than for other injuries with the same severity score, the hospital that included isolated hip fractures will appear to have a lower “risk-adjusted” mortality. Any difference in inclusion/exclusion criteria could produce a selection bias.

3. Missing data in NTDB

The proportion of missing data varies across data elements in NTDB, but it is important to decide how to deal with missing data when doing analyses. In most cases NTDB data are not missing at random and analyses, therefore, are subject to bias if missing data are ignored. That is, the results may be misleading when excluding all observations with missing data. Excluding observations with missing values is the default for most software programs when running statistical analyses. Another option is to provide plausible values for the missing data, either by single or multiple imputation. A single imputation of a value may be an educated guess at the value, substitution of the mean value, or substitution based on a regression equation using other (observed) values. Most statistical software packages can do imputations without much difficulty. However, it is important to explore the impact of missing data with sensitivity analyses. That is, repeat an analysis with and without imputation and see whether there are any important differences.

GETTING STARTED WITH NSP DATA

The NSP dataset is a set of relational tables and consists of 20 data files. These files are in ASCII-CSV format (comma separated value), standard SAS data sets, and DBF format (DBASE version 2.0), which can be easily imported to most statistical software (i.e. SAS, SPSS, and Stata). The file WEIGHTS includes the strata and weights for each trauma incident. This file and 16 other files include a unique incidents identified (inc_key) that can be used for merging the files together. One file include the facility information for the NSP participating hospitals for corresponding and this data can be merged to ED, DEMO, and DISCHARGE by using the unique facility identifier (fac_key). The remaining three data files (DCODEDES, ECODEDES and PCODEDES) are look-up tables with the description of the ICD-9 Diagnosis code, E-code, and procedure codes, respectively. The look-up tables can be merged with the unique DCODE, ECODE, and PCODE.

Included on the downloading website are two sample programs to help researchers get started with merging files and creating weighted statistical output. These sample

programs are available for SAS and Stata. A copy of the source codes of these programs can be found in the Appendix D and E. We hope that you will contact us with any concerns or suggestions on how to make these sample programs more useful in the future. Table 1 is a listing of the 20 relational files with a short description for each data file. A detailed data dictionary of each variable in the data sets can be found in Appendix A.

Table 1: Data files and descriptions

File name	Description
AISPCODE	The AIS (Abbreviated Injury Scale) code submitted by the hospital (excluding AIS version 2005)
AISP05CODE	The AIS (Abbreviated Injury Scale) code submitted by the hospital for AIS version 2005.
AISCCODE	The AIS (Abbreviated Injury Scale) code globally calculated with ICD-90 MAP
AIS98PCODE	The AIS (Abbreviated Injury Scale) code globally mapped to AIS version 1998. If the hospital does not submit AIS98, then ISS is based on AIS derived from ICDMAP-90.
COMORBID	Pre-existing comorbidity information
COMPLIC	Any NTDS complications
DEMO	Demographic information
DCODE	ICD-9-CM Code of Diagnosis Information
DCODEDES	Look-up table of the description of the ICD-9-CM diagnosis codes
DISCHARGE	Includes discharge and outcome information
ECODE	Includes the ICD-9 external cause of injury code.
ECODEDES	Ecode look up table
ED	Emergency Department information
FACILITY	Facility Information
PCODE	Procedure codes
PCODEDES	Look-up table for procedures
PROTDEV	Protective devices
TRANSPORT	Transport information
VITALS	Vital signs from EMS and ED
WEIGHTS	The final weights and Strata indicators for each incident

The breakdown of facilities and trauma incidents included in each year of the NSP data is presented in Table 2. The total number of hospitals in the NSP is 100 hospitals; however, not all hospitals submit data each year. NTDB has worked hard on trying to recruit hospitals to submit data in the last years and we have been targeting a participation rate of at least 85% of the hospitals. Table 2 also gives the number of trauma centers per strata used for the National Sample design.

Table 2: Description of data in each data set

Data set	Number Incidents	Number of trauma centers			
		Total	Trauma Level	NTDB Status	Census Region
2003	122,210	70	36 Level I 34 Level II	66 NTDB 4 non-NTDB	9 Northeast 21 South 23 Midwest 15 West
2004	109,284	71	40 Level I 31 Level II	68 NTDB 3 non-NTDB	6 Northeast 29 South 24 Midwest 12 West
2005	128,841	72	38 Level I 34 Level II	67 NTDB 5 non-NTDB	11 Northeast 23 South 21 Midwest 17 West
2006	150,159	86	46 Level I 40 Level II	79 NTDB 7 non-NTDB	15 Northeast 29 South 26 Midwest 16 West
2007	148,270	82	47 Level I 35 Level II	74 NTDB 8 non-NTDB	11 Northeast 28 South 26 Midwest 17 West
2008	162,138	90	49 Level I 41 Level II	83 NTDB 7 non-NTDB	12 Northeast 30 South 28 Midwest 20 West
2009	162,821	93	51 Level I 42 Level II	83 NTDB 10 non-NTDB	15 Northeast 31 South 27 Midwest 20 West
2010	161,086	91	49 Level I 42 Level II	82 NTDB 9 non-NTDB	14 Northeast 30 South 27 Midwest 20 West

FREQUENTLY ASKED QUESTIONS

This section includes research-related questions and answers related to using the NSP. In addition, Appendix B contains weighted frequencies and weighted means for the data in NTDB NSP samples 2010 to help users ensure they are correctly using the data.

1. Can I estimate the number of patients based on NSP?

The NTDB NSP is an **incident** database and there are no patient identifiers in the database. If a patient has more than one reported trauma incident during an admission year, this patient may be in the database more than once.

2. How can I merge the data sets in NTDB?

The data files can be merged by using the unique incident key for each incident (inc_key). There is also a unique facility key (fac_key) which can be used for hospital-level analysis. SAS and Stata source codes are provided (Appendix D and E) to help you get started.

3. What are the patient inclusion criteria for the NTDB?

All patients with ICD-9-CM discharge diagnosis 800.00 – 959.9

- Excluding 905-909 (late effects of injury)
- Excluding 910-924 (blisters, contusions, abrasion, and insect bites)
- Excluding 930-939 (foreign bodies)

AND who were admitted, died, or were transferred in or out of the reports hospitals.

4. Where can I find the external cause of injury and how many of them are available in the data set?

The ECODE table includes the primary (first-listed) ICD-9 external cause of injury code. Hence, there is only one ICD-9 external cause of injury code per incident. Appendix E contains the standard matrix of ICD-9 external-cause-of-injury code groupings used for reporting of injury mortality (defined by ICD-9 codes) and morbidity (defined by ICD-9-CM codes) data systems.

5. Where can I find the diagnosis codes and how many of them are available in the data set?

The DCODE table includes all of the ICD-9-CM Codes of Diagnosis for each incident. In addition, four Abbreviated Injury Scale scores are included in NSP. AISPCODE is the AIS score that is submitted to the NTDB for the trauma diagnosis, excluding the 2005 version and AISP05CODE is the AIS score submitted to NTDB with the 2005 version. AISCCODE is the AIS score that is calculated from the ICDMAP90 crosswalk for the trauma diagnosis and AIS98PCODE, which contains AIS codes that have been mapped or “crosswalked” to a common AIS 98 code for consistency.

6. There are multiple types of Injury Severity Scores (ISS) in the ED file, which one do I use?

There are four different Injury Severity Score (ISS) in NSP. The ISSLOC is the ISS submitted by the hospital to NTDB and no further changes are made to this value. There are also two ISS scores calculated in the database: ISSAIS is the ISS score that is derived from the AIS scores submitted by the hospitals. ISS98 is the ISS score that has been derived from a mapping of existing AIS codes to AIS98 for consistency. ISSICD is the ISS score that is derived from the AIS score that is calculated from the ICD/AIS map, ICDMAP-90, 1995 update (computer program: ICODERI.DLL, Windows version. Johns Hopkins University, 1997.) Each injury is allocated to one of six body regions based on the Abbreviated Injury Scale (AIS) score according to:

- Head or neck
- Face
- Chest
- Abdominal or pelvic contents
- Extremities or pelvic girdle
- External

The 3 most severely injured body regions have their AIS severity score squared and added together to produce the ISS score. Only the highest AIS score in each body region is used.

7. Do I need to use the sample weights in analyzing the data?

Yes, the sample weights are essential for computing national estimates. Each sample weight represents the inverse of the probability of selection of the hospitals. The sample weight has been adjusted for hospital nonresponse within each NSP sample stratum and changes in the number of ED visits annually in the sampling frame of US hospital EDs. The WEIGHTS table includes the sample weights for each incident. More details on the NTDB NSP sample are given in Appendix C: Sample Design and Sample Creation.

8. How do I calculate standard errors of the national estimates?

There are two computer programs available that can be used to calculate relative standard errors and 95% confidence intervals. Stata SVY and SAS proc SURVEYMEANS / SURVEYFREQ. Both programs seem to provide very similar estimates of standard errors. Sample programs written in Stata and SAS code estimation using the NSP data are provided in Appendix D and Appendix E, respectively.

9. What are the stratification variables for this sample?

The NTDB national sample is a stratified sample of 100 trauma centers. The sample is stratified by trauma designation level (I or II), census region (North East, South, Midwest, and West), and by NTDB participation (NTDB, non-NTDB) prior to year 2003 when the sampling frame was established. The 16 strata for the sample are:

- 1 = NTDB, Level I, North East
- 2 = NTDB, Level II, North East
- 3 = NTDB, Level I, South
- 4 = NTDB, Level II, South

- 5 = NTDB, Level I, Midwest
- 6 = NTDB, Level II, Midwest
- 7 = NTDB, Level I, West
- 8 = NTDB, Level II, West
- 9 = non-NTDB, Level I, North East
- 10 = non-NTDB, Level II, North East
- 11 = non-NTDB, Level I, South
- 12 = non-NTDB, Level II, South
- 13 = non-NTDB, Level I, Midwest
- 14 = non-NTDB, Level II, Midwest
- 15 = non-NTDB, Level I, West
- 16 = non-NTDB, Level II, West

More details on the NTDB NSP sample are given in Appendix C.

10. What statistical criteria should be used to decide if an estimate is unstable or unreliable?

There are approximately 110,000 -160,000 records of injury incidents for each admission year (2003 to 2010) in the NSP data files. Such a large sample size should allow estimates with sufficient precision in general, particularly estimates at the national level. However, when estimation is restricted to a sub-domain such as specific causes/mechanisms of injury or intents of injury by age, sex and/or race/ethnicity, the sample size may become too small to produce reliable estimates. We recommend the following rules based on sample size and the standard error estimate to determine the validity of an estimate:

1. At least 30 NSP cases can be used in the estimation, and
2. For estimates of continuous variable (i.e. mean of the length of hospital stay), relative standard error (ratio of standard error to the value of the estimate) should be less than 50%; for estimates of categorical variable (i.e. proportion) relative standard error is calculated on logarithm scale as the following,

$$RSE[-\ln(p)] \leq 0.225 \text{ when } p \leq 0.5 \text{ or}$$

$$RSE[-\ln(1-p)] \leq 0.225 \text{ when } p > 0.5.$$

11. How do I handle the BIU values, i.e., why are there negative values for certain variables when there should not be any?

For definition of the BIU values please see Appendix A. The BIU values for numerical values are coded with the number -2- and -1. It is recommended to either exclude or set these values to missing before doing any statistical analyses of these values.

12. There seem to be some inconsistencies between fields, how do I decide what data to include?

NTDB has been working the last couple of years trying to improve the quality of the data and, with the new data standard quality and consistency has improved, but is of course

not perfect. It is always important that researchers make sure that the data that is used for analyses are consistent and valid for their purpose. For further information on the valid values for each variable please see Appendix A. There is very limited cleaning of data when it comes to consistencies between variables, in order to avoid incorrectly deleting values. That is, there are instances where the ICU length of stay (ICUDAYS) is greater than the total hospital length of stay (LOSDAYS) and it is up to the researchers to decide how to use that information

14. What data cleaning was performed on the dataset before release?

Logical inconsistencies and out of range values were corrected in the dataset by replacing the values with the appropriate common null value.

Vent days > LOS are set to BIU -2

ICU days > LOS are set to BIU -2

ED or LOS times > 364 days are set to BIU -2.

EMS times > 28 days set to BIU -2.

YOADMIT or YOPROC >2010 are set to BIU -2.

YOINJ < 2009 is set to BIU -2

YOINJ >2010 is set to BIU -2

YOBIRTH \geq 2011 is set to BIU -2

PUBLICATIONS

We request that researchers using NSP notify us of any publications. Authors should be aware that the following recommendations have been provided to the editors of journals most likely to publish articles based upon NTDB data:

Recommendations for Peer Review of Studies using the NTDB (from the NTDB Subcommittee, ACS Committee on Trauma, March 2007)

The ACS Committee on Trauma does not presume or desire to involve itself directly in the editorial process by which manuscripts are selected for publication. However, we do wish to inform this process and maximize the quality of these publications by making editors and reviewers aware of the obligations of licensees to the National Trauma Data Bank (NTDB®), as well as some of the technical issues posed by research involving this database.

Licensees have agreed to include a statement in their manuscripts acknowledging that “the NTDB remains the full and exclusive copyrighted property of the American College of Surgeons. The American College of Surgeons is not responsible for any claims arising from works based on the original Data, Text, Tables, or Figures.”

Licensees have further agreed to include language indicating which version of the NTDB (e.g., NSP arrival year 2010) they are using. This is important since the database is updated frequently, and other researchers should be provided with sufficient information to allow replication of the findings using the same data set.

The NTDB files provide only general information about contributing institutions, such as trauma center verification status and categorical number of beds. We and our licensees are committed to maintaining the confidentiality of contributing institutions and patients as mandated by federal law. Studies claiming to add information about hospitals or patients from sources outside the NTDB should therefore be evaluated with great caution. Reviewers may wish to verify assertions about the characteristics of contributing hospitals against the characteristics actually available in the research data set.

Like any large database, the NTDB does not have complete data for all cases; therefore authors should be expected to state how they dealt with missing data (exclusion, imputation, etc.) Similarly, the NTDB is not a population-based dataset; therefore statements about the incidence of specific conditions are inappropriate if based only on NTDB data. A Reference Manual, which describes these and other sources of potential bias inherent to the NTDB, has been provided to all researchers with the database files. Reviewers are advised to look for explicit discussion of these biases and their possible effects on the analysis.

Our web site (www.ntdb.org) includes the data use agreements, data dictionaries, a list of prior publications, the Reference Manual, and other related material. Please feel free to contact the NTDB office for further information.

CONTACT INFORMATION

Additional information regarding the National Sample Program, 2003 – 2010, may be obtained from:

Melanie Neal, NTDB Manager

E-Mail: mneal@facs.org

Phone: 312-202-5536

LieLing Wu, NTDB Statistician

E-Mail: lwu@facs.org

Phone: 312-202-5255

Chrystal Price, NTDB Data Analyst

E-Mail: cprice@facs.org

Phone: 312-202-5467

Alice Rollins, NTDB Coordinator

E-Mail: arollins@facs.org

Phone: 312-202-5917

Sandra Goble, Statistical Consultant

E-Mail: sgoble@facs.org

American College of Surgeons

National Trauma Data Bank[®]

633 N. St. Clair 26th Floor

Chicago, IL 60611

APPENDIX A: VARIABLE LIST AND CLASSIFICATION

This appendix includes the definition, format and length of each variable in the NTDB NSP data sets. In addition to the variable list this appendix also includes other important descriptions on how NTDB data is derived. For example the Barrel matrix for classification of body region and nature of injury for trauma diagnosis and the E-Code grouping of mechanism of injury and type. For further information on the data included in the NTDB NSP please see the current NTDS dictionary (<http://www.ntdsdictionary.org/>)

VARIABLE DESCRIPTION LIST

This section includes the definition, format and length of each variable in each of the NSP 2010 data sets. Please see the external NTDS dictionary (<http://www.ntdsdictionary.org/dataElements/datasetDictionary.html>) for further details on each variable. The data sets are listed in alphabetic order.

NOTE: All data fields have Common Null Values (blank inappropriate values, hereforth known as BIU Values) as valid values unless specified.

Field Values

1 Not Applicable (-1)

2 Not Known/Not recorded (-2)

- *Not Applicable*: This null value code applies if, at the time of patient care documentation, the information requested was “Not Applicable” to the patient, the hospitalization or the patient care event. For example, variables documenting EMS care would be “Not Applicable” if a patient self-transported to the hospital.
- *Not Known/Not Recorded*: This null value applies if, at the time of patient care documentation, information was “Not Known” (to the patient, family, health care provider) or no value for the element was recorded for the patient. This documents that there was an attempt to obtain information but it was unknown by all parties or the information was missing at the time of documentation. For example, injury date and time may be documented in the hospital patient care report as “Unknown”. Another example, Not Known/Not Recorded should also be coded when documentation was expected, but none was provided (i.e., no EMS run sheet in the hospital record for patient transported by EMS).

File Name: *AISPCODE*

Definition: The AIS (Abbreviated Injury Scale) code version 1980, 1985, 1990, and 1998 submitted by the hospital for the trauma diagnosis

Frequency: Unlimited number of records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
AIS Version (AISVER)	The version of AIS used to code the particular incident.	Numeric	4	1980 1985 1990 1998	
AIS Predot Code (PREDOT)	The Abbreviated Injury Scale (AIS) predot codes that reflect the patient's injuries.	Numeric	6		
AIS Severity (SEVERITY)	This represents the Abbreviated Injury Scale severity code that reflects the patient's injuries.	Numeric	3	1 to 6, 9	

File Name: *AISP05CODE*

Definition: The AIS (Abbreviated Injury Scale) code version 2005 submitted by the hospital for the trauma diagnosis

Frequency: Unlimited number of records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
AIS Version (AISVER)	The version of AIS used to code the particular incident.	Numeric	4	2005	
AIS Predot Code (PREDOT)	The Abbreviated Injury Scale (AIS) predot codes that reflect the patient's injuries.	Numeric	6		
AIS Severity (SEVERITY)	This represents the Abbreviated Injury Scale severity code that reflects the patient's injuries.	Numeric	3	1 to 6, 9	

File Name: *AIS98PCODE*

Definition: The crosswalked AIS (Abbreviated Injury Scale) code. All hospitals' codes are set to AIS98 with the exception of those hospitals that do not code in AIS. In those cases, the AIS Code is filled with the mapped code from ICDMAP-90.

Frequency: Unlimited number of records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
AIS Version (AISVER)	The version of AIS used to code the particular incident.	Numeric	4	1998	
AIS Predot Code (PREDOT)	The Abbreviated Injury Scale (AIS) predot codes that reflect the patient's injuries.	Numeric	6		
AIS Severity (SEVERITY)	This represents the Abbreviated Injury Scale severity code that reflects the patient's injuries.	Numeric	3	1 to 6, 9	

File Name: *AISCCODE*

Definition: The AIS (Abbreviated Injury Scale) codes calculated from ICDMAP-90 for the trauma diagnosis

Frequency: Unlimited number of records per incident

Field Name	Definition	Data Type	Length	Valid values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
AIS Version (AISVER)	The version of AIS used to code the particular incident.	Numeric	4	1980 1985 1990 1998	
AIS Predot Code (PREDOT)	The Abbreviated Injury Scale (AIS) predot codes that reflect the patient's injuries.	Numeric	6		
AIS Severity (SEVERITY)	This represents the Abbreviated Injury Scale severity code that reflects the patient's injuries.	Numeric	3	1 to 6, 9	

File Name: *COMORBID*

Definition: Information pertaining to any pre-existing comorbid conditions a patient had upon arrival in the ED/hospital

Frequency: Unlimited number of records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Comorbidity Code (COMORKEY)	NTDS comorbid conditions.	String	50	See the NTDS data dictionary	
Comorbidity Description (COMORDES)	Description of comorbid conditions.	String	100	See the NTDS data dictionary	

File Name: *COMPLIC*

Definition: Information pertaining to any complications during the course of patient treatment

Frequency: Unlimited number of records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Complication Code (COMPLKEY)	NTDS hospital complications	String	50	See the NTDS data dictionary	
Complication Description (COMPLDES)	Description of complications.	String	100	See the NTDS data dictionary	

File Name: *DEMO*

Definition: Includes information about the patient and incident demographics

Frequency: One record per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Year of Birth (YOBIRTH)	The patient's birth year.	Numeric	4	1920 to 2009	Patients with age >89 are presented with YOBIRTH of -99
Age (AGE)	The patient's age at time of injury	Numeric	5	0-89	Patients with age >89 are presented with AGE of -99
Age Units (AGEU)	The patient's unit of age if the patient was under 1 year of age	String	150	Years Months	
Sex (GENDER)	The patient's gender at admission		100	Male Female	
Race1 (RACE1)	The patient's race	String	100	Asian Native Hawaiian or Other Pacific Islander Other Race American Indian Black or African American White	
Race2 (RACE2)	The patient's race (additional)	String	100	Asian Native Hawaiian or Other Pacific Islander	

Field Name	Definition	Data Type	Length	Valid Values	Notes
				Other Race American Indian Black or African American White	
Ethnicity (ETHNIC)	The patient's ethnicity	String	100	Hispanic or Latino Not Hispanic or Latino	
Facility Key (FAC_KEY)	Unique identifier for each facility	Numeric	4	No Null Values allowed	

File Name: *DCODE*

Definition: Includes the ICD-9-CM diagnosis codes

Frequency: One record per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
ICD-9-CM Diagnosis (DCODE)	ICD-9-CM Diagnosis Code	String	6		Maximum of 50 diagnoses per patient.

File Name: *DCODEDES*

Definition: Lookup table ICD-9-CM diagnoses codes

Frequency: One record per ICD-9-CM diagnoses codes DCODE

Field Name	Definition	Data Type	Length	Valid Values	Notes
Diagnosis Code (DCODE)	Unique ICD-9-CM diagnosis code	String	6		This field includes cormorbid conditions and complications.
Diagnosis Code	Description for ICD-9-CM	String	100		

Field Name	Definition	Data Type	Length	Valid Values	Notes
Description (DCODEDES)	diagnosis codes				
Nature of Injury (DXTYPE)	Nature of injury as defined by the Barell Injury Diagnosis Matrix	String	50		Barell Matrix see section below
Body Region 1 (REGION1)	ICD-9 body region as defined by the Barell Injury Diagnosis Matrix	String	50		Barell Matrix see section below
Body Region 2 (REGION2)	Second ICD-9 body region as defined by the Barell Injury Diagnosis Matrix	String	50		Barell Matrix see section below
Body Region 3 (REGION3)	Third ICD-9 body region as defined by the Barell Injury Diagnosis Matrix	String	50		Barell Matrix see section below

File Name: *DISCHARGE*

Definition: Includes discharge information

Frequency: One record per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Discharge Year (YODISCH)	Year the patient was discharged from the facility	Numeric	4	2009, 2010	
Hospital Discharge Disposition (HOSPDISP)	The disposition of the patient at hospital discharge	String	100	See the NTDS data dictionary	
Primary Payment Source (Payment)	The primary payment source	String	100	See the NTDS data dictionary	
Length of Stay (Minutes)	Total Length of Stay in minutes	Numeric	5		

Field Name	Definition	Data Type	Length	Valid Values	Notes
(LOSMIN)					
Length of Stay in Days (LOSDAYS)	Total Length of Stay in days	Numeric	5	1-364	
Intensive Care Unit Days (ICUDAYS)	Total number of days spent in the Intensive Care Unit	Numeric	5	1-364	
Ventilator Days (VENTDAYS)	Total number of days spent on the Ventilator	Numeric	5	1-364	
Facility Key (FAC_KEY)	Unique identifier for each facility	Numeric	4	No Null Values allowed	

File Name: *ECODE*

Definition: Includes ICD-9-CM E-Codes (Mechanism of Injury)

Frequency: One record per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Primary E-Code (ECODE)	ICD-9-CM External Cause of Injury Code	String	5		
ICD-9-CM Additional E-Code (ECODE2)	Additional ICD-9-CM External Cause of Injury Code	String	5		

File Name: *ECODEDES*

Definition: Look-up table for ICD-9-CM E-Codes

Frequency: One record per ICD-9-CM E-Code

Field Name	Definition	Data Type	Length	Valid Values	Notes
E-Code (ECODE)	Unique ICD-9-CM E-Code	String	5		To merge ECODE2 with descriptions, must change this variable name to ECODE2
Primary E-Code Description (ECODEDES)	Description of each ICD-9-CM E-Code	String	100		
Trauma Type (INJTYPE)	Indication of the type (nature) of trauma injury	String	4000	Blunt Burn Penetrating Other/Unspecified	See e-code grouping in section below
Injury Intent (INTENT)	Injury Intentionality as defined by the CDC Injury Intentionality Matrix	String	4000	Unintentional Self-inflicted Assault Undetermined Other	See e-code grouping in section below
Mechanism of	ICD-9-CM	String	4000		See e-code

Field Name	Definition	Data Type	Length	Valid Values	Notes
Injury (MECHANISM)	Mechanism of Injury E-Code				grouping in section below

File Name: *ED*

Definition: ED and Injury information

Frequency: One record per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Year of Injury (YOINJ)	The year when the patient was injured	Numeric	4	2008, 2009	
Admission Year (YOADMIT)	The year when the patient was admitted	Numeric	4		
Work-Related (WORKREL)	Work-relatedness of the injury	String	50	Yes No	
Industry of Work (INDUSTRY)	Occupation	String	50		
Location E-Code (LECODE)	ICD9-CM External Cause of Injury code	String	50	0-9	Value is <i>x</i> in 849. <i>x</i> code
Location Description (LOCATION)	Location where injury occurred	String	100		
Inter-hospital Transfer (TRANSFER)	Inter-hospital transfer	String	50	Yes No	
Alcohol Use (ALCOHOL)	Whether patient used alcohol	String	100	See NTDS dictionary	
Drug Use (DRUG1)	Whether patient used drugs	String	100	See NTDS dictionary	
Drug Use (DRUG2)	Whether patient used drugs	String	100	See NTDS dictionary	
Emergency Department	Disposition of the patient at the time of	String	100	See NTDS dictionary	

Field Name	Definition	Data Type	Length	Valid Values	Notes
Disposition (EDDISP)	discharge from the ED				
Emergency Department Death (EDDEATH)	Type of death incurred while the patient was in the ED	String	100	See NTDS dictionary	
EMS Response Minutes (EMSRESP)	Total elapsed time from dispatch of the EMS transporting unit to scene arrival of the EMS transporting unit	Numeric	10	1 - 40,320 min (28 days)	
EMS Scene Time (EMSSCENE)	Total elapsed time from dispatch of the EMS transporting unit to arrival at the facility	Numeric	10	1 - 40,320 min (28 days)	
Total Number of EMS Days (EMSDAYS)	Total elapsed days from dispatch of the EMS transporting unit to hospital arrival of the EMS transporting unit	Numeric	10	1 – 28 days	
Total Number of EMS Minutes (EMSMINS)	Total elapsed time from dispatch of the EMS transporting unit to hospital arrival of the EMS transporting unit	Numeric	10	1 - 40,320 min (28 days)	
Total Number of Minutes in the ED (EDMIN)	Total elapsed time the patient was in the emergency department	Numeric	10	1 - 524,160 min (364 days)	
Total Number Days in the ED (EDDAYS)	Total elapsed days the patient was in the emergency department	Numeric	10	1 - 524,160 min (364 days)	
Local ISS (ISSLOC)	The Injury Severity Score (ISSLOC) reflecting the patient's injuries directly submitted by the facility regardless of the	Numeric	3	1- 75	

Field Name	Definition	Data Type	Length	Valid Values	Notes
	method of calculation				
AIS derived ISS (ISSAIS)	The Injury Severity Score (ISSAIS) is calculated from AIS submitted directly by hospitals	Numeric	3	1- 75 and the number is a sum of 3 squared values ranging from 1 to 6. If any component is 6 then the value is set to 75	
ICDMAP-90 derived ISS (ISSICD)	The Injury Severity Score (ISSICD) is derived by converting ICD-9 codes to AIS using the ICD 90 Mapping program and then calculating ISS with the resulting AIS severity scores	Numeric	3	1- 75 and the number is a sum of 3 squared values ranging from 1 to 6. If any component is 6 then the value is set to 75	
AIS 98 crosswalked ISS (ISS98)	The Injury Severity Score (ISSICD) is derived by converting ICD-9 codes to AIS using the ICD 90 Mapping program and then calculating ISS with the resulting AIS severity scores	Numeric	3	1- 75 and the number is a sum of 3 squared values ranging from 1 to 6. If any component is 6 then the value is set to 75	
Facility Key (FAC_KEY)	Unique identifier for each facility.	Numeric	4	No Null Values allowed.	

File Name: *FACILITY*

Definition: Information pertaining to the facility dataset

Frequency: One record per facility

Field Name	Definition	Data Type	Length	Valid Values	Notes
Facility Key (FAC_KEY)	Unique identifier for each facility.	Numeric	4	No Null Values	

Field Name	Definition	Data Type	Length	Valid Values	Notes
				allowed.	
ACS Verification Level (ACSLEVEL)	ACS Verification	String	4000	I II III IV Not Applicable	
ACS Pediatric Verification Level (ACSPEDL)	ACS Pediatric Verification	String	4000	I II Not Applicable	
State Designation (STATELEV)	State Designation	String	4000	I II III IV V Other Not Applicable	
State Pediatric Designation (STATEPL)	State Pediatric Designation	String	4000	I II II IV Other Not Applicable	
Bedsizes (BEDSIZE)	Number of licensed beds in facility	String	4000	≤200 200-400 401-600 >600 Not Provided	
Region (REGION)	Geographic Region for the trauma facility	String	4000	Northeast, Midwest, South, West	
Length of Stay (LOSINCL)	What length of stay is included?	String	4000	All Admissions 23 hour holds ≥24 hours ≥48 hours ≥72 hours	
DOAs included	Dead on Arrival	String	5	True	

Field Name	Definition	Data Type	Length	Valid Values	Notes
(DOAINC)	included in registry			False	
Hip Fractures Included (HIPINCL)	The age cutoff for including hip fractures in non-elderly patients, if applicable	String	4000	None Patients ≤ 18 years Patients ≤ 50 years Patients ≤ 55 years Patients ≤ 60 years Patients ≤ 65 years Patients ≤ 70 years All	
Transfers In (TRANSIN)	Are transfers into the facility included?	String	4000	All transfers Within 12 hours Within 24 hours Within 48 hours Within 72 hours	
Transfers Out (TRANSOUT)	Does your facility transfer patients out to other facilities?	String	5	True False	
ICD-9 Inclusion Range the same as NTDB (ICD9NTDB)	ICD-9 Inclusion Criteria is 800-959.9, excluding 905-909, 910-924, and 930-939	String	5	True False	

File Name: *PCODE*

Definition: ICD-9-CM procedure codes

Frequency: Multiple records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No null values allowed	
ICD-9-CM Procedure Code (PCODE)	ICD-9-CM procedure code	String	5		
Year of Procedure (YOPROC)	Year in which the procedure occurred	String	100	2008, 2009	
Procedure Start Time (PROC_TIME)	Time when the procedure began	String	14	00:00:00 to 24:00:00	In the format HH:MM:SS
Days to Procedure (DAYTOPROC)	Number of days until the beginning of procedure	String	10	1-364	Number of days between arrival and procedure. Partial days are rounded up. A procedure that occurs within <24 hrs is given a day equal to 1.
Hours to Procedure (HOURTOPRO)	Number of hours until the beginning of procedure	String	10	1-8736 (364 days)	Number of hours between arrival and procedure. This is only calculated if both the time of arrival and the procedure are known.

File Name: *PCODEDES*

Definition: Look up table for ICD-9-CM Procedure Codes

Frequency: One record per procedure code

Field Name	Definition	Data Type	Length	Valid Values	Notes
ICD-9-CM Procedure Code (PCODE)	ICD-9-CM Procedure Code	String	5		
Procedure Description (PCODEDESCR)	Descriptor for procedure codes	String	100		

File Name: *PROTDEV*

Definition: Information on protective devices

Frequency: Multiple records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values Allowed	
Protective Device Description (PROTDEV)	Descriptor for protective devices	String	100		
Airbag Description (AIRBAG)	Descriptor for airbags	String	100		
Child Restraint Description (CHILDRES)	Descriptor for child restraints	String	100		

File Name: *TRANSPORT*

Definition: Information on mode of transportation to the ED

Frequency: Multiple records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values Allowed	
Transport Type (TRANSTYPE)	Type of Transportation	String	7		
Transportation Mode (TMODE)	Mode of Transportation	String	10		

File Name: *VITALS*

Definition: Information on patient vital signs for both EMS and ED

Frequency: Multiple records per incident

Field Name	Definition	Data Type	Length	Valid Values	Notes
Incident Key (INC_KEY)	Unique identifier for each record	Numeric	10	No Null Values allowed	
Vital Type (VSTYPE)	Type of vital sign: EMS or ED	String	3	EMS ED	
Systolic Blood Pressure (SBP)	Systolic blood pressure	Numeric	5	0-299	
Pulse Rate (PULSE)	The patient's pulse rate	Numeric	5	0-299	
Respiratory Rate (RR)	The patient's respiratory rate	Numeric	5	0-99	
Temperature (TEMP)	The patient's temperature in Centigrade	Numeric	5	0-45	
Pulse Oximetry/Oxygen Saturation (OXYSAT)	First recorded oxygen saturation in the ED or hospital	Numeric	5	0-100	
Supplemental Oxygen Description (SUPPOXY)	Supplemental oxygen	String	100		
Glasgow Coma Scale: Eye (GCSEYE)	First recorded Glasgow Coma Score (Eye)	Numeric	5	1 to 4; See the NTDS data dictionary for detail	
Glasgow Coma Scale: Verbal (GCSVERB)	First recorded Glasgow Coma Score (Verbal)	Numeric	5	1 to 5; See the NTDS data dictionary for detail	
Glasgow Coma Scale: Motor (GCSMOT)	First recorded Glasgow Coma Score (Motor)	Numeric	5	1 to 6; See the NTDS data dictionary for detail	
Glasgow Coma Scale Total (GCSTOT)	First recorded Glasgow Coma Score (total)	Numeric	5	Range is from 3-15	

Field Name	Definition	Data Type	Length	Valid Values	Notes
Glasgow Coma Scale Assessment Qualifier 1 (GCS_Q1)	Assessment Qualifier for Total GCS Score 1	String		See the NTDS data dictionary for detail	
Glasgow Coma Scale Assessment Qualifier 1 (GCS_Q2)	Assessment Qualifier for Total GCS Score 2	String		See the NTDS data dictionary for detail	
Glasgow Coma Scale Assessment Qualifier 1 (GCS_Q3)	Assessment Qualifier for Total GCS Score 3	String		See the NTDS data dictionary for detail	
Respiratory Assistance Description (RRAQ)	Respiratory assistance qualifier for GCS total score	String	100		

File Name: WEIGHTS

Definition: The final weights and Strata indicators for each incident

Frequency: One record per incident.

Field Name	Definition	Data Type	Length	Valid values	Notes
INC_KEY	Incident Key. This field is the Primary key to identify an incident in the incident record	Numeric	8	No Null Values allowed.	
STRATA	Stratification variable	Numeric	8	1 = NTDB, Level I, North East 2 = NTDB, Level II, North East 3 = NTDB, Level I, South 4 = NTDB, Level II, South 5 = NTDB, Level I, Midwest	

				6 = NTDB, Level II, Midwest 7 = NTDB, Level I, West 8 = NTDB, Level II, West 9 = non-NTDB, Level I, North East 10 = non-NTDB, Level II, North East 11 = non-NTDB, Level I, South 12 = non-NTDB, Level II, South 13 = non-NTDB, Level I, Midwest 14 = non-NTDB, Level II, Midwest 15 = non-NTDB, Level I, West 16 = non-NTDB, Level II, West	
WEIGHTS	Weights	Numeric	8	No Null Values allowed.	
FAC_KEY	Facitliy identifier	Numeric	4	No Null Values allowed.	

GROUPING FOR PRESENTING INJURY MORTALITY AND MORBIDITY DATA (FEB 2007)

This matrix contains the ICD-9 external-cause-of-injury codes used for coding of injury mortality data and additional ICD-9-CM external-cause-of-injury codes, designated in bold, only used for coding of injury morbidity data. Further details and access to SAS input statements set up to define these groupings can be found at: <http://www.cdc.gov/ncipc/osp/matrix2.htm>

Mechanism/Cause	Manner/Intent				
	Unintentional	Self-inflicted	Assault	Undetermined	Other ¹
Cut/pierce	E920.0-.9	E956	E966	E986	E974
Drowning/submersion	E830.0-.9, E832.0-.9 E910.0-.9	E954	E964	E984	
Fall	E880.0-E886.9, E888	E957.0-.9	E968.1	E987.0-.9	
Fire/burn³	E890.0-E899, E924.0-.9	E958.1,.2,.7	E961, E968.0,.3, E979.3	E988.1,.2,.7	
Fire/flame³	E890.0-E899	E958.1	E968.0, E979.3	E988.1	
Hot object/substance	E924.0-.9	E958.2,.7	E961, E968.3	E988.2,.7	
Firearm³	E922.0-.3,.8, .9	E955.0-.4	E965.0-4, E979.4	E985.0-.4	E970
Machinery	E919 (.0-.9)				
Motor vehicle traffic^{2,3}	E810-E819 (.0-.9)	E958.5	E968.5	E988.5	
Occupant	E810-E819 (.0,.1)				
Motorcyclist	E810-E819 (.2,.3)				
Pedal cyclist	E810-E819 (.6)				
Pedestrian	E810-E819 (.7)				
Unspecified	E810-E819 (.9)				

Mechanism/Cause	Manner/Intent				
	Unintentional	Self-inflicted	Assault	Undetermined	Other ¹
Pedal cyclist, other	E800-E807 (.3) E820-E825 (.6), E826.1,.9 E827-E829(.1)				
Pedestrian, other	E800-807(.2) E820-E825(.7) E826-E829(.0)				
Transport, other	E800-E807 (.0,.1,8,.9) E820-E825 (.0- .5,.8,.9) E826.2-.8 E827-E829 (.2-.9), E831.0-.9, E833.0- E845.9	E958.6		E988.6	
Natural/ environmental	E900.0-E909, E928.0-.2	E958.3		E988.3	
Bites and stings³	E905.0-.6,.9 E906.0-.4,.5,.9				
Overexertion	E927				
Poisoning	E850.0-E869.9	E950.0- E952.9	E962.0-.9, E979.6,.7	E980.0-E982.9	E972
Struck by, against	E916-E917.9		E960.0; E968.2		E973, E975
Suffocation	E911-E913.9	E953.0-.9	E963	E983.0-.9	

Mechanism/Cause	Manner/Intent				
	Unintentional	Self-inflicted	Assault	Undetermined	Other ¹
Other specified and classifiable³	E846-E848, E914-E915 E918, E921.0-.9, E922.4,.5 E923.0-.9, E925.0-E926.9 E928(.3-.5) , E929.0-.5	E955.5,.6,.7 ,.9 E958.0,.4	E960.1, E965.5-.9 E967.0-.9, E968.4,.6, .7 E979 (.0-.2,.5,.8,.9)	E985.5,.6,.7 E988.0,.4	E971, E978, E990-E994, E996 E997.0-.2
Other specified, not elsewhere classifiable	E928.8, E929.8	E958.8, E959	E968.8, E969, E999.1	E988.8, E989	E977, E995, E997.8 E998, E999.0
Unspecified	E887, E928.9, E929.9	E958.9	E968.9	E988.9	E976, E997.9
All injury³	E800-E869, E880-E929	E950-E959	E960- E969, E979 , E999.1	E980-E989	E970-E978, E990-E999.0
Adverse effects					E870-E879 E930.0-E949.9
Medical care					E870-E879
Drugs					E930.0-E949.9
All external causes					E800-E999

¹Includes legal intervention (E970-E978) and operations of war (E990-E999).

²Three 4th-digit codes (.4 [occupant of streetcar], .5 [rider of animal], .8 [other specified person]) are not presented separately because of small numbers. However, because they are included in the overall motor vehicle traffic category, the sum of these categories can be derived by subtraction.

³Codes in bold are for morbidity coding only.

The Barell Injury Diagnosis Matrix, Classification by Body Region and Nature of Injury

This matrix contains the ICD-9 diagnosis classification. Further details on these groupings can be found at: <http://www.cdc.gov/nchs/about/otheract/ice/barellmatrix.htm>

The Barell Injury Diagnosis Matrix, Classification by Body Region and Nature of the Injury

based on 5 digit ICD-9 CM codes

		ICD-9-CM codes																															
												FRACTURE	DISLOCATION	SPRAINS & STRAINS	INTERNAL	OPEN WOUND	AMPUTATIONS	BLOOD VESSELS	CONTUSION / SUPERFICIAL	CRUSH	BURNS	NERVES	UNSPECIFIED										
												800-829	830-839	840-848	850-859	870-884, 890-894	895-897, 898-897	900-904	910-924	925-929	940-949	950-951, 953-957	959										
Head and Neck	T	Type 1 TBI	800,801,803,804(1-4, 6-9), (09-05, 53-55) 850(2-4), 851-854, 950(1-3), 995-95										800,801,803,804(1-4, 6-9)	/	/	850(2-4), 851-854*, 995-95	/	/	/	/	/	/	/	/	/	/	/						
			Type 2 TBI	800,801,803,804(00, 02, 06, 09) (50, 52, 56, 59), 850(0, 1, 5, 9)										800,801,803,804(03, 05, 05, 53-55)	/	/	850(2-4), 851-854*, 995-95	/	/	/	/	/	/	/	/	/	/						
				Type 3 TBI	800,801,803,804(01, 51)										800,801,803,804(00, 02, 06, 09)	/	/	850(0, 1, 5, 9)	/	/	/	/	/	/	/	/	/						
					Other Head	873(0-1, 8-9), 941 x8, 951, 959, 01										/	/	/	/	873.0-1, 8-9	/	/	/	/	/	941 x8	951	959, 01*					
						Face	802, 830, 848.0-1, 872, 873.2-7, 941(x1, x3-x5, x7)										802	830	848.0-1	/	872, 873.2-7	/	/	/	/	/	941.x1, x3-x5, x7	/	/	/			
							Eye	870-871, 918, 921, 940, 941.x2, 950(0, 9)										/	/	/	/	870-871	/	/	918, 921	/	/	940, 941.x2	950(0, 9)	/	/		
								Neck	807.5-6, 848.2, 874, 925.2, 941.x8, 953.0, 954.0										807.5-6	/	848.2	/	874	/	/	/	925.2	941.x8	953.0, 954.0	/	/		
									Head, Face and Neck Unspecified	900, 910, 920, 925.1, 941.x0, x5, 947.0, 957.0, 959.09										/	/	/	/	/	/	900	910, 920	925.1	941.x0, x5, 947.0	957.0	959.09	/	
										Cervical SCI	806(0-1), 952.0										806.0-1	/	/	952.0	/	/	/	/	/	/	/	/	/
											Thoracic/Dorsal SCI	806(2-3), 952.1										806.2-3	/	/	952.1	/	/	/	/	/	/	/	/
Lumbar SCI	806(4-5), 952.2											806.4-5	/	/	952.2	/	/	/	/	/	/	/	/	/									
	Spinal Cord SCI	806(6-7), 952(3-4)										806.6-7	/	/	952.3-4	/	/	/	/	/	/	/	/	/									
		Spinal Cord VCI	806(8-9), 952(8-9)										806.8-9	/	/	952.8-9	/	/	/	/	/	/	/	/	/								
			Cervical VCI	805(0-1), 839(0-1), 847.0										805.0-1	839.0-1	847.0	/	/	/	/	/	/	/	/	/	/							
				Thoracic/Dorsal VCI	805(2-3), 839(21, 31), 847.1										805.2-3	839.21, 31	847.1	/	/	/	/	/	/	/	/	/	/						
					Lumbar VCI	805(4-5), 839(20, 30), 847.2										805.4-5	839.20, 30	847.2	/	/	/	/	/	/	/	/	/	/					
						Spinal Cord VCI	805(6-7), 839(41-42), 839(51-52), 847.3-4										805.6-7	839(41-42, 51-52)	847.3-4	/	/	/	/	/	/	/	/	/	/				
							Unspecified VCI	805(8-9), 839(40, 49), 839(50, 59)										805.8-9	839(40, 49, 50, 59)	/	/	/	/	/	/	/	/	/	/	/			
								Chest (Thorax)	807(0-4), 839(61, 71), 848(3-4), 890-892, 875, 879(0-1), 901, 922(0-1, 33), 926-19, 942.x1-x2, 953.1										807.0-4	839.61, 71	848.3-4	890-892	875, 879.0-1	901	922(0, 1, 33)	926-19	942.x1-x2	953.1	/	/			
									Abdomen	863-866, 868, 879(2-5), 902(0-4), 922.2, 942.x3, 947.3, 953.2, 5)										/	/	/	863-866, 868	879.2-5	/	902.0-4	922.2	/	942.x3, 947.3	953.2, 953.5	/	/	
Pelvis										808, 839(69, 79), 846, 848.0, 867, 877-878										808	839.69, 79	846, 848.0	867	877-878	/	902(5, 81-82)	922.4	926(0, 12)	942.x5, 947.4	953.3	/	/	
	Unspecified									902(5, 81-82), 922.4, 926(0, 12), 942.x5, 947.4, 953.3										/	/	/	/	/	/	/	/	/	/	/	/	/	
		Trunk								806, 879(6-7), 911, 922(8-9)										806	/	/	/	879.6-7	/	911, 922.8-9	926.8-9	942.x0, 942.x9	954.1, 8-9	959.1	/		
			Back and Backstoc							847.9, 876, 922(11-22), 926.11, 942.x4										/	847.9	/	/	/	/	922.31-32	926.11	942.x4	/	/	/	/	
				Shoulder & Upper arm						810-812, 831, 840, 880, 887(2-3), 912, 923.0, 927.0, 943(x3-x5), 959.2										810-812	831	840	/	/	/	/	/	/	/	/	/	/	
					Forearm & elbow					813, 832, 841, 881(x0-x1), 887(0-1), 923.1, 927.1, 943(x1-x2)										813	832	841	/	881 x0-x1	887.0-1	/	923.1	927.1	943.x1-x2	/	/	/	
						Wrist, hand & fingers				814-817, 833-834, 842, 881 x2, 882, 893, 895-896, 914-915, 923(2-3), 927(2-3), 944, 959(4-5)										814-817	833, 834	842	/	881 x2, 882, 883	/	914-915, 927.2-3	923.2-3	944	/	/	959.4-5		
							Other & unspecified			818, 884, 887(4-7), 903, 913, 923(8-9), 927(8-9), 943(x0, x9), 953.4, 959.3										818	/	/	/	884	887.4-7	903	913, 923.8, 9	927.8-9	943.x0, x9	953.4, 959.3	/	/	
								Hip		820, 835, 843, 924.01, 928.01										820	835	843	/	/	/	/	924.01	928.01	/	/	/	/	
									Upper leg & thigh	821, 807(2-3), 924.00, 928.00, 945.x0										821	/	/	/	/	807.2-3	/	924.00	928.00	945.x0	/	/	/	
Knee										822, 836, 844(0-3), 924.11, 928.11, 945.x0										822	836	844.0-3	/	/	/	/	924.11	928.11	945.x0	/	/	/	
	Lower leg & ankle									823-824, 837, 845.0, 897(0-1), 924.10, 928.10, 928.11, 945(x3-x4)										823-824	837	845.0	/	897.0-1	/	924.10, 21	928.10, 21	945.x3-x4	/	/	/		
		Foot & toes								825-826, 838, 845.1, 892-893, 895-896, 917, 924(3, 20), 928(3, 20), 945(x1-x2)										825-826	838	845.1	/	892-893, 895-896	/	917, 924.3, 20	928.3, 20	945.x1-x2	/	/	/		
			Other & unspecified							827, 844(8-9), 890-891, 894, 897(4-7), 904(0-8), 916, 924(4-5), 928(8-9), 945(x0, x9), 959.6-7										827	/	844.8-9	/	890-891, 894	897.4-7	904.0-8	916, 924.4-5	928.8-9	945.x0, x9	959.6-7	/	/	
				Other/multiple						819, 828, 902(87, 86), 947(1-2), 953.8, 956										819, 828	/	/	/	/	/	902.87, 89	/	/	947.1-2	953.8, 956	/	/	
					Unspecified site					829, 839(8-9), 848.8-9										829	839.8-9	848.8-9	/	/	/	902.9, 904.9	919, 924.8, 9	929	946, 947.8, 9	953.9, 957.1, 8, 9	959.8, 9		
						System-wide & site effects				905-908, 909(0, 1, 2, 4-9), 930-935, 958, 996-994, 995-99, 54, 59, 995(80-89)										/	/	/	/	/	/	/	/	/	/	/	/	/	/
							Foreign body (803-805), Early complications of trauma (856), Poisoning (960-979), Toxic Effects (980-989), Other and unspecified effects of external cause (990-994) Child and adult maltreatment (995.50-54, 55, 995.80-85)			/										/	/	/	/	/	/	/	/	/	/	/	/	/	
								Late effects of injuries, poisonings, toxic effects and other external causes (995.90-99) excluding 900(3, 2)		/										/	/	/	/	/	/	/	/	/	/	/	/	/	

Special diagnostic codes for Trauma: Flail Chest (807.4) Pneumothorax (860)
 For purposes of classification, head injuries are labeled as Type 1 TBI if there is recorded evidence of an intracranial injury or a moderate or a prolonged loss of consciousness (LOC), Shaken Infant Syndrome (SIS), or injuries to the optic nerve pathways.
 Type 2 TBI includes injuries with no recorded evidence of intracranial injury, and LOC of less than one hour, or LOC of unknown duration, or unspecified level of consciousness. Type 3 TBI includes patients with no evidence of intracranial injury and no LOC.
 * Note from ODS: 959.01 (added to ICD-9-CM in 1997) is not intended to be assigned to TBI cases; however, in the USA it has been assigned incorrectly to a substantial proportion of cases previously coded 884.
 The Matrix is available on the net at www.cdc.gov/nchs/about/otheract/ice/barellmatrix.htm

**APPENDIX B:
SELECTED ESTIMATES USING NSP**

This appendix contains weighted frequencies and mean values for selected variables to help the user to ensure they are correctly reading the data. All the data in the NTDB NSP samples were used to calculate the weighted estimates. The estimates in the tables below are supposed to be used as a verification tool that data was read properly from the data sets. Please note that different statistical software packages (e.g., SAS, Stata, SPSS) treat missing values differently and therefore the estimates might vary. This data is not supposed to be used for publication. For use of NTDB NSP data please see the Terms of Use in this document, and use of any information from these tables must include a prominent credit line. That line is to read as follows:

Committee on Trauma, American College of Surgeons. NTDB NSP 2010. Chicago, IL. The content reproduced from the NTDB NSP remains the full and exclusive copyrighted property of the American College of Surgeons. The American College of Surgeons is not responsible for any claims arising from works based on the original Data, Text, Tables, or Figures.

Table 1: Weighted Estimates of the Number of incidents based on all data from the National Sample Program 2010 American College of Surgeons, United States.

	Admission year 2010:
Total Number of incidents (Sum of Weights)	697,025

Table 2: Weighted Estimates of the Number and Percent by Gender categories based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Gender	N (%)
Female	249,011 (35.7%)
Male	447,898 (64.3%)

Table 3: Weighted Estimates of the Number and Percent by Age groups based on all data from the National Sample Project 2010, American College of Surgeons, United States.

	Admission year 2010:
Age in Years	N (%)
0 – 5	16,082 (2.3%)
6 – 10	12,044 (1.7%)
11 – 15	20,225 (2.9%)
16 – 20	62,656 (9.0%)
21 – 25	65,718 (9.5%)
26 – 30	54,278 (7.8%)
31 – 35	43,007 (6.2%)
35 – 40	40,662 (5.9%)
41 – 45	43,573 (6.3%)
46 – 50	50,082 (7.2%)
51 – 55	46,786 (6.8%)
55 – 60	39,957 (5.8%)
61 – 65	33,624 (4.9%)
66 – 70	27,089 (3.9%)
71 – 75	26,146 (3.8%)
76 – 80	30,742 (4.4%)
81 – 85	33,756 (4.9%)
86 – 89	24,991 (3.6%)
> 89	21,638 (3.1%)

Note: Patients of age > 89 years are de-identified in accordance with HIPAA and given a age = - 99.

Table 4: Weighted Estimates of the Number and Percent by Race categories based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Race	N (%)
American Indian	7,698 (1.1%)
Asian	9,848 (1.4%)
Black or African American	106,673 (15.3%)
Native Hawaii or other Pacific Islander	2,618 (0.4%)
White	456,505 (65.5%)
Other Race	85,200 (12.2%)

Table 5: Weighted Estimates of Mortality based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Discharge Status	N (%)
Alive	675,582 (96.9%)
Dead	21,388 (3.1%)

Note: Dead is defined as ED discharge disposition = ‘Died’ or Hospital discharge = ‘Expired’. Alive is defined as any other discharge disposition except for the BIU values.

Table 6: Weighted Estimates of the Number and by Injury Severity Score categories based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Injury Severity Score	N (%)
0 - 8	328,004 (50.8%)
9 - 15	177,427 (27.5%)
16 - 24	103,925 (16.1%)
25 - 75	36,473 (5.6%)

Note: The Injury Severity score mapped from the ICD-9 CM code (ISSICD) was used.

Table 7: Weighted Estimates of the Number and Percent by Type of Injury based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Type of Injury	N (%)
Blunt	571,080 (82.7%)
Burn	14,152 (2.0%)
Penetrating	73,673 (10.7%)

Table 8: Weighted Estimates of the Number and Percent by Intent of Injury based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Intent of Injury	N (%)
Assault	93,838 (13.6%)
Self-inflicted	11,448 (1.7%)
Undetermined	3,209 (0.5%)
Unintentional	576,770 (83.8%)
Other	2,874 (0.4%)

Table 9: Weighted Estimates of the Number and Percent by Cause/ Mechanism of Injury based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Mechanism of Injury	N (%)
Cut/piece	37,176 (5.4%)
Drowning/ submerging	419 (0.1%)
Fall	253,946 (36.9%)
Fire/flame	7,206 (1.0%)
Firearm	36,490 (5.3%)
Machinery	6,174 (0.9%)
Motor vehicle traffic	209,536 (30.4%)
Natural/ environmental	4,509 (0.7%)
Other specified and classified	9,937 (1.4%)
Other specified, not elsewhere classified	3,166 (0.5%)
Overexertion	1,434 (0.2%)
Pedal cyclist, other	9,966 (1.4%)
Pedestrian, other	2,365 (0.3%)
Poisoning	310 (0.0%)
Struck by, against	53,008 (7.7%)
Suffocation	578 (0.1%)
Transport, other	36,083 (5.2%)
Unspecified	7,252 (1.1%)

Table 10: Weighted Estimates of the Mean and Standard Error for Selected Characteristics based on all data from the National Sample Program 2010, American College of Surgeons, United States.

	Admission year 2010:
Characteristics	Mean (SE)
Age (years)	44.5 (0.304)
Hospital length of stay (days)	5.5 (0.146)
ICU length of stay (days)	5.2 (0.171)

APPENDIX C: SAMPLE DESIGN AND MAINTENANCE

INTRODUCTION

The National Trauma Data Bank (NTDB), which is managed by the American College of Surgeons (ACS), contains over 3 million records voluntarily provided by over 900 U.S. trauma centers. The NTDB represents the largest compilation of traumatic injury data in the United States and contains detailed clinical indicators and other trauma care information on patients admitted into hospitals. The data are useful for research in injury epidemiology and prevention, acute care, and health services policy. However, the NTDB is subject to a limitation of all “convenience samples.” The data may not be representative of all trauma hospitals in the nation and thus do not allow statistically valid inferences about national injury incidence and prevalence. This means that findings from analyses on outcome measures such as survival probability, length of hospital stay, or other indicators would have limited relevance to the universe of all patients (Clark and Winchell, 2004). Although nationally representative data such as the National Hospital Discharge Survey data are available, they typically lack the richness of the NTDB data, which contain detailed injury information including a wide array of diagnostic and clinical indicators.

The National Sample Program (NSP) is intended to (1) create a traumatic injury database from a nationally representative sample of trauma hospitals; (2) collect a wide variety of diagnostic and clinical indicators complementary to the NTDB; and (3) produce national baseline estimates of variables and indices associated with hospitalized traumatic injuries such as prehospital diagnosis and management, trauma outcomes, and other variables that characterize the dimensions of trauma treatment. It is also intended to help characterize the circumstances of the injury incident (e.g., external causes of injury) and injured patients treated in trauma centers in the United States.

SAMPLING UNIVERSE

The Trauma Information Exchange Program (TIEP) of the American Trauma Society maintains the National Inventory of Hospital Trauma Centers, which contains the most complete and up-to-date list of trauma centers in the United States (MacKenzie et al., 2003). This inventory includes hospital information such as location, designated level of care, number of annual emergency room (ER) visits, and other organizational characteristics extracted from the American Hospital Association’s (AHA’s) Annual Survey of Hospitals (AHA, 2002). For this project, we updated data in the National Inventory of Hospital Trauma Centers and used this updated version to construct the sampling frame.

The designated levels of care of trauma centers are usually made either by the ACS/COT or by states. The TIEP follows a clearly defined procedure to determine the level of care designation for trauma center hospitals included in the National Inventory of Hospital Trauma Centers: (1) in states that have a formal process for designating or certifying trauma centers, the designated level of care is determined through discussions with the appropriate lead agencies; (2) in states that do not have such a formal process, the designated level of care must be verified by the ACS/COT; (3) if there are discrepancies between hospital self-reported, state-reported, and the ACS/COT-verified level of care designation, TIEP gives priority in this order: state, ACS/COT, and hospital report. Self-designated trauma center hospitals without outside verification of resources or capabilities are excluded from the inventory.

There is a direct link between this inventory and the NTDB. The information on the status of the hospitals contributing data to the NTDB was collected when the inventory was created. After obtaining the hospital list, hospitals were identified that have been contributing or have agreed to contribute data to the NTDB. Only hospitals with a level I or level II designation were included in the sampling frame. Of the 453 level I and level II trauma center hospitals, 179 could be identified as NTDB-contributing hospitals out of the 453 hospitals in the TIEP 2003 data set. The other 274 hospitals could not be identified as NTDB-contributing hospitals and were designated non-NTDB hospitals.

The hospitals in the sampling frame are not distributed uniformly across geographic regions. The Midwest has more trauma center hospitals (34% 153/453) than any other region, and the West has the fewest (19% 86/453). The South has the highest proportion of trauma center hospitals contributing to NTDB (59% 64/109), whereas the Northeast has the highest proportion of trauma center hospitals that do not contribute (76% 80/105). By the designated level of care, the South (53% 58/109) and the Northeast (51% 54/109) have more level I hospitals but the West (72% 62/86) and the Midwest (65% 99/153) have more level II hospitals. The distribution of TIEP hospitals is presented in Table 1.

Table 1. TIEP hospital universe

Stratum ^a	U.S. Census Region				Total
	Midwest	Northeast	South	West	
NTDB					
Level I	27	14	39	17	97
Level II	23	11	25	23	82
Subtotal	50	25	64	40	179
Non-NTDB					
Level I	27	40	19	7	93
Level II	76	40	26	39	181
Subtotal	103	80	45	46	274
Total	153	105	109	86	453

^a Sampling strata were formed according to contributing (NTDB) or not contributing (non-NTDB) data to NTDB and designated level of trauma care.

SAMPLE DESIGN

A stratified sample design was used, and 100 sample hospitals of level I and level II were to be included. Stratification was based on U.S. Census region (four regions), level of trauma care designation (two categories), and NTDB reporting status (two categories). Thus, there were 16 total strata: 8 NTDB strata and 8 non-NTDB strata. Of the 100 sample hospitals, 90 were allocated to the known NTDB-contributing hospitals and 10 to non-NTDB hospitals. The reason for this dramatic oversampling of NTDB-contributing hospitals was to avoid the extraordinary effort and the expense that would be required to recruit a large number of non-NTDB hospitals during the first years of this project. The sample size of 100 hospitals was chosen on the basis of recent NTDB data that suggested that a sample of 100 hospitals would provide estimates having sufficient precision for most analyses at the national level.

The 90 NTDB-contributing sample hospitals were further allocated to the 8 NTDB strata in proportion to the number of hospitals in each of these strata as indicated in Table 1. The 10 non-NTDB sample hospitals were also proportionally allocated to the 8 strata while each stratum was made sure to contain at least one sample hospital. The resulting sample allocation is shown in Table 2, and it is apparent that the overall distribution of the 100 sample hospitals by region and level of care reflects the distribution of the NTDB-contributing hospitals because of the oversampling of these hospitals.

Table 2. Hospital sample allocation

Stratum ^a	U.S. Census Region				Total
	Midwest	Northeast	South	West	
NTDB					
Level I	14	7	20	8	49
Level II	11	6	12	12	41
Subtotal	25	13	32	20	90
Non-NTDB					
Level I	1	2	1	1	5
Level II	2	1	1	1	5
Subtotal	3	3	2	2	10
Total	28	16	34	22	100

^a Sampling strata were formed according to hospitals contributing (NTDB) or not contributing (non-NTDB) data to NTDB before admission year 2003 and designated level of trauma care.

HOSPITAL SAMPLE SELECTION

Sample hospitals were drawn within strata by using the probability-proportional-to-size (PPS) without-replacement method (Levy and Lemeshow, 1999). When there are large differences in the size of sampling units (e.g., trauma admissions) with respect to variables of importance (e.g., number of trauma admissions), the PPS method tends to produce estimates with smaller variance compared to an equal probability sampling method.

The size measurement used was originally the annual number of ER visits in 2002, but has been updated each year with estimates based on AHA Healthcare Quickdisc as it becomes available. In the process of selecting the samples, we noted a number of hospitals with very large numbers of ER visits. An investigation by the NTDB staff revealed that these hospitals were members of hospital systems and provided the aggregated ER visit numbers of their affiliated hospital systems. These hospitals were then contacted to provide their hospital-specific number of ER visits. For a few hospitals that did not provide the data, we used the average of the system-wide number of ER visits per hospital as their estimated size measurement. Also, six hospitals were included in the sample with certainty due to their large size measurements. For these sample hospitals, the probability of selection is thus one.

CALCULATION OF WEIGHTS

The design weight of a selected hospital is defined as the inverse of its selection probability. Let z_{hi} be the number of ED visits (the size measurement for sampling) for the i th hospital in stratum h , and N_h and n_h be the total and selected numbers of hospitals in stratum h . If this hospital is selected, its sample design weight may be calculated as follows,

$$w_{hi} = \left(\sum_{i=1}^{N_h} z_{hi} \right) / (n_h z_{hi})$$

One exception is for the six hospitals selected with certainty, whose sample weights are set to equal one. The final weights for each hospital were adjusted for non-response and for changed in ED admissions. The detailed description of these adjustments can be found in the following sections.

1) Weight adjustment for non-response

Some of the sample hospitals might choose not to participate in this project, or might not be able to contribute complete data throughout the project period for a variety of reasons. To take this variability into consideration, a procedure was developed for adjusting the sample design weights for non-respondent sample hospitals on a monthly basis. The final weights for hospitals with less than 30 ER visits in one month were classified as a non-responder for that month and the final weight was set to missing. The date of arrival at the ER was used to assess the month since it is a required field in NTDB, compared to using injury date which is not consistently reported in NTDB.

These sample design weights within each hospital stratum were adjusted for non-responses on monthly basis. The monthly adjustment factors were calculated by the following formula:

$$\alpha_{1ht} = (\sum w_{hi} z_{hi} \text{ over all eligible hospitals in stratum } h) / (\sum w_{hi} z_{hi} \text{ over all responding hospitals in month } t)$$

where w_{hi} is the design weight for hospital i in stratum h , and z_{hi} is the number of ER visits used as size measurement for hospital sampling. This adjustment factor essentially rescales

the total sum of sample weights among respondent hospitals to the annual number of ER visits.

2) Weight adjustment for changes in ED volume

Furthermore, the volume of injuries and number of ED visits at a given hospital will surely fluctuate over time. The weights were adjusted for the updated total number of ER visits in the reporting year by using AHA data as an estimation of number of annual ER visits. This is done by inflating the sample weight by a ratio of:

$$\alpha_{2h} = Z_h' / Z_h$$

where the numerator is the updated total number of ER visits in stratum h , and the denominator is the total number of ER visits currently used for hospital sampling.

The annual number of ER visits in 2002 was used for the original data set (NSP 2003), and the updated number of ER visits each year is based on AHA Healthcare Quickdisc as it becomes available. The updated number was set to equal the total number of ER visits for the first year of the sample. Hence, the ratio is assumed to be 1.

The final monthly weights were calculated according to the following formula:

$$\text{fnlwt}_{hi} = w_{hi} \alpha_{1ht} \alpha_{2hi}$$

where w_{hi} is the design weight for hospital i in stratum h , α_{1ht} is the monthly adjustment factor in stratum h for month t , and α_{2hi} is the post-stratification factor for hospital i in stratum h . Data sets with detailed patient and injury information (variables included in the National Data Elements Project) was then created for those sample hospitals currently contributing data to the NTDB.

SAMPLE MAINTENANCE

The national sample is intended to reflect the universe of all trauma level I and II hospitals that provides trauma care. As the hospital universe changes inevitably over time due to closing of the existing hospitals, opening of the new hospitals, and other reasons, the national sample must be evaluated from time to time and revised so that it continues to be representative. In the meantime, the sample should provide certain longitudinal comparability, and thus requires some stability. The various maintenance steps performed for the national sample are described below.

No hospitals have been replaced in NSP with admission year 2003 to 2006, however, the weights have been adjusted each year for non-response as described in section above. In NSP 2007, three hospitals were identified which had not submitted data during the last three years to NTDB. These three hospitals were replaced by randomly chosen hospitals from the same strata. In addition, one hospital had moved from one stratum to another due to changing from a trauma level I to a level II designation. In order to properly adjust the weights for the hospital that changed stratum the following steps were performed:

- The adjusted weight for the moving hospital is $w'_{hi} = w_{hi} \left(1 + \frac{n_h \sum_j z_{lj}}{\sum_i z_{hi}}\right) \left(\frac{1}{n_l + 1}\right)$,

where sample hospital i in stratum h moves to stratum l .

- The adjusted weight for a sample hospital in stratum l other than the new hospital i

is $w'_{lj} = w_{lj} \left(1 + \frac{\sum_i z_{hi}}{\sum_j z_{lj}} \frac{1}{n_h}\right) \left(\frac{n_l}{n_l + 1}\right)$.

- The sample weight for a sample hospital in stratum h remains same.

APPENDIX D: SAMPLE SAS SOURCE CODE

```

/*****
*/
*/ Title:          trauma_estimate_2010.sas          */
*/ Author:         S. Goble, Statistician NTDB       */
*/ Project:        National Sample Program (NSP)     */
*/
*/ Purpose: Create statistical estimates for valid trauma cases,
*/             excluding hip fractures, analyzing the weighted data
*/             taking into account the sample design.
*/
*/ Input data:   1.   The final weights and Strata indicators
*/                 for each incident
*/                 Name: WEIGHTS
*/                 Variables needed:          Name:
*/                 Incident ID                INC_KEY
*/                 Facility ID                FAC_KEY
*/                 Strata                    STRATA
*/                 Weights                   WEIGHTS
*/
*/
*/                 2.   ED information.
*/                 Name: ED
*/                 Variables needed:          Name:
*/                 Incident ID                INC_KEY
*/                 ED discharge              EDDISP
*/                 Disposition
*/
*/
*/                 3.   Includes information about the patient
*/                 and incident demographics.
*/                 Name: DEMO
*/                 Variables needed:          Name:
*/                 Incident ID                INC_KEY
*/                 Age                       AGE
*/                 Gender                    GENDER
*/                 Race                      RACE
*/
*/
*/                 4.   Includes information pertaining to the outcome
*/                 of the trauma incident.
*/                 Name: DISCHARGE
*/                 Variables needed:          Name:
*/                 Incident ID                INC_KEY
*/                 Hospital discharge        HOSPDISP
*/                 Disposition

```

```

/*          Hospital length of stay          LOSDAYS          */
/*          ICU length of stay              ICUDAYS           */
/*          Ventilator days                 VENTDAYS          */
/*
/*      Output: Frequency estimate of gender, race and mortality
/*              Mean estimate of Age, LOS and ICU days
/*
/*      Created: Feb, 2009
/*
/*      **There are 16 weighting strata that are combinations of
/*      4 Census regions, 2 designated levels of trauma care level I or
/*      level II, and NTDB status (NTDB or non-ntdb)
/*
/*****

```

```

* Change the following: '\yourpathname\'
/*folder for saving input and output Data_Sets*/

```

```

*** Import the weights ***;
PROC IMPORT FILE="\yourpathname\Weights.csv" OUT=weights DBMS=csv
REPLACE;
GETNAMES=YES;
RUN;
***** ED *****;
PROC IMPORT FILE="\yourpathname\ED.csv" OUT=ED DBMS=csv REPLACE;
GETNAMES=YES;
RUN;
***** DEMOGRAPHICS *****;
PROC IMPORT DATAFILE="\yourpathname\DEMO.csv" OUT=DEMO DBMS=csv
REPLACE;
GETNAMES=YES;
RUN;

**** OUTCOME DATA *****;
PROC IMPORT DATAFILE="\yourpathname\DISCHARGE.csv" OUT=OUTCOME
DBMS=csv REPLACE;
GETNAMES=YES;
RUN;

```

```

PROC SORT DATA=WEIGHTS;
BY INC_KEY;
RUN;
PROC SORT DATA=DEMO;
BY INC_KEY;
RUN;
PROC SORT DATA=OUTCOME;

```

```
BY INC_KEY;
RUN;
```

```
**** DATASET READY TO ANALYZE ****;
DATA ANALYZE;
  MERGE WEIGHTS(IN=IN1) ED DEMO OUTCOME;
  BY INC_KEY;
  IF IN1;          /* CASES WITH WEIGHTS */;
RUN;
```

```
**** Create an indicator variable for patients that expired **;
DATA ANALYZE;
  SET ANALYZE;
  IF EDDISP='Died' or HOSPDISP='Expired' then dead=1;
  else dead=0;
  if EDDISP in ('Not Applicable BIU 1', 'Not Known/Not Recorded BIU 2')
  and HOSPDISP in ('Not Applicable BIU 1', 'Not Known/Not Recorded BIU 2')
  then dead=.;
```

```
*** do not include the BIU values in the analyzes;
if age<0 then age=.;
if losdays<0 then losdays=.;
if icudays<0 then icudays=.;
if ventdays<0 then ventdays=.;
run;
```

```
***** STATISTICAL ANALYSES *****;
PROC SURVEYFREQ DATA=ANALYZE;
  CLUSTER FAC_KEY;          *** FACILITY ID IS THE
  CLUSTER VARIABLE;        *** THE VARIABLE WITH
  STRATA STRATA;           *** VARIABLES ANALYZED;
  STRATA FOR THE DESIGN;   *** WEIGHTS;
  TABLES GENDER RACE1 RACE2 DEAD;
  WEIGHT WEIGHTS;
run;
```

```
PROC SURVEYMEANS DATA=ANALYZE;
  WEIGHT WEIGHTS;          *** WEIGHTS;
  CLUSTER FAC_KEY;       *** FACILITY ID IS THE
  CLUSTER VARIABLE;     *** THE VARIABLE WITH
  STRATA STRATA;
  STRATA FOR THE DESIGN;
  VAR AGE LOSDAYS ICUDAYS VENTDAYS; *** VARIABLES ANALYZED;
run;
```

APPENDIX E: SAMPLE STATA SOURCE CODE

```

/*****
*/
*/ Title:      trauma_estimate_2010.do      */
*/ Author:    S. Goble, Statistician NTDB  */
*/ Project:   National Sample Program (NSP) */
*/
*/ Purpose: Create statistical estimates for valid trauma cases,
*/           excluding hip fractures, analyzing the weighted data
*/           taking into account the sample design.
*/
*/ Input data:  1.   The final weights and Strata indicators
*/                for each incident
*/                Name: WEIGHTS
*/                Variables needed:      Name:
*/                Incident ID           INC_KEY
*/                Facility ID           FAC_KEY
*/                Strata                 STRATA
*/                Weights                WEIGHTS
*/
*/
*/                2.   ED information.
*/                Name: ED
*/                Variables needed:      Name:
*/                Incident ID           INC_KEY
*/                ED discharge          EDDISP
*/                Disposition
*/
*/
*/                3.   Includes information about the patient
*/                and incident demographics.
*/                Name: DEMO
*/                Variables needed:      Name:
*/                Incident ID           INC_KEY
*/                Age                   AGE
*/                Gender                 GENDER
*/                Race                   RACE
*/
*/
*/                4.   Includes information pertaining to the outcome
*/                of the trauma incident.
*/                Name: DISCHARGE
*/                Variables needed:      Name:
*/                Incident ID           INC_KEY
*/                Hospital discharge    HOSPDISP
*/

```

```

/*          Disposition          */
/*          Hospital length of stay LOSDAYS      */
/*          ICU length of stay    ICUDAYS        */
/*          Ventilator days      VENTDAYS       */
/*          */
/*          Output: Frequency estimate of gender, race and mortality      */
/*          Mean estimate of Age, LOS and ICU days                        */
/*          */
/*          Created: Feb, 2009                                           */
/*          */
/*          **There are 16 weighting strata that are combinations of     */
/*          4 Census regions, 2 designated levels of trauma care level I or */
/*          level II, and NTDB status (NTDB or non-ntdb)                 */
/*          */
/*****/
clear
set memory 700000

* Change the following: \yourpathname\
/*folder for saving input and output Data_Sets*/

* WEIGHTS
insheet using \yourpathname\Weights.csv
save \yourpathname\Weights.dta, replace
clear

* ED
insheet using \yourpathname\ED.csv
sort inc_key
save \yourpathname\ED.dta, replace
clear

* DEMOGRAPHICS
insheet using \yourpathname\Demo.csv
sort inc_key
save \yourpathname\Demo.dta, replace
clear

* DISCHARGE
insheet using \yourpathname\DISCHARGE.csv
sort inc_key
save \yourpathname\Outcome.dta, replace
clear

*MERGE FILES
use \yourpathname\Weights.dta
sort inc_key

```

**** KEEP ONLY RECORDS WITH WEIGHT**

```
merge inc_key using \yourpathname\ED.dta
```

```
keep if _merge==3
```

```
drop _merge
```

```
sort inc_key
```

```
merge inc_key using \yourpathname\Demo.dta
```

```
keep if _merge==3
```

```
drop _merge
```

```
sort inc_key
```

```
merge inc_key using \yourpathname\outcome.dta
```

```
keep if _merge==3
```

```
drop _merge
```

*** REFORMAT FILES FOR PROPORTIONAL ESTIMATES**

```
gen dead=0
```

```
replace dead=1 if eddisp=="Died" | hospdisp=="Expired"
```

```
replace dead=2 if (eddisp=="Not Applicable BIU 1" | eddisp=="Not Known/ Not Recorded  
BIU 2") & (hospdisp=="Not Applicable BIU 1" | hospdisp=="Not Known/ Not Recorded  
BIU 2" )
```

```
gen male=0
```

```
replace male=1 if gender=="Male"
```

```
replace male=2 if (gender=="Not Applicable BIU 1" | gender=="Not Known/ Not Recorded  
BIU 2" )
```

```
gen race=0
```

```
replace race=1 if race1=="American Indian"
```

```
replace race=2 if race1=="Asian"
```

```
replace race=3 if race1=="Black or African American"
```

```
replace race=4 if race1=="Native Hawaii or Other Pacific"
```

```
replace race=5 if race1=="Other Race"
```

```
replace race=6 if race1=="White"
```

```
replace race=7 if (race1=="Not Applicable BIU 1" | race1=="Not Known/ Not Recorded  
BIU 2")
```

*** DO NOT INCLUDE THE BIU VALUES IN ANALYSIS**

```
replace age=. if age<0
```

```
replace losdays=. if losdays<0
```

```
replace ventdays=. if ventdays<0
```

```
replace icudays=. if icudays<0
```

```
save \yourpathname\analyze.dta, replace
```

* STATISTICAL ANALYSES

svyset [pweight=weights], strata(strata)

*ESTIMATING MEAN OF AGE LOS AND ICUDAYS

svy: mean age

svyset [pweight=weights], strata(strata)

svy: mean losdays

svyset [pweight=weights], strata(strata)

svy: mean icudays

svyset [pweight=weights], strata(strata)

svy: mean ventdays

svyset [pweight=weights], strata(strata)

svy: prop dead

svyset [pweight=weights], strata(strata)

svy: prop male

svyset [pweight=weights], strata(strata)

svy: prop race