# Adult Cardiac Surgery National Database
# of the
# Society of Thoracic Surgeons

# Software Specifications

**Version 2.61**

Note: Some portions of this document are highlighted in gray. Although it is critical for the success of the developer's software that all of the information in this document be understood and followed, the highlights are used to point out areas that have changed since previous versions or areas of extreme importance to the functionality of the software.

Purpose:

The purpose of this document is to describe the features that are required to exist in software certified by The Society of Thoracic Surgeons (STS) for the collection and submission of adult cardiac surgery data. The STS is making an effort to set minimum standards for the software to be used by its members, while allowing enough flexibility so that developers can produce competitive features for the members' benefit.

The intended audience for this document is the software developers who are designing and maintaining the code used by participants to collect and submit data to the STS database. This information will be essential for developers working for vendors who will distribute their software to many members as well as developers working for an individual member designing a package to be used only by themselves (Participant Generated Software).

Note: All software used to collect data to be submitted to the STS Data Warehouse must go through a certification process before data will be accepted into the national database. Developers must also have a signed contract on file with the STS before the certification process can begin.

Since the functionality of the software will revolve around the data specifications, this document will start by providing some information about the specifications.

Data Specifications:

1. Global changes between versions 2.52.1 and 2.61.

   The contents of the data specifications field "Format" has been changed to remove unnecessary formatting restrictions. For example, the format of the field RF-Last Creat Lvl was changed from "Real number 2.1 digits e.g. 99.9" to "Real" because it is not necessary to specify the number of decimal places. In some cases, the length restriction of text fields was removed. This was done for fields such as hospital name, where there can't be a limit to the field size because the field must be able to store what ever value is required by the site.

   In previous versions of the data specifications, there was a field called "MissingData" that was used to describe how or if the user should be notified if the user did not record a value in this field. This would include instructions for everything from do nothing to provide a pop-up warning message as well as include the information in a missing data report. It became clear from feedback from users that there could not be one set of rules that would provide all users with the information they wanted. Some users want to know if any values are missing in any of their data records, where other users only have the time and resources to concentrate on key fields. To solve this issue, it was decided that the STS will not specify instructions for each individual field, but instead require

certified software to provide a utility for sites to review the completeness of their own data for a list of fields they specify. Therefore, the MissingData field was removed from the specifications. See “Data quality and completeness checks” below for a description of how this utility should work.

2. Purpose of the Data Specifications

The data specifications describe the data fields that are required to exist in certified software. It details the field names, definitions, dependencies, acceptable values, the harvest codes associated with those values, etc. Developers of certified software should use the data specifications to ensure their software:

a. includes all core fields in the application (see description of Core fields below),
b. uses the correct programmatic name (Short Name) for each field,
c. follows the defined field dependency rules (see description of Parent / Child relationships below),
d. accepts only the defined valid values appropriate to each field and ensures that the values are in the correct format,
e. provides the user with appropriate field definitions, and
f. includes only the appropriate fields in the extracted data files the site will submit to the Data Warehouse.

3. Data Version Numbers

As medicine, technology and interest in research areas change, the data specifications have and will change to collect additional and more detailed information. A Data Version number is assigned by the STS to each official version of the data specifications. This number will play a key role in how the data is handled and processed (see Software Specifications below).

STS members were required to start using certified software as of January 1, 2000. At that time, version 2.35 of the data specifications was put into affect and any data collected for procedures performed before January 1, 2000 were converted as closely as possible to the 2.35 format.

Since that time, the data specifications have been upgraded three times; first to version 2.41 and then to 2.52.1 and 2.61. With these upgrades, there is a conversion period when the data can be recorded following either the version being replaced or the newer version. This allows sites to continue entering their data into an old version of their software while they are waiting to have their software upgraded. The following table

defines which version of the data specifications will be accepted into the national database for procedures performed during the specified time periods:

| Surgery date | Data Specifications version number |
|---|---|
| Any dates up to December 31, 1999 | Data converted to 2.35 format |
| January 1, 2000 through December 31, 2001 | 2.35 |
| January 1, 2002 through June 30, 2002 | 2.35 or 2.41 |
| July 1, 2002 through December 31, 2003 | 2.41 |
| January 1, 2004 through June 30, 2004 | 2.41 or 2.52.1 |
| July 1, 2004 through June 31, 2007 | 2.52.1 |
| July 1, 2007 through December 31, 2007 | 2.52.1 or 2.61 |
| January 1, 2008 through the current date | 2.61 |

4. Sequence Number

   The sequence number field (SeqNo) is provided in the data specifications solely for identifying fields and sorting fields within the data specification database and documentation. They are not intended as a permanent identifier for individual fields and a number assigned to a field in one version of the data specifications might be assigned to a different field in another version. Because of this, it is highly recommended that developers should not use the SeqNo value as a field identifier in any of their programs. See Appendix C for a list of SeqNo values for each field for each of the most recent versions of the data specifications.

5. Future Upgrades

   As the need arises, new versions of the data specifications will be distributed by the STS. In the interest of keeping major software upgrades and testing down to a minimum, the STS does not expect to upgrade the specifications more frequently than once every other year. Developers should anticipate these upgrades and design their software in such a way that the new versions can be incorporated with minimal software changes and that records created under different data versions will be handled properly, as described below.

6. Data Specifications field descriptions

   The data specifications are maintained in a table in an Access database to allow the information to be cut and pasted, sorted and reported on in a variety of ways to make incorporating the information easier for the developer. The table for the 2.61 version of the specifications contains 20 fields which are described here:

A. Section – The section of the Data Collection Form (DCF) in which the field is located.
B. SeqNo – An arbitrary number (sequence number) used for ordering the fields within a specific version of the data specifications. The ordering of the numbers is set to loosely follow the order in which the fields appear in the DCF. As described above, the SeqNo value for one field can change from one version of the specifications to the next. The values, therefore, should never be used in any reports, queries or programs to refer to a specific field.
C. FieldName – The longer and more descriptive name of the field. In most cases, the FieldName does not change from one version of the specifications to the next, but they do change in some instances. Because of this, the FieldName value should never be used to refer to a field in reports, queries or programs.
D. ShortName – The short, programmatic name assigned to the field. The ShortName value should be used in all reports, queries and programs to refer to a given field as this value will not change from one version of the specifications to another.
E. Core – This field contains a value of Yes or No to define whether or not the field should be available to the users for data entry. These values have the following meanings:
    - Yes = Field must be available to the users for entering data for records following this version of the data specifications and the field must be included in the data files exported for submission to the STS database that contain records following this data version.
    - No = Field is not required to be available to the users for entering data for records following this version of the data specifications. Whether or not the field is included in data files exported for submission to the STS database depends on what other data versions are being included in the data extract. (See the "Data export for harvest to the data warehouse" section of the Software Specifications below.) Fields defined with Core=No are in the specification only to be able to express that the field was being collected in the previous version of the specifications, but is no longer being collected. A field defined in this way in one version of the specifications, will not appear at all in the next version.
F. Harvest – This field contains a value of Yes, No or Optional to define whether or not the data for this field is included in the export file to be submitted to the data warehouse. (See the "Data export for harvest to the data warehouse" section of the Software Specifications below for more details about the contents of the files submitted to the data warehouse.) The values for this field have the following meanings:
    - Yes – Data from this field must be included in the data file for all records following this version of the data specifications.
    - No – Data from this field must not be included in the data file for all records following this version of the data specifications.

- Optional – The individual users determine whether or not the data from this field is included in the data file. By default, the software should treat this as a Yes and include the data in the extract. The users must explicitly state that they do not want the data for this field included. This distinction is defined for fields the STS would prefer to have included in the harvest, but the site might have reasons (such as not being allowed by state laws) for not including the values in the harvest file.

G. Status – This field defines what has happened to the field moving from the previous version of the data specifications to this version. This field will have one of the following values:
   - New – This field was not a core field in the previous version but now is a core field in this version.
   - Extended – This field was a core field in the previous version but now is not a core field in this version.
   - Changed – This field is a core field in both the previous and current versions. However, something has changed for this field between the two versions.
   - Continued – This field is a core field in both the previous and current versions and nothing has changed for this field between the two versions.
H. Format – The format in which the values for the field should be collected, such as integer, real values, text, date, etc. In some cases, more information will be provided to describe the expected values (such as number of characters or number of decimal places).
I. DataSource – This field defines how the data is entered into the field. The options for this field are (note, in some cases, there is more than one option for data source, such as "User or Calculated"):
   - User – The user enters the value, otherwise it is left missing (null).
   - Automatic – The software automatically inserts a value for every record. This is usually assigned to administrative fields that must contain a value, such as the DataVrsn field.
   - Calculated – The value is calculated by the software based on values in other fields (for example, the risk model fields).
   - Lookup – The software automatically inserts a value after looking up the information kept in a table maintained by the user (for example, HospStat is filled in based on which HospName value is selected).
J. Definition – The official definition of the field.
K. ValidData – The values that can be accepted for the specified field. This can be a list of values or a numeric range. (See the "Data Entry" section of the "Software Specifications" portion of this document).
L. UsualRange – The range of values that are expected to be entered in most cases. (See the "Data Entry" section of the "Software Specifications" portion of this document).

M. HarvestCoding – The numerical code that is assigned to each choice in the valid data. These are the values that are used in the exported data file that is submitted to the Data Warehouse.
N. ParentField – The "parent" field on which this field (the "child" field) is dependant. Software must be defined such that the parent field must contain a value that is specified in the ParentValue field before data can be entered into this field, otherwise the field is disabled or unavailable.
O. ParentShortName – The STS short name of the parent field.
P. ParentValue – The list of values the parent field can have before this field can be available for data entry.
Q. ACCField – This field indicates whether or not the definition and harvest coding of this field maps to a similar field in the 2007 revised American College of Cardiology (ACC) NCDR-ACTION and/or CathPCI data specifications. This field will contain one of the following values with these meanings:
    - "Not mapped" – There is no ACC field that is similar to this STS field in definition or coding.
    - "Mapped – Definition only" – There is an ACC field that is similar to this STS field in definition, but not in coding. These two fields will have some difference (such as the time at which the value is collected) that precludes the data from being combined or stored in the database as one field.
    - "Mapped – Definition and coding" – There is an ACC field that is similar to this STS field in definition and coding. These two fields can be combined and stored in the database as one field.

Software specifications:

It is not the intention of the STS to regulate the algorithms and methodologies the developers use to produce their software. However, there are specific features and functionalities that are needed in the software to allow data to be collected and submitted in a uniform format and to enable the warehouse to communicate with the members about individual records and data items. The purpose of this section is to describe those features and functions.

1. General features

   The certified software must have the following minimum features:

   a. Provide a user-friendly interface that can be used on a current personal computer operating system.
   b. Allow users to be able to view and select the actual data values for each field. If the data is coded internally, user should, by default, view the non-coded values.
   c. Ensure all date values are year 2000 compliant having a 4-digit year format.
   d. The STS database has a logical flat structure in which each record describes one surgical case. If a developer chooses, this can be implemented as a set of relational tables (e.g. demographics table, procedure table, etc.), but the software must be able to export the data in a flat file structure compatible with that of the STS. (See "Data Export for Harvest to the Data Warehouse", below).
   e. Software must accept and integrate STS data previously collected and maintained in other software products or data versions. (See "Data Import", below).
   f. The user's data must be accessible for *ad hoc* queries either through the software package or by common third party software (e.g. Microsoft Access Crystal Reports, etc.) If the data is not directly accessible, then the software must provide the ability for the user to export the data in a standard file format which can be queried using common third party query software. (See "Data Export for Analysis by Users", below). When users are querying their data, grouping records that were created under multiple data version numbers must be invisible to the user. For example, if a user wants to analyze a risk factor in their data for a time period of two years, the fact that their data was recorded under two different version numbers during that period must not require any additional steps for the user to build the query. We strongly recommend ensuring this by keeping all data in one database regardless of the version number. This requirement is the result of feedback from many frustrated users.
   g. Users must be able to select specific records in their database via key fields including patient's name, medical record number, and the record identification field (RecordID).
   h. Software must include a utility that allows users to check the completeness of any or all of their data fields. This utility must allow the user to select which fields are included in the data check and have the option of including all fields or just specified fields. (See "Data quality and completeness checks" below)

i. Software must include a utility that allows on-demand updates for the following areas (see "On-demand updates" below):
    1. Valid values and harvest coding for the valve prosthesis fields (VS-Aortic Proc-Imp, VS-Mitral Proc-Imp, VS-Tricuspid Proc-Imp, VS-Pulmonic Proc-Imp)
    2. Valid values and harvest coding for the VAD device fields (VAD-Product Type, VAD-Product Type #2, VAD-Product Type #3)
    3. The coefficients used for calculating risk scores.

2. Record management

Each record in the database describes one surgical case. On each record, there are four key fields used for record management:

a. Participant identification number (ParticID): Each group of surgeons collecting and entering data into a database for submission to the STS is assigned a 5-digit ParticID by the STS. In most cases, all data being entered into a database will be for one participating group, in which case all records will have the same value in this field. In these situations, the developer can have the software enter the value into the record automatically for the user.

In some situations however, more than one participating group will be entering their data into a single database. In these situations, the user should select the appropriate ParticID value from a drop down list (see "Categorical values specified by user" under the Data Source description in the "Explanation of Data Specification Terms", below).

The developer should consult with the users to determine how many participants will be entering data into a single database and adjust the programs accordingly. In either case, a value for ParticID is required and the software should ensure one exists for every record.

b. Record identification number (RecordID): The RecordID field contains a unique numeric value that identifies the record in the database. This is an arbitrary number and must not be a value that could identify the patient, such as Social Security Number, Medical Record Number, etc. Once attached to a specific record, the value can never be changed, nor can it be reused if the record is deleted. The data warehouse uses the RecordID field to communicate record-specific data quality issues to the participants. Because of this, users must be able to select cases from their database for review using this field and the field must be labeled "RecordID" on the data entry screen. See also the special considerations necessary for this field when importing data from another database in the "Data Import" section, below.

Together, the ParticID and the RecordID will affect a composite key, which is unique to each record throughout the national STS database.

c. Data Version Number (DataVrsn): The DataVrsn field contains the data specifications version number under which the record is created. The value is automatically entered into the record by the software at the time the record is created. The value then can never be changed, even if the software is upgraded to a newer version of the specifications.

   Once a record is created and a data version has been assigned to it, that record will always follow the rules defined by that version of the data specifications. When a user selects a record for editing that has an older data version number, the software must follow the older data specification rules for editing that record. This includes controlling which fields are available to the user, which values are available for each field and the appropriate parent/child dependencies.

d. Patient identification number (PatID): The PatID field contains a unique, arbitrary number to uniquely identify the patient in the database. If one patient has multiple admissions to the hospital, the records for each admission will contain the same PatID value. The number, once assigned to a patient, can not be edited or reused if the patient records are ever deleted. In order to avoid issues of patient confidentiality in transferring records, the PatID value should not be any known identifier such as Social Security Number or Medical Record Number. A PatID value is required on every record regardless of the structure of the software's database.

3. Data entry

   The software must have the following features to control the data being entered by the users:

   a. For export of data to the warehouse, most data fields have a default value, usually null or blank, which indicates that the data is "Missing" (see data specifications). For data entry purposes the site and vendor may choose to institute internal codes for "Missing" values. As the site drives the need for this feature, the STS data specifications do not define standard codes for "Missing" values during data entry. If a site applies data entry "Missing" codes, the harvest process must include a step that maps the missing code to the STS specification for "Missing" values (null or blank). Note: zero must never be used to indicate missing data.

   b. The user should always be able to delete entered data, and return the field's value to the null or blank "Missing" value.

   c. For any field having "Valid Data" specified, the software must restrict data entries to this set of values. For categorical variables this is expressed as a set of valid

text values and the user must select from a pick list of these values. For numerical variables, this is expressed as a valid numeric range and the user must enter a value on or between the specified lower and upper limits.

d. Where a numeric variable has a "Usual Range" specified, if the user attempts to enter a value that is outside of that range but still inside the Valid Data range, the software must warn the user that they are entering an unusual value and ask if the entry is correct. If the user confirms that the value is correct, then it should be accepted into the field.

e. Some categorical text fields are designed to have data values controlled by the user. This applies primarily to a few site-specific fields such as hospital name and surgeon name. These fields are indicated in the Data Specifications by their Format specifying "categorical values specified by user", and their Valid Data specifying "(elements of user list)". The user should be able to maintain the pick list of valid data for these fields including the ability to add, change, or delete list elements. During data entry, the user should be able to enter only values that are in this pick list.

   The process of maintaining the list should be separate from the data entry process. In other words, users must purposely add a value to the list to make it available for selection during data entry. If a user enters a value that is not on the list, it should be rejected and not automatically added to the list. The idea here is to avoid the possibility of users entering “free text” which causes unacceptable data quality issues at the warehouse.

   It is important that the vendor support the site's ability to control these fields. Items in the user list should not have more than one choice for the same entity. For example, the hospital names “General Memorial Hospital” and “GMH” should not represent select choices for the same hospital.

f. Documentation including data definitions and help should be easily accessible to the user, preferably on-line.

g. Specific considerations are needed for the fields related to valve prostheses. There is an implicit relationship within the data describing valve prostheses. Specifically, there are constraints between the prosthesis type and the prosthesis name.

   This applies to four different potential prostheses per operative case record: one at each of four valve positions (Aortic, Mitral, Tricuspid, and Pulmonic).

   Software should be written so that once a prosthesis type is chosen, only the prostheses of that chosen type are allowable potential data entries for the prosthesis name. See Appendix A for a list of the data fields containing the prosthesis type and the corresponding prosthesis name.

For any prosthesis type, the prosthesis name choices of "Other" should always be available.

4. Field dependencies

Field dependencies exist where one field (the “parent” field) controls whether or not one or more other fields (the “child” fields) can contain data. Child fields are indicated in the specifications by having their immediate parent field named in the "Parent Field" section of their specification. For example, "RF-Cerebrovascular Dis " is a parent field to its child "RF-CVA". The following guidelines must be followed to handle dependent fields:

a. If the data value of a parent field indicates that no data should be in its dependent fields, then those dependent fields should be skipped or unavailable on the data entry screen. In the example above, only if “RF-Cerebrovascular Dis” = "Yes" should “RF-CVA” be available for data entry.
b. If a parent field contains a “No” value, vendors can choose one of two methods for handling the values in the associated child fields:

    1. set all child field values to Null, or
    2. set child field values to “No” as is appropriate.

    Note that the STS highly recommends following the first method of setting all child fields to Null.

    Vendors must keep in mind that the first method is required in the export file created for submission to the data warehouse. In other words, regardless of what is in the user’s database, the export file must contain Nulls in child fields when the parent is No.

    Also, vendors must notify the STS and the data warehouse if their software will insert No values into child fields when the parent is No. This will allow the warehouse to know that the data received by a site during a data harvest will not look exactly like what the user has in their database.

c. If a parent field is originally set to “Yes”, then values can be entered into its child fields. If the record is subsequently edited by the user and the parent value is changed to “No”, the values in the child fields must be automatically changed to Null or No depending on the method being used by the vendor as described above. This will avoid the possibility of conflicting information being left in the data record (for example “RF-Cerebrovascular Dis“is “No” but “RF-CVA” is “Yes”).

d. Reporting on missing data values needs to be handled differently in dependent (child) fields, since its meaning depends upon the data value of the parent field. See “Data quality and completeness checks” below for a full description of how this should be handled.

5. Data quality and completeness checks

   The software must provide the users with a utility for checking the accuracy and completeness of their data that includes the following features:

   a. Data quality checks can be run during data entry and/or on demand for groups of records as specified by the user. This utility produces a data quality report indicating which records and fields failed the data checks. This report is used by the site data manager to review and potentially repair the data. The Data Warehouse will make available to developers a description of the data quality checks it performs while processing each site’s data. This information will be updated annually. It is recommended that developers use this information to include similar checks in their data quality checking routines. This will allow sites to check the quality of their data on a more regular basis and avoid finding large data issues at harvest time.

   b. Certified software must contain a utility for checking and reporting on data completeness. This utility must include the following features:

      i) The user must be able to identify in a list the fields that they want to have checked for completeness. The user should be able to select just one field, all fields, or any number of fields desired (by default, the utility should report on ALL fields). It is recommended that user should be able to save the selected list so as not to have to go through the selection process again the next time data quality is being checked.
      ii) The utility should report on individual records or groups of records (recommend grouping by surgery date range) as specified by the user.
      iii) The utility must take into consideration dependent fields when checking for completeness. For fields defined as “child” fields of a “parent” field, the child is considered missing only if the parent is answered “Yes” (or in a way that would allow the user to enter data into the child field) and the child field contains no data. Following this guideline will restrict reporting missing data to only those situations where data is clinically expected.

6. Data Import

   a. Software must be able to import data in standard file formats from third party applications. At a minimum, this must include delimited, ASCII text files. Other common formats (e.g. Excel or MS Access) are also recommended.

b. Data that is imported will require controlled conversion to an acceptable STS data version. The conversion process must include reviewing the data for consistency with the STS data (i.e. mapping the categorical values in the imported data to the appropriate STS values). The site data manager and software vendor hold responsibility for the accuracy (both clinical definition and harvest format) of all imported data harvested to the warehouse. The software will assign to each imported record the STS data version number to which the data is converted. The warehouse will handle data according to the STS data version number on each observation in a harvest file regardless of whether it was created in the software's data entry utility or imported from another source.

c. Special consideration is needed for the values in the RecordID field when importing data. This is especially true when importing data that was previously submitted to the data warehouse (i.e. data from another certified software package). RecordID values must never change once they are assigned to a record. The software developers and data managers must ensure that the values in the imported data do not change in the conversion process, and that they do not cause duplication of values with any existing records. Developers must also ensure that new records created after the data has been imported are not assigned RecordID values that already exist in the data. If data is to be imported that would cause a conflict in this manner, the software developer must contact the Data Warehouse to determine what steps need to be taken.

7. Record subsets and queries

a. Software must allow users to search for Individual records selected by RecordID or by patient identifiers including patient name, medical record #, and surgery date.

b. Software should allow groups of records to be selected (e.g. filter function) by multiple fields, which minimally include procedure type, surgeon, hospital, date of surgery, date of admission, and date of discharge. This will also help sites find individual records when specific identifiers are not known.

c. Users should be able to name, save, copy and modify record selection criteria.

d. Users should also be able to construct more general queries including field selection, record selection, sorting, and summarizing. It is acceptable if this function is provided by a third party application (e.g. MS Access or Crystal Reports).

8. Reporting

Software should provide the users with reporting abilities that can do the following:

a. View and print listing of records (either all records or a selected subset) with basic information such as, but not limited to, record number, patient name, SSN, procedure type, medical record number, date of birth, date of surgery, surgeon, and hospital.

b. Print full record detail on single or multiple selected records.

c. View and print a data completeness report listing the records having missing fields and which fields are missing from each record.

d. Build, save, copy, and modify more general reports with capability to select fields, record subsets, sorting, and summary statistics. (It is acceptable if this function is provided by a third party application, such as MS Access or Crystal Reports).

e. Incorporate capabilities for graphing the data in reports, including trends over time (it is acceptable if this function is provided by a third party application).

f. Data harvest procedure provides the site with a report documenting the following:
    1. whether or not the extract completed successfully
    2. number of records extracted
    3. time frame of the data extract (by date of surgery)
    4. date the data extraction was performed
    5. name of the person who performed the data extraction

9. Data export for analysis by users

The software must allow users to export their data for their own use in the following manner:

a. Software must be able to export data in standard file formats suitable for transfer into third party applications. This must include at a minimum delimited, ASCII text, and optionally other common formats such as Excel and Access. Developers should keep in mind that sites may need to export their data for reasons other than the STS data harvests.

b. User should be able to choose whether an export includes all data or selected records and fields.

c. If data is coded for internal storage (e.g. text string is stored as a number), the data must be decoded when written to the export file so that actual values (e.g. full text strings) are contained in export file.

d. Export files must have short field names in the first header row in the same order as the data in subsequent rows.

e. User can build, save, copy, and modify named export configurations.

f. User can control export file naming convention.

10. Data export for harvest to the data warehouse

As one of the key reasons for having certified software, the software must allow users to export their data for submission to the STS data warehouse following these exact guidelines:

a. The user must be able to specify the records to be exported for harvest by using range limits for the surgery date.

b. The Data Harvest file exported must adhere to this specific format:
    1. File is an ASCII text file with vertical bar delimiters
    2. The first row is a "header" record containing the STS short field names in the same sequence as the data fields in subsequent rows
    3. Each subsequent row represents one data record describing one surgical case

c. Only a single harvest file for each participant can be submitted to the warehouse for processing. Participants may submit repeatedly during a harvest, but each submission is only one file.

d. The extracted file must contain data for only one participant ID (ParticID) value. If the site's database contains data for more than one participant, all of which is to be submitted to the warehouse, the software must extract the data for each ParticID into separate data files each with an appropriate file name (see below).

e. The harvest file must include all fields, and only those fields, defined in the data specifications with Core = "Yes" and Harvest = "Yes" or "Optional" for all STS data versions within the harvest file. In other words, a file containing v2.52.1 and v2.61 records would contain all fields where Core is "Yes" and Harvest is "Yes" or "Optional" for either version of the specifications (more information on submitting data from multiple data versions is given below). Fields with Core="No" or Harvest="No" and site-specific or custom fields must not be included in the export file.

f. Fields that are defined as Core = Yes and Harvest = Optional must be included in the data file. What is "optional" is whether or not the field contains data. By default, the software should include all data for optional fields. If the user specifies that an optional field should not be included, the data file will include the

field but every record will contain a blank (null) in that field. This is necessary for the warehouse to be able to tell the difference between a field being left out by mistake and a site opting not to include that data.

g. The values in the harvest file must be the numerical "Harvest Coding" of the data values and not the full text strings.

h. A harvest report should be produced whenever a data harvest is performed (see "Reporting", above).

i. The software must create the exported data file using the file naming convention of XXXXXadt.dat where "XXXXX" is the 5-digit ParticID for the data contained in the file. The users should not specify the file naming convention. Files not using this naming convention can not be accepted by the automated process at the data warehouse and may be returned to the participant.

When records from more than one data version are being exported for an STS data harvest, the file must adhere to the following format:

j. The first record of the file must be the one and only "header" record containing the STS short field names in the same sequence as the data fields in subsequent rows.

k. Every data record in the file must contain the same fields which will consist of a superset of the Core, Harvested fields from all included data versions.

l. On each data record, the fields that are Core and Harvested for the data version specified in the DataVrsn field will contain data values as available and appropriate. The fields that are not Core or not Harvested for that data version will contain nulls (blanks). When the data is being processed by the warehouse, only the fields appropriate for the data version specified on the record will be included.

For an example of a data file containing more than one data version, consider a data file being submitted with records having data versions 2.52.1 and 2.61. The software will produce one data file with one header record that will identify all of the Core / Harvested fields for both versions, including "Patient Age" (Age), "RF-Renal fail" (RenFail), and "Hospital National Provider Identifier" (HospNPI). The Age field is Core to both 2.52.1 and 2.61. RenFail is Core for 2.52.1 but is not Core in 2.61. HospNPI didn't exist in 2.52.1 but is a new, Core field in 2.61. A data record in the extracted file that has a DataVrsn value of 2.52.1 should contain a value in Age and RenFail, but would contain a null in HospNPI. A data record that has a DataVrsn value of 2.61 should contain a value in Age and HospNPI, but would contain a null in RenFail.

11. Customization

It is up to the developer's discretion as to whether or not the users will have the ability to add customized fields to their software and database. If the user will have this ability, the following items must be considered:

a. In no case can the field names, short field names, or categorical data values specified by the STS be customized or modified by the users. (Please note however in the STS specifications that users can build the categorical data values for certain fields such as Hospital Name, see "Data entry", above.)

b. Fields added by users must not be included in the data file exported for submission to the STS data warehouse.

c. Developers should make clear to the potential users whether users can add custom fields themselves, or if they will require contracted work by the developer.

d. It should be possible for users of customizable software to import custom fields that they might have created in a previous database or software package.

e. Most importantly, developers who allow users to add customized fields must keep in mind that software upgrades will be necessary from time to time as new versions of the data specifications become available. These changes include adding new fields, discontinuing fields, and moving fields to a new location. It is the developer's responsibility to handle how a user's customization is incorporated when their software is being upgraded.

12. Combining collection of STS and non-STS database fields

Developers who design their software to collect data for more than just the STS Adult Cardiac database must not combine fields from other databases with the STS fields unless it is explicitly stated in the STS data specifications that the fields are the same in definition and coding. At the time this document was produced, the only other database that has been designated as having fields in common with the STS Adult Cardiac database are the 2007 versions of the American College of Cardiology (ACC) NCDR-ACTION and Cath-PCI databases. Within the STS data specifications, the field called "ACCField" contains the information that defines which STS fields can be combined with ACC fields (see "Data Specifications field descriptions" in the "Data Specifications" section above).

13. On-demand updates

Starting with v2.61, certified software must have the ability to load updated values to be used in three areas:

1. Valid values and harvest coding for the valve prosthesis fields (VS-Aortic Proc-Imp, VS-Mitral Proc-Imp, VS-Tricuspid Proc-Imp, VS-Pulmonic Proc-Imp)
2. Valid values and harvest coding for the VAD device fields (VAD-Product Type, VAD-Product Type #2, VAD-Product Type #3)
3. The coefficients used for calculating risk scores.

The Data Warehouse will provide data files that will contain the information needed for each area which will be in a bar-delimited ASCII text format. Each set of information will be assigned a version number by the Data Warehouse. Updated versions of these files will be made available annually.

Software should be designed to be able to load these updates so that they can be used by the users during the data entry process. This will allow newly available devices to be valid choices for the users without having to wait for a full specification and software upgrade. It will also allow the risk models to use more precise coefficients that can be calculated by the Data Warehouse as the national database grows.

For each of these three areas, fields have been added to the data specifications to hold the version number of the set of choices or coefficients being used when each record is created. Those fields are as follows:

| Value set | Version number field name | Short name |
|---|---|---|
| Valve prosthesis | Valve Implant List Version Number | ValveVrsn |
| VAD devices | VAD Product Type List Version Number | VADListVrsn |
| Risk models | Risk Model Coefficients Version Number | PredCoefVrsn |

Having the version numbers recorded on the data record will enable the Data Warehouse to know what device options were available to the user at the time of data entry and what coefficients were used for calculating the risk scores.

## Appendix A: Valve prosthesis and types

The valid data choices for the valve prosthesis fields are not meant to be an all-inclusive list. The included choices are the devices that are most commonly used and/or have the most interest for being identified in analysis.

Between versions 2.52 and 2.61 of the data specifications, only a few new prosthesis were added to the list and none of the options were removed.

This table can also be used to determine the constraints between the prosthesis type and the prosthesis name (see the Data Entry section above).

| 2.61 status | 2.52.1 harvest code | 2.61 harvest code | Type | Prosthesis |
|---|---|---|---|---|
| Continued | 2 | 2 | Mechanical | 2 = ATS Mechanical Prosthesis |
| Continued | 3 | 3 | Mechanical | 3 = Björk-Shiley Convex-Concave Mechanical Prosthesis |
| Continued | 4 | 4 | Mechanical | 4 = Björk-Shiley Monostrut Mechanical Prosthesis |
| Continued | 6 | 6 | Mechanical | 6 = CarboMedics Mechanical Prosthesis |
| Continued | 57 | 57 | Mechanical | 57 = CarboMedics Carbo-Seal Ascending Aortic Valved Conduit Prosthesis |
| Continued | 58 | 58 | Mechanical | 58 = CarboMedics Carbo-Seal Valsalva Ascending Aortic Valved Conduit Prosthesis |
| Continued | 59 | 59 | Mechanical | 59 = CarboMedics Reduced Cuff Aortic Valve |
| Continued | 60 | 60 | Mechanical | 60 = CarboMedics Standard Aortic Valve |
| Continued | 61 | 61 | Mechanical | 61 = CarboMedics Top-Hat Supra-annular Aortic Valve |
| Continued | 62 | 62 | Mechanical | 62 = CarboMedics OptiForm Mitral Valve |
| Continued | 63 | 63 | Mechanical | 63 = CarboMedics Standard Mitral Valve |
| Continued | 64 | 64 | Mechanical | 64 = CarboMedics Orbis Universal Valve |
| Continued | 65 | 65 | Mechanical | 65 = CarboMedics Small Adult Aortic and Mitral Valves |
| Continued | 7 | 7 | Mechanical | 7 = Edwards Tekna Mechanical Prosthesis |
| Continued | 53 | 53 | Mechanical | 53 = Lillehei-Kaster Mechanical Prosthesis |
| Continued | 10 | 10 | Mechanical | 10 = MCRI On-X Mechanical Prosthesis |
| Continued | 8 | 8 | Mechanical | 8 = Medtronic-Hall/Hall Easy-Fit Mechanical Prosthesis |
| Continued | 66 | 66 | Mechanical | 66 = Medtronic ADVANTAGE Mechanical Prosthesis |
| Continued | 9 | 9 | Mechanical | 9 = OmniCarbon Mechanical Prosthesis |
| Continued | 54 | 54 | Mechanical | 54 = OmniScience Mechanical Prosthesis |
| Continued | 11 | 11 | Mechanical | 11 = Sorin Bicarbon (Baxter Mira) Mechanical Prosthesis |
| Continued | 12 | 12 | Mechanical | 12 = Sorin Monoleaflet Allcarbon Mechanical Prosthesis |
| Continued | 13 | 13 | Mechanical | 13 = St. Jude Medical Mechanical Prosthesis or St. Jude Medical Mechanical Heart Valve |
| Continued | 67 | 67 | Mechanical | 67 = SJM Masters Series Mechanical Heart Valve |
| Continued | 68 | 68 | Mechanical | 68 = SJM Masters Series Aortic Valve Graft Prosthesis |
| Continued | 69 | 69 | Mechanical | 69 = St. Jude Medical Mechanical Heart Valve Hemodynamic Plus (HP) Series |
| Continued | 70 | 70 | Mechanical | 70 = SJM Masters Series Hemodynamic Plus Valve with FlexCuff Sewing Ring |
| Continued | 71 | 71 | Mechanical | 71 = SJM Regent Valve |
| Continued | 14 | 14 | Mechanical | 14 = Starr-Edwards Caged-Ball Prosthesis |
| Continued | 15 | 15 | Mechanical | 15 = Ultracor Mechanical Prosthesis |
| New | | 108 | Bioprosthesis | 108 = ATS 3f Aortic Bioprosthesis |
| Continued | 72 | 72 | Bioprosthesis | 72 = Baxter Prima Stentless Porcine Bioprosthesis - Subcoronary |
| Continued | 73 | 73 | Bioprosthesis | 73 = Baxter Prima Stentless Porcine Bioprosthesis - Root |

| | | | | |
|---|---|---|---|---|
| Continued | 19 | 19 | Bioprosthesis | 19 = Biocor Porcine Bioprosthesis |
| Continued | 74 | 74 | Bioprosthesis | 74 = Biocor Stentless Porcine Bioprosthesis - Subcoronary |
| Continued | 75 | 75 | Bioprosthesis | 75 = Biocor Stentless Porcine Bioprosthesis - Root |
| Continued | 21 | 21 | Bioprosthesis | 21 = CarboMedics PhotoFix Pericardial Bioprosthesis |
| Continued | 76 | 76 | Bioprosthesis | 76 = Carpentier-Edwards Duraflex Porcine Bioprosthesis |
| Continued | 77 | 77 | Bioprosthesis | 77 = Carpentier-Edwards Prima Plus Stentless Porcine Bioprosthesis - Subcoronary |
| Continued | 78 | 78 | Bioprosthesis | 78 = Carpentier-Edwards Prima Plus Stentless Porcine Bioprosthesis - Root |
| Continued | 22 | 22 | Bioprosthesis | 22 = Carpentier-Edwards PERIMOUNT Pericardial Bioprosthesis |
| New | | 103 | Bioprosthesis | 103 = Carpentier-Edwards PERIMOUNT Pericardial Magna Bioprosthesis |
| Continued | 23 | 23 | Bioprosthesis | 23 = Carpentier-Edwards Standard Porcine Bioprosthesis |
| Continued | 25 | 25 | Bioprosthesis | 25 = Carpentier-Edwards Supra-Annular Aortic Porcine Bioprosthesis |
| Continued | 79 | 79 | Bioprosthesis | 79 = Cryolife O'Brien Stentless Porcine Bioprosthesis - Subcoronary |
| Continued | 80 | 80 | Bioprosthesis | 80 = Cryolife O'Brien Stentless Porcine Bioprosthesis - Root |
| Continued | 55 | 55 | Bioprosthesis | 55 = Hancock Standard Porcine Bioprosthesis |
| Continued | 28 | 28 | Bioprosthesis | 28 = Hancock II Porcine Bioprosthesis |
| Continued | 29 | 29 | Bioprosthesis | 29 = Hancock Modified Orifice Porcine Bioprosthesis |
| Continued | 30 | 30 | Bioprosthesis | 30 = Ionescu-Shiley Pericardial Bioprosthesis |
| Continued | 31 | 31 | Bioprosthesis | 31 = Labcor Stented Porcine Bioprosthesis |
| Continued | 81 | 81 | Bioprosthesis | 81 = Labcor Stentless Porcine Bioprosthesis - Subcoronary |
| Continued | 82 | 82 | Bioprosthesis | 82 = Labcor Stentless Porcine Bioprosthesis - Root |
| Continued | 83 | 83 | Bioprosthesis | 83 = Medtronic Freestyle Stentless Porcine Bioprosthesis - Subcoronary |
| Continued | 84 | 84 | Bioprosthesis | 84 = Medtronic Freestyle Stentless Porcine Bioprosthesis - Root |
| Continued | 35 | 35 | Bioprosthesis | 35 = Medtronic Intact Porcine Bioprosthesis |
| Continued | 36 | 36 | Bioprosthesis | 36 = Medtronic Mosaic Porcine Bioprosthesis |
| Continued | 85 | 85 | Bioprosthesis | 85 = Medtronic Contegra Bovine Jugular Bioprosthesis |
| Continued | 37 | 37 | Bioprosthesis | 37 = Mitroflow Pericardial Bioprosthesis |
| Continued | 39 | 39 | Bioprosthesis | 39 = St. Jude Medical - Toronto SPV Stentless Porcine Bioprosthesis or SJM Toronto SPV Valve |
| Continued | 40 | 40 | Bioprosthesis | 40 = St. Jude Medical-Bioimplant Porcine Bioprosthesis |
| Continued | 86 | 86 | Bioprosthesis | 86 = SJM Biocor Valve |
| Continued | 87 | 87 | Bioprosthesis | 87 = SJM Epic Valve |
| Continued | 88 | 88 | Bioprosthesis | 88 = SJM Toronto Root Bioprosthesis |
| Continued | 38 | 38 | Bioprosthesis | 38 = Sorin Pericarbon Stentless Pericardial Bioprosthesis |
| Continued | 89 | 89 | Homograft | 89 = CryoLife Aortic Homograft |
| Continued | 90 | 90 | Homograft | 90 = CryoLife Pulmonary Homograft |
| Continued | 91 | 91 | Homograft | 91 = CryoLife CryoValve SG(Decellularized)Aortic Homograft |
| Continued | 92 | 92 | Homograft | 92 = CryoLife CryoValve SG Pulmonary Homograft |
| Continued | 41 | 41 | Homograft | 41 = Homograft Aortic - Subcoronary |
| Continued | 42 | 42 | Homograft | 42 = Homograft Aortic - Root |
| Continued | 43 | 43 | Homograft | 43 = Homograft Mitral |
| Continued | 44 | 44 | Homograft | 44 = Homograft Pulmonic Root |
| Continued | 93 | 93 | Homograft | 93 = LifeNet CV Allografts |
| Continued | 45 | 45 | Autograft | 45 = Pulmonary Autograft to aortic root (Ross Procedure) |
| New | | 109 | Ring – Annuloplasty | 109 = ATS Simulus Flex-O Ring |
| New | | 110 | Ring – Annuloplasty | 110 = ATS Simulus Flex-C Band |
| Continued | 94 | 94 | Ring – Annuloplasty | 94 = CarboMedics AnnuloFlo Ring |
| Continued | 95 | 95 | Ring – Annuloplasty | 95 = CarboMedics AnnuloFlex Ring |
| Continued | 96 | 96 | Ring – Annuloplasty | 96 = CarboMedics CardioFix Bovine Pericardium with PhotoFix Technology |
| Continued | 46 | 46 | Ring – | 46 = Carpentier-Edwards Classic Annuloplasty Ring |

| | | | | |
|---|---|---|---|---|
| | | | Annuloplasty | |
| New | | 104 | Ring – Annuloplasty | 104 = Carpentier-Edwards Geoform Ring |
| New | | 105 | Ring – Annuloplasty | 105 = Carpentier-Edwards IMR Etlogix Ring |
| Continued | 47 | 47 | Ring – Annuloplasty | 47 = Carpentier-Edwards Physio Annuloplasty System Ring |
| Continued | 48 | 48 | Ring – Annuloplasty | 48 = Cosgrove-Edwards Annuloplasty System Ring |
| Continued | 97 | 97 | Ring – Annuloplasty | 97 = Edwards MC³ Tricuspid Annuloplasty System G Future Band |
| Continued | 98 | 98 | Ring – Annuloplasty | 98 = Genesee Sculptor Annuloplasty Ring |
| Continued | 49 | 49 | Ring – Annuloplasty | 49 = Medtronic Sculptor Ring |
| Continued | 50 | 50 | Ring – Annuloplasty | 50 = Medtronic-Duran AnCore Ring |
| Continued | 51 | 51 | Ring – Annuloplasty | 51 = Sorin-Puig-Messana Ring |
| Continued | 52 | 52 | Ring - Annuloplasty | 52 = St. Jude Medical Sequin Ring or SJM Séguin Annuloplasty Ring |
| New | | 106 | Ring – Annuloplasty | 106 = St. Jude RSR (Rigid Saddle Ring) |
| Continued | 99 | 99 | Ring - Annuloplasty | 99 = SJM Tailor Annuloplasty Ring |
| Continued | 100 | 100 | Band - Annuloplasty | 100 = Medtronic Colvin Galloway Future Band |
| Continued | 101 | 101 | Band - Annuloplasty | 101 = Medtronic Duran Band |
| Continued | 102 | 102 | Band - Annuloplasty | 102 = Medtronic Duran - Ancore Band |
| New | | 107 | Band - Annuloplasty | 107 = St. Jude Tailor Band |
| Continued | 777 | 777 | | 777 = Other |

## Appendix B: Procedure identification algorithm

Below is the algorithm that is used at the data warehouse to determine which procedure was performed. This is written in a computer program-like format specifically for the software developers.

```
If DataVrsn=2.35 or DataVrsn=2.41 then

    If (OpTricus > 1 Or OpPulm > 1 Or OpONCard = 1 Or ONCAoAn = 1 Or ONCCarEn = 1 Or
                ONCOVasc = 1 Or ONCOThor = 1 Or OCarLVA = 1 Or OCarVSD = 1 Or
                OCarASD = 1 or OCarBati = 1 Or OCarSVR = 1 Or OCarCong = 1 Or
                OCarLasr = 1 Or OCarTrma = 1 Or OCarCrTx = 1 Or OCarAICD = 1 Or
                OCarOthr = 1) then
        Procedure type is “Other”

    Else
        If OpCAB is “Yes” then
            If OpAortic is missing or “No” then
                If OpMitral is missing or “No” then
                    Procedure is “CAB Only”
                Else
                    If OpMitral is “Replacement” then
                        Procedure is “MV Replacement + CAB”
                    Else
                        If OpMitral is   “Annuloplasty only”, or
                                         “Reconstructions with annuloplasty”, or
                                         “Reconstruction without annuloplasty” then
                            Procedure is “MV Repair + CAB”

            Else
                If OpAortic is ”Replacement” then
                    If OpMitral is missing or “No” then
                        Procedure is “AV Replacement + CAB”

        Else
            If OpAortic is missing or “No” then
                If OpMitral is “Replacement” then
                    Procedure is “MV Replacement Only”
                Else
                    If OpMitral is   “Annuloplasty only”, or
                                     “Reconstruction with annuloplasty” or
                                     “Reconstruction without annuloplasty” then
                        Procedure is “MV Repair”

            Else
                If OpAortic is “Replacement” then
                    If OpMitral is missing or “No”  then
                        Procedure is “AV Replacement”
                    Else
                        If OpMitral = “Replacement” then
                            Procedure is “AV Replacement + MV Replacement”
```

```
If DataVrsn=2.52.1 OR 2.61 then

    If (OpTricus > 1 Or OpPulm > 1 Or OpONCard = 1 Or ONCAoAn = 1 Or
                OCarLVA = 1 Or OCarVSD = 1 Or  OCarASD = 1 Or OCarBati = 1 Or
                OCarSVR = 1 Or OCarCong = 1 Or OCarLasr = 1 Or OCarTrma = 1 Or
                OCarCrTx = 1 Or OCarOthr = 1 Or OCarAFib>1 or VAD=1) then
        Procedure type is “Other”

    Else
        If OpCAB is “Yes” then
            If OpAortic is missing or “No” then
                If OpMitral is missing or “No” then
                    Procedure is “CAB Only”
                Else
                    If OpMitral is “Replacement” then
                        Procedure is “MV Replacement + CAB”
                    Else
                        If OpMitral is   “Annuloplasty only”, or
                                         “Reconstructions with annuloplasty”, or
                                         “Reconstruction without annuloplasty” then
                            Procedure is “MV Repair + CAB”

            Else
                If OpAortic is ”Replacement” then
                    If OpMitral is missing or “No” then
                        Procedure is “AV Replacement + CAB”

        Else
            If OpAortic is missing or “No” then
                If OpMitral is “Replacement” then
                    Procedure is “MV Replacement Only”
                Else
                    If OpMitral is   “Annuloplasty only”, or
                                     “Reconstruction with annuloplasty” or
                                     “Reconstruction without annuloplasty” then
                        Procedure is “MV Repair”

            Else
                If OpAortic is “Replacement” then
                    If OpMitral is missing or “No”  then
                        Procedure is “AV Replacement”
                    Else
                        If OpMitral = “Replacement” then
                            Procedure is “AV Replacement + MV Replacement”
```

Appendix C: Field ShortName and SeqNo by DataVrsn.

The following table lists all fields that have been collected in the STS Adult CV Database since 1999. The sequence number (SeqNo) of each field for a given version of the specifications is specified under the version number. If no sequence number is specified, the field was not a Core field for that version of the specifications.

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| VendorID | 10 | 10 | 10 | 10 |
| SoftVrsn | 20 | 20 | 20 | 20 |
| DataVrsn | 30 | 30 | 30 | 30 |
| ParticID | 40 | 40 | 40 | 40 |
| RecordID | 50 | 50 | 50 | 50 |
| CostLink | | 52 | 60 | 60 |
| STSTLink | | 54 | 70 | 70 |
| PatID | 60 | 60 | 80 | 80 |
| PatLName | 80 | 80 | 100 | 100 |
| PatFName | 90 | 90 | 110 | 110 |
| PatMInit | 100 | 100 | 120 | 120 |
| DOB | 110 | 110 | 130 | 130 |
| Age | 120 | 120 | 140 | 140 |
| Gender | 130 | 130 | 150 | 150 |
| SSN | 140 | 140 | 160 | 160 |
| MedRecN | 150 | 150 | 170 | 170 |
| HICNumber | | | | 171 |
| PatZIP | 190 | 190 | 180 | 180 |
| RaceCaucasian | | | | 191 |
| RaceBlack | | | | 192 |
| RaceAsian | | | | 193 |
| RaceNativeAm | | | | 194 |
| RacNativePacific | | | | 195 |
| RaceOther | | | | 196 |
| Ethnicity | | | | 199 |
| RefCard | 220 | 220 | 200 | 200 |
| RefPhys | 250 | 250 | 210 | 210 |
| HospName | 280 | 280 | 220 | 220 |
| HospZIP | 282 | 282 | 230 | 230 |
| HospStat | 284 | 284 | 240 | 240 |
| HospNPI | | | | 241 |
| PayorGov | | | | 247 |
| PayorGovMcare | | | | 248 |
| PayorGovMcaid | | | | 249 |
| PayorGovMil | | | | 250 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| PayorGovState | | | | 251 |
| PayorGovIHS | | | | 252 |
| PayorCom | | | | 254 |
| PayorHMO | | | | 255 |
| PayorNonUS | | | | 256 |
| PayorNS | | | | 257 |
| AdmitDt | 320 | 320 | 260 | 260 |
| SurgDt | 330 | 330 | 270 | 270 |
| DischDt | 340 | 340 | 280 | 280 |
| ICUVisit | | | 300 | 300 |
| ICUInHrs | | 354 | 310 | 310 |
| ICUReadm | | 355 | 320 | 320 |
| ICUAdHrs | | 356 | 330 | 330 |
| TotHrICU | | 357 | 340 | 340 |
| WeightKg | 400 | 400 | 350 | 350 |
| HeightCm | 420 | 420 | 360 | 360 |
| CigSmoker | | | | 385 |
| FHCAD | 470 | 470 | 390 | 390 |
| Hct | | | | 391 |
| WBC | | | | 392 |
| Diabetes | 480 | 480 | 400 | 400 |
| DiabCtrl | 490 | 490 | 410 | 410 |
| A1cLvl | | | | 412 |
| Dyslip | | | | 421 |
| CreatLst | 550 | 525 | 430 | 430 |
| Dialysis | 560 | 560 | 450 | 450 |
| Hypertn | 570 | 570 | 460 | 460 |
| InfEndo | 610 | 610 | 490 | 490 |
| InfEndTy | 620 | 620 | 500 | 500 |
| ChrLungD | 660 | 660 | 510 | 510 |
| ImmSupp | 670 | 670 | 520 | 520 |
| PVD | 680 | 680 | 530 | 530 |
| CVD | 690 | 690 | 540 | 540 |
| CVDComa | | | | 551 |
| CVA | 590 | 590 | 470 | 552 |
| CVAWhen | 600 | 600 | 480 | 553 |
| CVDRIND | | | | 554 |
| CVDTIA | | | | 555 |
| CVDNInvas | | | | 556 |
| CVDPCarSurg | | | | 557 |
| PrCVInt | 710 | 710 | 570 | 570 |
| PrCAB | 760 | 760 | 600 | 600 |
| PrValve | 770 | 770 | 610 | 610 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| PrOthCar | 940 | 940 | 620 | 620 |
| PrOthCongen | | | | 621 |
| PrOCAICD | | | 630 | 630 |
| PrOCPace | | | 640 | 640 |
| POCPCI | | | 660 | 660 |
| POCPCISt | | | | 661 |
| POCPCIStTy | | | | 663 |
| POCPCIIn | | | 670 | 670 |
| POCO | | | | 671 |
| PrevMI | | | | 751 |
| MIWhen | 1360 | 1360 | 760 | 760 |
| CHF | 1370 | 1370 | 770 | 770 |
| ClassNYH | 1540 | 1540 | 870 | 775 |
| CardPres | | | | 791 |
| CarShock | 1420 | 1420 | 810 | 810 |
| Resusc | 1440 | 1440 | 830 | 830 |
| Arrhyth | 1450 | 1450 | 840 | 840 |
| ArrhyVtach | | | | 851 |
| ArrhyTHB | | | | 852 |
| ArrhyAfib | | | | 853 |
| MedBeta | 1650 | 1650 | 890 | 890 |
| MedACEI | | 1670 | 900 | 900 |
| MedNitIV | 1690 | 1690 | 910 | 910 |
| MedACoag | 1720 | 1720 | 930 | 930 |
| MedACMN | | | 940 | 940 |
| MedCoum | | | 950 | 950 |
| MedInotr | 1740 | 1740 | 970 | 970 |
| MedSter | 1750 | 1750 | 980 | 980 |
| MedASA | 1760 | 1760 | 990 | 990 |
| MedLipid | | | 1000 | 1000 |
| MedLipMN | | | 1010 | 1010 |
| MedADP5Days | | | | 1021 |
| MedADPIDis | | | | 1022 |
| MedAplt5Days | | | | 1023 |
| MedGP | | | 1030 | 1030 |
| MedGPMN | | | 1040 | 1040 |
| NumDisV | 1820 | 1820 | 1050 | 1050 |
| LMainDis | 1830 | 1830 | 1060 | 1060 |
| HDEFD | | 1858 | 1070 | 1070 |
| HDEF | 1860 | 1860 | 1080 | 1080 |
| HDEFMeth | 1870 | 1870 | 1090 | 1090 |
| HDPAD | | 1915 | 1100 | 1100 |
| HDPAMean | 1940 | 1940 | 1110 | 1110 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| VDStenA | 2010 | 2010 | 1120 | 1120 |
| VDGradA | | 2015 | 1130 | 1130 |
| VDStenM | 2020 | 2020 | 1140 | 1140 |
| VDStenT | 2030 | 2030 | 1150 | 1150 |
| VDStenP | 2040 | 2040 | 1160 | 1160 |
| VDInsufA | 2050 | 2050 | 1170 | 1170 |
| VDInsufM | 2060 | 2060 | 1180 | 1180 |
| VDInsufT | 2070 | 2070 | 1190 | 1190 |
| VDInsufP | 2080 | 2080 | 1200 | 1200 |
| Surgeon | 2230 | 2230 | 1210 | 1210 |
| SurgNPI | | | | 1221 |
| TIN | | | | 1222 |
| Incidence | | | | 1230 |
| Status | 2300 | 2300 | 1240 | 1240 |
| UrgntRsn | 2310 | 2310 | 1250 | 1250 |
| EmergRsn | 2320 | 2320 | 1260 | 1260 |
| Robotic | | | 1270 | 1270 |
| OpCAB | 2340 | 2340 | 1280 | 1280 |
| OpValve | | | 1290 | 1290 |
| VAD | 4550 | 4550 | 1300 | 1300 |
| OpOCard | 2510 | 2510 | 1310 | 1310 |
| OpONCard | 2520 | 2520 | 1320 | 1320 |
| CPT1Code1 | | | | 1321 |
| CPT1Code2 | | | | 1322 |
| CPT1Code3 | | | | 1323 |
| CPT1Code4 | | | | 1324 |
| CPT1Code5 | | | | 1325 |
| CPT1Code6 | | | | 1326 |
| CPT1Code7 | | | | 1327 |
| CPT1Code8 | | | | 1328 |
| CPT1Code9 | | | | 1329 |
| CPT1Code10 | | | | 1330 |
| OREntryDT | | | | 1335 |
| ORExitDT | | | | 1336 |
| IntubateDT | | | | 1337 |
| ExtubateDT | | | | 1338 |
| SIStartDT | | | | 1341 |
| SIStopDT | | | | 1342 |
| AbxSelect | | | | 1345 |
| AbxTiming | | | | 1346 |
| AbxDisc | | | | 1347 |
| CPBUtil | | | 1350 | 1350 |
| CPBCmb | | | 1360 | 1360 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| CPBCmbR | | | 1370 | 1370 |
| PerfusTm | 4360 | 4360 | 1380 | 1380 |
| CircArr | | | | 1381 |
| DHCATm | | | | 1382 |
| CanAortFem | | | | 1391 |
| CanFemFem | | | | 1392 |
| CanAortAtr | | | | 1393 |
| CanFemAtr | | | | 1394 |
| CanOther | | | | 1395 |
| AortOccl | 3880 | 3880 | 1400 | 1400 |
| XClampTm | 4350 | 4350 | 1410 | 1410 |
| Cplegia | 4380 | 4380 | 1420 | 1420 |
| PreRSO2Lft | | | | 1422 |
| PreRSO2Rt | | | | 1423 |
| CumulSatLft | | | | 1424 |
| CumulSatRt | | | | 1425 |
| COFirstInd | | | | 1426 |
| SCRSO2Lft | | | | 1427 |
| SCRSO2Rt | | | | 1428 |
| IABP | 4480 | 4480 | 1430 | 1430 |
| IABPWhen | 4490 | 4490 | 1440 | 1440 |
| IABPInd | 4500 | 4500 | 1450 | 1450 |
| IBldProd | | | 1460 | 1460 |
| IBldProdRef | | | | 1461 |
| IBdRBCU | | | 1470 | 1470 |
| IBdFFPU | | | 1480 | 1480 |
| IBdCryoU | | | 1490 | 1490 |
| IBdPlatU | | | 1500 | 1500 |
| IMedAprot | | | | 1509 |
| IMedAprotD | | | | 1510 |
| IMedEACA | | | | 1511 |
| IMedDesmo | | | | 1512 |
| IMedTran | | | | 1513 |
| DistArt | 2570 | 2570 | 1520 | 1520 |
| DistVein | 2580 | 2580 | 1530 | 1530 |
| DistVeinHTech | | | | 1531 |
| SaphHrvstT | | | | 1532 |
| AnasDevU | | | 1540 | 1540 |
| AnasDev | | | 1550 | 1550 |
| IMAArtUs | 2590 | 2590 | 1560 | 1560 |
| IMATechn | 4070 | 4070 | 1570 | 1570 |
| NumIMADA | 2660 | 2660 | 1580 | 1580 |
| RadArtUs | 2670 | 2670 | 1590 | 1590 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| NumRadDA | 2680 | 2680 | 1600 | 1600 |
| RadHTech | | | | 1601 |
| RadHrvstT | | | | 1602 |
| NumGEPDA | 2700 | 2700 | 1610 | 1610 |
| NumOArtD | | | 1620 | 1620 |
| OpAortic | 2350 | 2350 | 1630 | 1630 |
| OpMitral | 2360 | 2360 | 1640 | 1640 |
| MitralIntent | | | | 1641 |
| OpTricus | 2370 | 2370 | 1650 | 1650 |
| OpPulm | 2380 | 2380 | 1660 | 1660 |
| AnlrEnl | | | 1670 | 1670 |
| VSAoImTy | 3240 | 3240 | 1680 | 1680 |
| VSAoIm | 3250 | 3250 | 1690 | 1690 |
| VSAoImSz | 3260 | 3260 | 1700 | 1700 |
| VSMiImTy | 3300 | 3300 | 1740 | 1740 |
| VSMiIm | 3310 | 3310 | 1750 | 1750 |
| VSMiImSz | 3320 | 3320 | 1760 | 1760 |
| VSTrImTy | 3360 | 3360 | 1800 | 1800 |
| VSTrIm | 3370 | 3370 | 1810 | 1810 |
| VSTrImSz | 3380 | 3380 | 1820 | 1820 |
| VSPuImTy | 3420 | 3420 | 1860 | 1860 |
| VSPuIm | 3430 | 3430 | 1870 | 1870 |
| VSPuImSz | 3440 | 3440 | 1880 | 1880 |
| ValveVrsn | | | | 1881 |
| PrevVAD | | | 1920 | 1920 |
| PrevVADF | | | | 1921 |
| VADListVrsn | | | | 1922 |
| VADInd | | | 1930 | 1930 |
| IntPVAD | | | 1940 | 1940 |
| HPVPCWP | | | 1950 | 1950 |
| HPVCVP | | | 1960 | 1960 |
| HPVCI | | | 1980 | 1980 |
| HPVRVEF | | | 1990 | 1990 |
| VImpTy | | | 2030 | 2030 |
| LVADInf | | | 2110 | 2032 |
| RVADInf | | | 2120 | 2033 |
| VProdTy | | | 2040 | 2040 |
| VImpDt | | | 2050 | 2050 |
| VExp | | | 2060 | 2060 |
| VExpDt | | | 2070 | 2070 |
| VExpRsn | | | 2080 | 2080 |
| VTxDt | | | 2100 | 2100 |
| VImp2 | | | | 2129 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| VImpTy2 | | | 2130 | 2130 |
| LVADinf2 | | | | 2131 |
| RVADinf2 | | | | 2132 |
| VProdTy2 | | | 2140 | 2140 |
| VImpDt2 | | | 2150 | 2150 |
| VExp2 | | | 2160 | 2160 |
| VExpDt2 | | | 2170 | 2170 |
| VExpRsn2 | | | 2180 | 2180 |
| VTxDt2 | | | 2200 | 2200 |
| VImp3 | | | | 2209 |
| VImpTy3 | | | 2210 | 2210 |
| LVADInf3 | | | | 2211 |
| RVADInf3 | | | | 2212 |
| VProdTy3 | | | 2220 | 2220 |
| VImpDt3 | | | 2230 | 2230 |
| VExp3 | | | 2240 | 2240 |
| VExpDt3 | | | 2250 | 2250 |
| VExpRsn3 | | | 2260 | 2260 |
| VTxDt3 | | | 2280 | 2280 |
| PVCmpBld | | | 2290 | 2290 |
| PVCmpESt | | | 2300 | 2300 |
| PVCmpDCI | | | 2310 | 2310 |
| PVCmpPPI | | | 2320 | 2320 |
| PVCmpEnd | | | 2330 | 2330 |
| PVCmpMal | | | 2340 | 2340 |
| PVCmpBO | | | | 2341 |
| VADDiscS | | | 2350 | 2350 |
| OCarLVA | 4150 | 4150 | 2360 | 2360 |
| OCarVSD | 4160 | 4160 | 2370 | 2370 |
| OCarASD | 4170 | 4170 | 2380 | 2380 |
| OCarBati | 4180 | 4180 | 2390 | 2390 |
| OCarSVR | | 4185 | 2400 | 2400 |
| OCarCong | 4190 | 4190 | 2410 | 2410 |
| OCarLasr | 4200 | 4200 | 2420 | 2420 |
| OCarTrma | 4210 | 4210 | 2430 | 2430 |
| OCarCrTx | 4220 | 4220 | 2440 | 2440 |
| OCarACD | | | 2450 | 2450 |
| OCarACDL | | | 2460 | 2460 |
| OCarAFib | | | 2470 | 2470 |
| ONCAoAn | 4260 | 4260 | 2510 | 2510 |
| ONCAsc | | | 2520 | 2520 |
| ONCArch | | | 2530 | 2530 |
| ONCDesc | | | 2540 | 2540 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| ONCThAbd | | | 2550 | 2550 |
| OCarOthr | 4250 | 4250 | 2560 | 2560 |
| ONCCarEn | 4320 | 4320 | 2570 | 2570 |
| ONCOVasc | 4330 | 4330 | 2580 | 2580 |
| ONCOThor | 4340 | 4340 | 2590 | 2590 |
| ONCOther | | | 2600 | 2600 |
| PostCreat | | | | 2605 |
| BldProd | 4630 | 4630 | 2610 | 2610 |
| BdRBCU | | | 2620 | 2620 |
| BdFFPU | | | 2630 | 2630 |
| BdCryoU | | | 2640 | 2640 |
| BdPlatU | | | 2650 | 2650 |
| ExtubOR | | | 2660 | 2660 |
| ReIntub | | 4678 | 2680 | 2680 |
| VentHrsA | | 4679 | 2690 | 2690 |
| Complics | 4760 | 4760 | 2710 | 2710 |
| COpReBld | 4840 | 4840 | 2720 | 2720 |
| COpReVlv | 4850 | 4850 | 2730 | 2730 |
| COpReGft | 4860 | 4860 | 2740 | 2740 |
| COpReOth | 4870 | 4870 | 2750 | 2750 |
| COpReNon | 4880 | 4880 | 2760 | 2760 |
| COpPerMI | 4890 | 4890 | 2770 | 2770 |
| CIStDeep | 4920 | 4920 | 2780 | 2780 |
| CIThor | 4930 | 4930 | 2790 | 2790 |
| CILeg | 4940 | 4940 | 2800 | 2800 |
| CIArm | | | | 2801 |
| CISeptic | 4960 | 4960 | 2810 | 2810 |
| CNStrokP | 5000 | 5000 | 2830 | 2830 |
| CNStrokTTIA | | | | 2841 |
| CNStrokTRIND | | | | 2842 |
| CNComa | 5030 | 5030 | 2850 | 2850 |
| CNParal | | | | 2851 |
| CNParalTy | | | | 2852 |
| CPVntLng | 5050 | 5050 | 2860 | 2860 |
| CPPulEmb | 5070 | 5070 | 2870 | 2870 |
| CPPneum | 5100 | 5100 | 2880 | 2880 |
| CRenFail | 5120 | 5120 | 2890 | 2890 |
| CRenDial | | 5130 | 2900 | 2900 |
| CVaIlFem | 5230 | 5230 | 2910 | 2910 |
| CVaLbIsc | 5240 | 5240 | 2920 | 2920 |
| COtHtBlk | 5260 | 5260 | 2930 | 2930 |
| COtArrst | 5270 | 5270 | 2940 | 2940 |
| COtCoag | 5280 | 5280 | 2950 | 2950 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| COtTamp | 5290 | 5290 | 2960 | 2960 |
| COtGI | 5300 | 5300 | 2970 | 2970 |
| COtMSF | 5310 | 5310 | 2980 | 2980 |
| COtAFib | 5320 | 5320 | 2990 | 2990 |
| CVaAoDis | 5220 | 5220 | 3000 | 3000 |
| COtOther | | | 3010 | 3010 |
| Mortalty | | 5337 | 3020 | 3020 |
| MtDCStat | 5340 | 5340 | 3030 | 3030 |
| Mt30Stat | 5350 | 5350 | 3040 | 3040 |
| MtOpD | 5400 | 5355 | 3050 | 3050 |
| MtDate | 5360 | 5360 | 3060 | 3060 |
| MtLocatn | 5370 | 5370 | 3070 | 3070 |
| MtCause | 5380 | 5380 | 3080 | 3080 |
| DCADP | | | 3090 | 3090 |
| DCAArhy | | | 3100 | 3100 |
| DCAArMN | | | 3110 | 3110 |
| DCASA | | 5331 | 3120 | 3120 |
| DCACE | | 5332 | 3130 | 3130 |
| DCBeta | | 5333 | 3140 | 3140 |
| DCLipid | | 5334 | 3150 | 3150 |
| DCLipMT | | | 3160 | 3160 |
| DCCoum | | | 3180 | 3180 |
| DisLoctn | | 5336 | 3190 | 3190 |
| CardRef | | | 3200 | 3200 |
| SmokCoun | | | 3210 | 3210 |
| Readm30 | 5500 | 5500 | 3220 | 3220 |
| ReadmRsn | 5510 | 5510 | 3230 | 3230 |
| ReadmPro | | | 3240 | 3240 |
| PredCoefVrsn | | | | 3249 |
| PredMort | 2530 | 5610 | 3250 | 3250 |
| PredDeep | | 5620 | 3260 | 3260 |
| PredReop | | 5630 | 3270 | 3270 |
| PredStro | | 5640 | 3280 | 3280 |
| PredVent | | 5650 | 3290 | 3290 |
| PredRenF | | 5660 | 3300 | 3300 |
| PredMM | | 5670 | 3310 | 3310 |
| Pred6D | | 5680 | 3320 | 3320 |
| Pred14D | | 5690 | 3330 | 3330 |
| STSCustNum1 | | | | 3400 |
| STSCustNum2 | | | | 3410 |
| STSCustNum3 | | | | 3420 |
| STSCustNum4 | | | | 3430 |
| STSCustNum5 | | | | 3440 |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| STSCustTxt1 | | | | 3450 |
| STSCustTxt2 | | | | 3460 |
| STSCustTxt3 | | | | 3470 |
| STSCustTxt4 | | | | 3480 |
| STSCustTxt5 | | | | 3490 |
| IschTRCA | 3960 | | | |
| IschTLAD | 3950 | | | |
| OpMinInv | 2500 | | | |
| IschTCFX | 3970 | | | |
| PrPTCA | 1160 | 1160 | | |
| PrPTIntv | 1190 | 1190 | | |
| PrNSStnt | 1230 | 1230 | | |
| StntIntv | | 1235 | | |
| Thrmblys | 1240 | 1240 | | |
| ThrIntvl | 1260 | 1260 | | |
| PrNSBall | 1280 | 1280 | | |
| AngUnstT | 1400 | 1400 | | |
| ClassCCS | 1530 | 1530 | | |
| MedDig | 1640 | 1640 | | |
| MedAPlt | | 1710 | | |
| MedDiur | 1730 | 1730 | | |
| SurgGrp | 2235 | 2235 | | |
| CABUnpln | 2550 | 2550 | | |
| VSAoExTy | 3270 | 3270 | | |
| VSAoEx | 3280 | 3280 | | |
| VSAoExSz | 3290 | 3290 | | |
| VSMiExTy | 3330 | 3330 | | |
| VSMiEx | 3340 | 3340 | | |
| VSMiExSz | 3350 | 3350 | | |
| VSTrExTy | 3390 | 3390 | | |
| VSTrEx | 3400 | 3400 | | |
| VSTrExSz | 3410 | 3410 | | |
| VSPuExTy | 3450 | 3450 | | |
| VSPuEx | 3460 | 3460 | | |
| VSPuExSz | 3470 | 3470 | | |
| CPBUsed | 3750 | 3478 | | |
| ConvCPB | | 3479 | | |
| IndMnInv | 3480 | 3480 | | |
| PrimInc | 3490 | 3490 | | |
| SameDay | 350 | 350 | | |
| NumIncis | 3500 | 3500 | | |
| CnvStdIn | 3510 | 3510 | | |
| CnvIndic | 3520 | 3520 | | |

| ShortName | v2.35 | v2.41 | v2.52.1 | V2.61 |
|---|---|---|---|---|
| CorShunt | 3930 | 3930 | | |
| SutrTech | 4040 | 4040 | | |
| VslStblz | 4050 | 4050 | | |
| FlowPtcy | 4080 | 4080 | | |
| OCarPace | 4230 | 4230 | | |
| OCarAICD | 4240 | 4240 | | |
| CIUTI | 4970 | 4970 | | |
| DCAntPlt | | 5335 | | |
| PrCBNum | 740 | 740 | | |
| PrCNNum | 750 | 750 | | |
| MedADPI | | | 1020 | |
| SurgID | | | 1220 | |
| SIStartT | | 4347 | 1330 | |
| SIStopT | | 4348 | 1340 | |
| Cannulat | 3760 | 3760 | 1390 | |
| Race | 210 | 210 | 190 | |
| HPVPVR | | | 1970 | |
| HPVRVMth | | | 2000 | |
| HPVPVO2M | | | 2010 | |
| HPVPVO2 | | | 2020 | |
| VCardTx | | | 2090 | |
| VCardTx2 | | | 2190 | |
| VCardTx3 | | | 2270 | |
| OCarAFES | | | 2480 | |
| Payor | 290 | 290 | 250 | |
| VentHrsI | | 4676 | 2670 | |
| VentHrs | 4680 | 4680 | 2700 | |
| CNStrokT | 5010 | 5010 | 2840 | |
| Smoker | 440 | 440 | 370 | |
| SmokCurr | 450 | 450 | 380 | |
| Hyprchol | 510 | 510 | 420 | |
| RenFail | 530 | 530 | 440 | |
| CVDType | 700 | 700 | 550 | |
| Incidenc | | | 560 | |
| POCPaceT | | | 650 | |
| MI | 1340 | 1340 | 750 | |
| Angina | 1380 | 1380 | 780 | |
| AngType | 1390 | 1390 | 790 | |
| CarShTyp | 1430 | 1430 | 820 | |
| ArrhyTyp | 1460 | 1460 | 850 | |
| RecComp | 70 | 70 | 90 | |