Data Managers Training Session 2

- **Software and Data Specifications**
- **Risk Model Variable Chart**

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Objectives:

Upon completion of this session, participant will be able to:

- **Identify how to read the Software and Data Specifications**
- **Understand the Risk Model Variables**

Navigating the STS Website

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Software Specifications

- 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 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.

- Important resource to be familiar with as it contains much information.

Dates of the Versions

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Surgery date	Data Specifications
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 December 31, 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 June 30, 2011	2.61
July 1, 2011 through June 30, 2014	2.73
July 1, 2014 through June 30, 2017	2.81
July 1, 2017 through June 30, 2020	2.9
July 1, 2020 through current date	4.20.2

V 2.35 was the first official version for the ACSD and includes procedures up to 6/30/2002. Any data that existed before that version was defined was converted to that version.

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Sequence Number (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.

The SeqNo value for one field can change from one version of the specifications to the next. The seq number is 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.

Example of different Seq No

V 2.9 - Reason for no IMA: NoIMARsn (2627)

V 4.2 - Reason for no IMA: NoIMARsn (2629)

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LongName – **The longer and more descriptive name of the field. In most cases, the LongName does not change from one version of the specifications to the next but can change in some instances. Because of this, the LongName value should never be used to refer to a field in reports, queries or programs.**

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.**

Example of different Long Name and same Short Name

V 2.9 - Reintervention for Myocardial Ischemia: CReintMI (6771)

V 4.2 - Unplanned Coronary Artery Intervention: CReintMI (6771)

H. Format – The format in which the values for the field should be collected. The options for this field are:

- Date - mm/dd/yyyy: Date values only with the month specified as a 2-digit numeric value, day specified as a 2-digit numeric value, and year specified as a 4-digit numeric value.
- Time - hh:mm (24-hour clock): Time values only with the hours specified as a 2-digit numeric value (in 24-hour format), and the minutes specified as a 2-digit numeric value.
- Date/Time - mm/dd/yyyy hh:mm : Date and time values in one field with the month specified as a 2-digit numeric value, day specified as a 2-digit numeric value, and year specified as a 4-digit numeric value, followed by a single space and then the hours specified as a 2-digit numeric value (in 24-hour format), and the minutes specified as a 2-digit numeric value.
- Integer: Numeric values with no decimal points.
- Real: Numeric values with at least one decimal point.
- Text: Value can contain any alphanumeric characters.
- Text (categorical values specified by STS): Values displayed to the user are the text descriptions defined in the data specifications table. The values submitted to the Data Warehouse are the Harvest Codes defined in the data specifications.
- Text (categorical values specified by user): Values displayed to the user and submitted to the Data Warehouse come from a list maintained by the user (see item "e" under the "3. Data Entry" section of the "Software Specification" below).

I. DataSource – This field defines how the data is entered into the field. The options for this field are as follows (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.

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Describes how to read Data Specs

Software Specs – page 11 Record Management - Each record in the database describes one surgical case (i.e., one admission to the hospital).

On each record, there are four situations, used for record management:

#1 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.

A value for ParticID is required and the software should ensure one exists on every record.

Software Specs – page 11 Record Management - Each record in the database describes one surgical case (i.e., one admission to the hospital).

On each record, there are four situations, used for record management:

#2 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.

Data Source – Automatic generated by the software

Software Specs – page 11 Record ID

Beginning with version 2.73 of the data specifications, the values generated by the software for the RecordID field must be a combination of three parts:

- **The letter "V" to indicate vendor software**
- **A two-digit code assigned by the STS to uniquely identify the vendor**
- **An alphanumeric value that makes the identifier unique (such as a record counter).**

For example, the software will generate a RecordID value of V01000001 for the first record and V01000002 for the second record.

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

Software Specs – page 11 Record Management - Each record in the database describes one surgical case (i.e., one admission to the hospital).

On each record, there are four situations, used for record management:

#3 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.

Data source – Automatic generated by software

Software Specs – page 11 Record Management - Each record in the database describes one surgical case (i.e., one admission to the hospital).

On each record, there are four situations, used for record management:

#4. 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, cannot be edited or reused if the patient records are ever deleted. 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.

Data Source – Automatic generated by the software

Software Specs – page 11 Patient ID

Beginning with version 2.73 of the data specifications, the values generated by the software for the RecordID field must be a combination of three parts:

- **The letter “V” to indicate vendor software**
- **A two-digit code assigned by the STS to uniquely identify the vendor**
- **An alphanumeric value that makes the identifier unique (such as a record counter).**

For example, the software will generate a PatID value of V01000001 for the first record and V01000002 for the second record. ‘V’ indicating vendor software, ‘01’ indicating a specific vendor, and the ‘000001’ or ‘000002’ to indicate the specific record within that specific site’s software.

The purpose of this feature is to allow sites to move their data from one version of a software package to another, or from one vendor package to another, and maintain the referential integrity of their data records.

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STS data specifications do not define standard codes for "Missing" values during data entry –meaning there are no thresholds for entry for most of the fields.

Patient Population for Analysis

Records are included in analyses if they meet the following criteria:

- A valid patient age and the patient age is 18 or older
- Valid procedure classification
- Valid date of surgery
- Is not still in the acute care setting, or a transcatheter valve replacement

Software Specs – page 14

- **Points out what data can be imported into Vendor Data Form**
- **ADT Tool**
- **Reason we can't import more data is because of the importance of the data managers eyes on the data, the limitations of informatics on writing the correct code, especially when there are changes in definitions and between EMR versions and vendors**

Although the data many participants are entering into their STS certified software may be gathered from another electronic data system at their site (such as an EMR), it is strictly against STS policy for vendors to provide the users with the means to import this data automatically.

There are only two exceptions to this policy:

- Unique Device Identification (UDI) numbers can be imported from devices such as barcode readers.
- The following data fields can be imported from an Admission/Discharge/Transfer (ADT) system

The following data fields can be imported from an Admission/Discharge/Transfer (ADT) system

LongName	ShortName
Patient Last Name	PatLName
Patient First Name	PatFName
Patient Middle Name	PatMName
Date of Birth	DOB
Patient Age	Age
Sex	Gender
National Identification (Social Security Number) Known	SSNKnown
National ID Number	SSN
Medical Record Number	MedRecN
Patient's Permanent Street Address	PatAddr
Patient's Permanent City	PatCity
Patient's Permanent Region	PatRegion
ZIP Code	PatZIP
Country	PatientCountry
Race Documented (Note, race can only be imported if the original data allows for selecting more than one race)	RaceDocumented
Race – Multi-Select	RaceMulti
Hispanic or Latino or Spanish Ethnicity	Ethnicity
Date of admission	AdmitDt
OR Entry Date and Time	OREntryDT
OR Exit Date and Time	ORExitDT
Date of Discharge	DischDt
Mort-Date	MtDate

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5. 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, "Cerebrovascular Disease" is a parent field to its child "Prior 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 unavailable on the data entry screen. In the example above, only if "Cerebrovascular Disease"= "Yes" should "Prior CVA" be available for data entry.

b. If a parent field indicates that no data should be in its dependent field, vendors must set all child fields to Null. **Note that in prior versions of the Software Specifications, vendors had the option of setting child field values to "No" provided those fields were set to Null during data extract. This has caused parent/child issues to appear in site data, so this practice is no longer acceptable.**

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**.

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.

- **Parent Child Relationships**

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Data export for harvest to the data warehouse

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

Note that users must not be able to select individual records for exporting (for example, by RecordID value). **It is acceptable for users to extract data for one specific day by specifying the same date value for the beginning and ending dates of the requested export time period. If there is only one record with that surgery date, then it is acceptable that the export file would contain only that one record. However, users must not be able to pick only one record for export as this would cause other records at the Data Warehouse for that date to be deleted from the database.**

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- Meld Score Calculation – system calculation must have INR, Total Bili, and Creatinine to calculate

Appendix A: Calculation of MELD scores:

Starting with version 2.73, software must be able to calculate the MELD score for each patient. The results from this calculation are entered by the software into the field RF-MELD Score (MELDScr). The value of this score is calculated using the values entered by the user into the three fields "RF-Total Bilirubin" (TotBlrbn), "RF-INR" (INR), and "RF-Last Creat Level" (CreatLst). The patient's dialysis status (RF-Renal Fail-Dialysis) is also considered in the calculation.

The calculation can be made by creating a "factor" for each of the three variables involved in the score. The value of the variable is used to determine the value of the factor. The factors are then used in a formula to determine the MELD score. The algorithm for determining the value of each factor is as follows:

If RF-Total Bilirubin is >0 and <=1 then bilirubin_factor = 1
otherwise, if RF-Total Bilirubin is >1, then bilirubin_factor = the specified RF-Total Bilirubin value.

If RF-INR is >0 and <=1 then inr_factor = 1
otherwise, if RF-INR is > 1, then inr_factor = the specified RF-INR value.

if RF-Renal Fail-Dialysis=Yes, then creatinine_factor = 4
otherwise, if RF-Last Creat Level is >0 and <=1 then creatinine_factor = 1
otherwise, if RF-Last Creat Level is >1 and <=4, then creatinine_factor = the RF-Last Creat Level value
otherwise, if RF-Last Creat Level is >4, then creatinine_factor = 4

After determining the three factors, the calculation is done using the formula:

MELDScr = (3.8 x Ln([bilirubin_factor])) + (11.2 x Ln([inr_factor])) + (9.6 x Ln([creatinine_factor])) + 6.4

Note that "Ln" refers to the mathematical "natural log" function.

No score should be calculated if any of the following conditions are true:
- RF-Total Bilirubin is missing

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Appendix C: Calculation of Total Postoperative Initial Ventilation Hours

Starting with v4.20.2, software must be able to calculate the Total Postoperative Initial Ventilation Hours. The results of this calculation are entered by the software into the field "Total Postoperative Initial Ventilation Hour" (TotalPOInitVentHr). The value of this field is calculated by finding the number of **hours between "OR Exit Date and Time" (ORExitDT) and "Initial Extubation Date And Time" (ExtubateDT).** ~~Value should be stored in decimal format with at least two decimal places. This value is zero for patients extubated in OR or not intubated for procedure (ExtubOR = Yes or N/A (not intubated)).~~

- If either ORExitDT or ExtubateDT are missing, TotalPOInitVentHr is left missing.
- The difference between ORExitDT and ExtubateDT must not be rounded.
- If ExtubOR="Yes" or "N/A", TotalPOInitVentHr must be set to zero.
- Final calculation should include at least two decimal places.

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Appendix F: 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	2.35	2.41	2.52.1	2.61	2.73	2.81	2.9	4.20.2
AbxDisc				1347	2730	2290	2290	2290
AbxSelect				1345	2710	2280	2280	2280
AbxTiming				1346	2720	2285	2285	2285
AddIntraopPAnti						2295	2295	
ADevDelMeth01							5455	5455
ADevDelMeth02							5480	5480
ADevDelMeth03							5505	5505
ADevDelMeth04							5530	5530
ADevDelMeth05							5555	5555
ADevDelMeth06							5580	5580
ADevDelMeth07							5605	5605
ADevDelMeth08							5630	5630
ADevDelMeth09							5655	5655
ADevDelMeth10							5680	5680
ADevDelMeth11							5705	5705
ADevDelMeth12							5730	5730
ADevDelMeth13							5755	5755

Appendix F: Field Short Name and Seq Number by Data Version

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:

- includes all core fields in the application
- uses the correct programmatic name (Short Name) for each field
- follows the defined field dependency rules (Parent / Child relationships)
- accepts only the defined valid values appropriate to each field and ensures that the values are in the correct format
- provides the user with appropriate field definitions
- includes only the appropriate fields in the extracted data files the site will submit to the Data Warehouse.

Data Specifications

Long Name: RF-Renal Fail-Dialysis

SeqNo: 375

Short Name: Dialysis

Core: Yes

Section Name: Risk Factors

Harvest: Yes

DBTableName Adultdata2

Definition: Indicate whether the patient is currently (prior to surgery) undergoing dialysis.

Data Source: User

Format: Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

LongName – The longer and more descriptive name of the field.

ShortName – The short programmatic name assigned to the field.

Section Name – The name of the section of the DCF where the field is located.

DBTableName – The name of the table in the export file in which the field should reside.

SeqNo - The order number of the section of the DCF where the field is located.

Definition – The official definition of the specified choice for this field. Note that not all choices will have a definition.

Data Specifications

Long Name: RF-Renal Fail-Dialysis *SeqNo:* 375

Short Name: Dialysis *Core:* Yes

Section Name: Risk Factors *Harvest:* Yes

DBTableName Adultdata2

Definition: Indicate whether the patient is currently (prior to surgery) undergoing dialysis.

Data Source: User *Format:* Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

DataSource – This field defines how the data is entered into the field. The options for this field are:

- **User**
- **Automatic**
- **Calculated**

User – The user enters the value, otherwise it is left missing (null).

Data Specifications

Long Name:	STS Data Version	*SeqNo:*	15
Short Name:	DataVrsn	*Core:*	Yes
Section Name:	Administrative	*Harvest:*	Yes
DBTableName	Adultdata1		

Definition: Version number of the STS Data Specifications/Dictionary, to which each record conforms. It will identify which fields should have data, and what are the valid data for each field. This must be entered into the record automatically by the software.

Data Source: Automatic *Format:* Text

DataSource – This field defines how the data is entered into the field. The options for this field are:

- **User**
- **Automatic**
- **Calculated**

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.

Data Specifications

Long Name:	MELD Score	*SeqNo:*	625
Short Name:	MELDScr	*Core:*	Yes
Section Name:	Risk Factors	*Harvest:*	Yes
DBTableName	Adultdata2		

Definition: MELD score value calculated by software to indicate severity of liver disease.

Data Source: Calculated *Format:* Real

Low Value: 0.00 High Value: 150.00

DataSource – This field defines how the data is entered into the field. The options for this field are:

- **User**
- **Automatic**
- **Calculated**

Calculated – The value is calculated by the software based on values in other fields (for example, the risk model fields). In v4.20.2 of the data specifications there are a total of 15 fields to be calculated – see list in Software Specs page 7

Data Specifications

Long Name: RF-Renal Fail-Dialysis

SeqNo: 375

Short Name: Dialysis

Core: Yes

Section Name: Risk Factors

Harvest: Yes

DBTableName Adultdata2

Definition: Indicate whether the patient is currently (prior to surgery) undergoing dialysis.

Data Source: User

Format: Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

Core – This field contains a value of Yes or No to define if the field should be available to the users for data entry.

Fields defined as Core=No are no longer collected in the current version and will not appear in subsequent versions.

Data Specifications

Long Name:	RF-Renal Fail-Dialysis	*SeqNo:*	375
Short Name:	Dialysis	*Core:*	Yes
Section Name:	Risk Factors	*Harvest:*	Yes
DBTableName	Adultdata2		
Definition:	Indicate whether the patient is currently (prior to surgery) undergoing dialysis.		
Data Source:	User	*Format:*	Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

Harvest – This field contains a value of Yes, No or Optional to define if the data for this field is included in the export file to be submitted to the data warehouse.

Yes – Data from this field must be included in the data file for all records following this version of the data specifications.

Data Specifications

Long Name: Patient Last Name *SeqNo:* 50

Short Name: PatLName *Core:* Yes

Section Name: Demographics *Harvest:* Optional

DBTableName Adultdata1

Definition: Indicate the patient's last name documented in the medical record. This field should be collected in compliance with state/local privacy laws.

Data Source: User *Format:* Text

Harvest – This field contains a value of Yes, No or Optional to define if the data for this field is included in the export file to be submitted to the data warehouse.

Optional – The individual users determine if 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.**

Data Specifications

Long Name:	Permanent Address	*SeqNo:*	120
Short Name:	PermAddr	*Core:*	No
Section Name:	Demographics	*Harvest:*	No
DBTableName	Adultdata1		

Definition: Indicate whether the patient considers the given address to be their permanent address.

Data Source: User *Format:* Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

Fields defined as Core=No are no longer collected in the current version and will not appear in subsequent versions.

Fields defined as Harvest=No: Data from this field must not be included in the data file for all records following this version of the data specifications.

Data Specifications - Format

The format in which the values for the field should be collected. The options for this field are:

- **Date - mm/dd/yyyy**
- **Time - hh:mm (24-hour clock)**
- **Date/Time - mm/dd/yyyy hh:mm**
- **Integer: Numeric values with no decimal points.**
- **Real: Numeric values with at least one decimal point.**
- **Text: Value can contain any alphanumeric characters.**
- **Text (categorical values specified by STS)**
- **Multi-Select**

Data Specifications

Long Name:	Hospital CMS Certification Number	*SeqNo:*	221
Short Name:	HospCMSCert	*Core:*	Yes
Section Name:	Hospitalization	*Harvest:*	Yes
DBTableName	Adultdata1		
Definition:	Indicate the hospital's CMS certification number		
Data Source:	User	*Format:*	Text

Text: Value can contain any alphanumeric characters.

Data Specifications

Long Name:	RF-Renal Fail-Dialysis	*SeqNo:*	375
Short Name:	Dialysis	*Core:*	Yes
Section Name:	Risk Factors	*Harvest:*	Yes
DBTableName	Adultdata2		

Definition: Indicate whether the patient is currently (prior to surgery) undergoing dialysis.

Data Source: User *Format:* Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

What Are Harvest Codes:

- **The numbers that represent the choices for various fields**
- **Harvest codes and the associated text description are defined in the Data Specifications**
  - For example: Admit Source
    - *1 = Elective Admission*
    - *2 = Emergency Department*
    - *3 = Transfer in from another acute care facility*
    - *4 = Other*
- **Changes can be made between data versions**

How Are Harvest Codes Used:

- **The data files you submit to the Data Warehouse contain harvest codes, not the text descriptions**
- **Working with data is much easier with harvest codes**
  - Much easier to count the number of records where:

AdmitSrc = 3

instead of:

AdmitSrc= "Transfer in from another acute care facility"

Data Specifications

Long Name: RF-Renal Fail-Dialysis *SeqNo:* 375

Short Name: Dialysis *Core:* Yes

Section Name: Risk Factors *Harvest:* Yes

DBTableName Adultdata2

Definition: Indicate whether the patient is currently (prior to surgery) undergoing dialysis.

Data Source: User *Format:* Text (categorical values specified by STS)

Harvest Codes:

Code:	Value:
1	Yes
2	No
3	Unknown

Text (categorical values specified by STS): Values displayed to the user are the text descriptions defined in the data specifications harvest codes table.

The values submitted to the Data Warehouse are the Harvest Codes defined in the data specifications.

Data Specifications

Long Name:	Race - Multi-Select	*SeqNo:*	151
Short Name:	RaceMulti	*Core:*	Yes
Section Name:	Demographics	*Harvest:*	Yes
DBTableName	Adultdata1		
Definition:	Indicate the patient's race(s) selecting all that apply.		
Data Source:	User	*Format:*	Multi-Select

ParentShortName: RaceDocumented

ParentLongName: Race Documented

ParentHarvestCodes: 1

ParentValues: = "Yes"

Harvest Codes:

Code:	Value:
1	White
2	Black/African American
3	Asian
4	Am Indian/Alaskan
5	Hawaiian/Pacific Islander
6	Other

Multi-Select: This format is like “Text (categorical values specified by STS)” format in that values displayed to the user are the text descriptions defined in the data specifications harvest codes table. However, for fields with a multi-select format, users can select more than one choice.

The values submitted to the Data Warehouse are a comma-delimited list of the harvest codes associated with each choice indicated by the user.

Data Specifications

Long Name:	Admit Date	*SeqNo:*	305
Short Name:	AdmitDt	*Core:*	Yes
Section Name:	Hospitalization	*Harvest:*	Yes
DBTableName	Adultdata1		

Definition: Indicate the Date of Admission. For those patients who originally enter the hospital in an out-patient capacity (i.e., catheterization), the admit date is the date the patient's status changes to in-patient. In the event admission date comes after date of surgery, use date of surgery.

Data Source: User *Format:* Date mm/dd/yyyy

Date - mm/dd/yyyy: Date values only with the month specified as a 2- digit numeric value, day specified as a 2-digit numeric value, and year specified as a 4-digit numeric value.

Data Specifications

Long Name: OR Entry Date And Time *SeqNo:* 2245

Short Name: OREntryDT *Core:* Yes

Section Name: Operative *Harvest:* Yes

DBTableName Adultdata1

Definition: Indicate the date and time, to the nearest minute (using 24-hour clock), that the patient entered the operating room. If the procedure was performed in a location other than the OR, record the time when the sterile field, or its equivalent, was set up.

Data Source: User

Format: Date and time in the format mm/dd/yyyy hh:mm with the time in 24-hour clock

Date - mm/dd/yyyy

Time - hh:mm (24-hour clock)

Date/Time - mm/dd/yyyy hh:mm : Date and time values in one field with the month specified as a 2-digit numeric value, day specified as a 2-digit numeric value, and year specified as a 4-digit numeric value, followed by a single space and then the hours specified as a 2-digit numeric value (in 24-hour format), and the minutes specified as a 2- digit numeric value.

Data Specifications

Long Name:	INR	*SeqNo:*	615
Short Name:	INR	*Core:*	Yes
Section Name:	Risk Factors	*Harvest:*	Yes
DBTableName	Adultdata2		

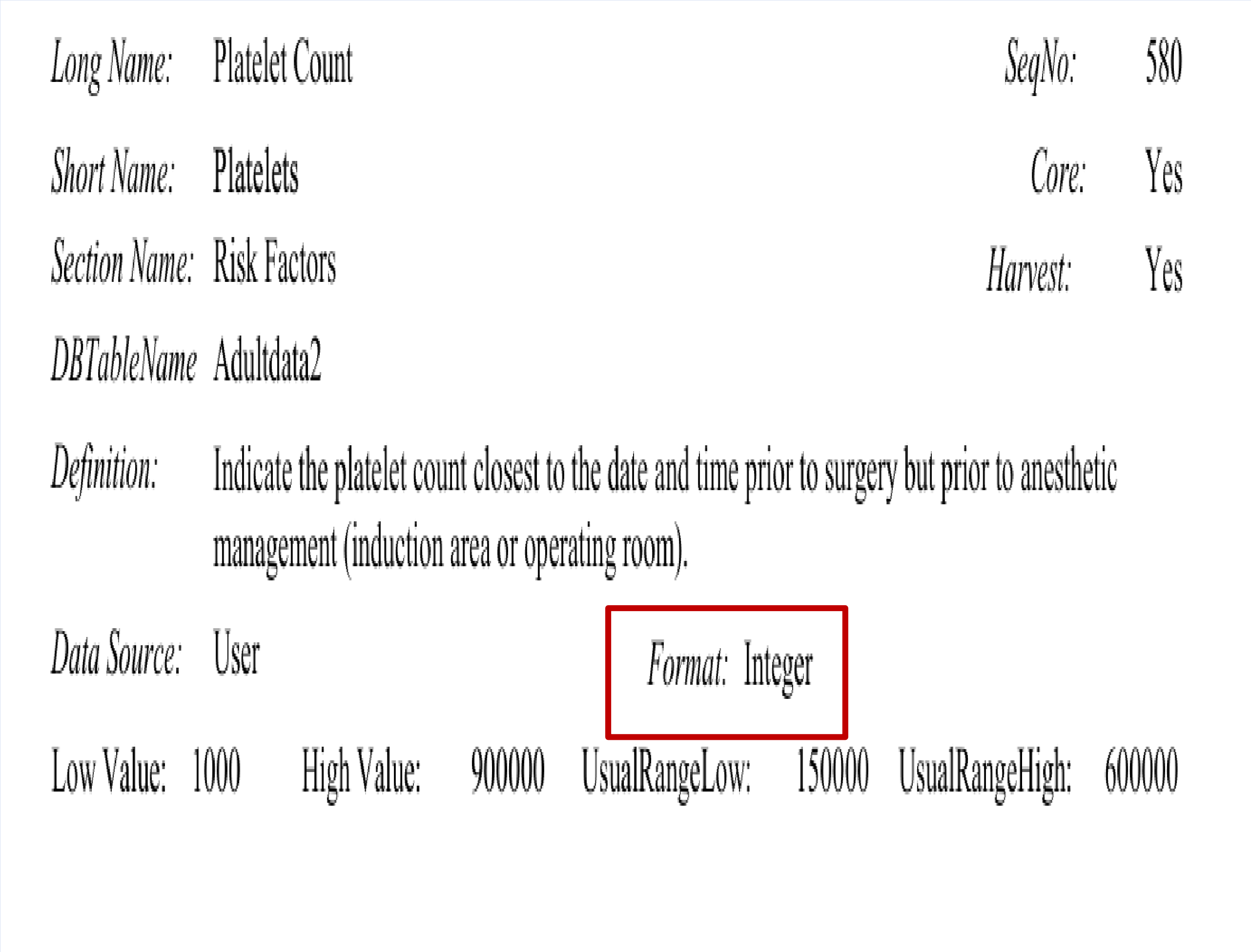
Definition: Indicate the International Normalized Ratio (INR) closest to the date and time prior to surgery but prior to anesthetic management (induction area or operating room).

Data Source: User *Format:* Real

Low Value: 0.50 High Value: 30.00 UsualRangeLow: 0.90 UsualRangeHigh: 1.30

Real: Numeric values with at least one decimal point.

Data Specifications



Long Name:	Platelet Count	*SeqNo:*	580
Short Name:	Platelets	*Core:*	Yes
Section Name:	Risk Factors	*Harvest:*	Yes
DBTableName	Adultdata2		

Definition: Indicate the platelet count closest to the date and time prior to surgery but prior to anesthetic management (induction area or operating room).

Data Source: User *Format:* Integer

Low Value: 1000 High Value: 900000 UsualRangeLow: 150000 UsualRangeHigh: 600000

Integer: Numeric values with no decimal points.

Data Specifications

Long Name: INR *SeqNo:* 615

Short Name: INR *Core:* Yes

Section Name: Risk Factors *Harvest:* Yes

DBTableName Adultdata2

Definition: Indicate the International Normalized Ratio (INR) closest to the date and time prior to surgery but prior to anesthetic management (induction area or operating room).

Data Source: User *Format:* Real

Low Value:	0.50	High Value:	30.00	UsualRangeLow:	0.90	UsualRangeHigh:	1.30

LowValue – The lowest valid value that will be accepted for the specified field. This is used only in fields that accept numeric values. If field values are submitted to the Data Warehouse that are less than LowValue, the entire data record will be rejected.

HighValue – The highest valid value that will be accepted for the specified field. This is used only in fields that accept numeric values. If field values are submitted to the Data Warehouse that are greater than HighValue, the entire data record will be rejected.

UsualRangeLow - The lowest value that is likely to be entered by the user. If the user enters a value that is below this number, but still greater than or equal to the value defined in LowValue, the value should be accepted, but the user should be given a message that the value they entered is unusually low and that they should verify the value.

UsualRangeHigh - The highest value that is likely to be entered by the user. If the user enters a value that is above this number, but still less than or equal to the value defined in HighValue, the value should be accepted, but the user should be given a message that the value they entered is unusually high and that they should verify the value.

Data Specifications

Long Name: INR *SeqNo:* 615

Short Name: INR *Core:* Yes

Section Name: Risk Factors *Harvest:* Yes

DBTableName Adultdata2

Definition: Indicate the International Normalized Ratio (INR) closest to the date and time prior to surgery but prior to anesthetic management (induction area or operating room).

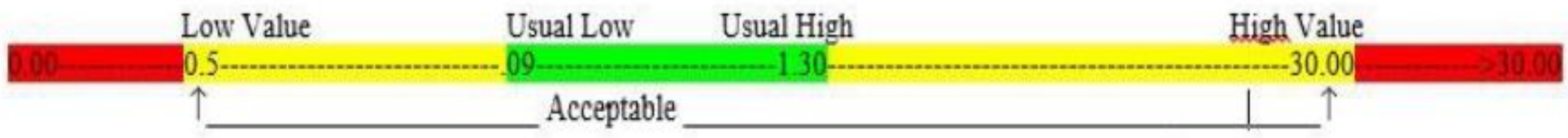
Data Source: User *Format:* Real

Low Value: 0.50 High Value: 30.00 UsualRangeLow: 0.90 UsualRangeHigh: 1.30

Values in the GREEN - no warning

Values in YELLOW – Usual High or Usual Low warning – just check data and enter the value

Values in RED – Max Allowable Value or Illegal Warning – enter the max allowable high or low value that you can in the Database



Data Specifications - Parent Child Relationship

Long Name: RF-Forced Expiratory Volume Predicted *SeqNo:* 420

Short Name: FEV1 *Core:* Yes

Section Name: Risk Factors *Harvest:* Yes

DBTableName Adultdata2

Definition: Indicate the FEV1 % predicted from the most recent pulmonary function test prior to procedure. Choose the highest value reported for % predicted, with or without a bronchodilator.

Data Source: User *Format:* Integer

Low Value: 1 High Value: 200

ParentShortName: PFT

ParentLongName: RF-Pulmonary Function Test

ParentHarvestCodes: 1

ParentValues: = "Yes"

ParentLongName – The "parent" field on which this field (the "child" field) is dependent. 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.

ParentShortName – The programmatic "ShortName" of the parent field.

ParentValue – The list of values the parent field can have before this field can be available for data entry.

ParentHarvestCodes – A bar-delimited list of the harvest codes associated with the values identified in the ParentValue field.

Risk models are a core element of the STS quality program


REPORT OF STS QUALITY MEASUREMENT TASK FORCE

The Society of Thoracic Surgeons 2008 Cardiac Surgery Risk Models: Part 1—Coronary Artery Bypass Grafting Surgery

REPORT OF STS QUALITY MEASUREMENT TASK FORCE

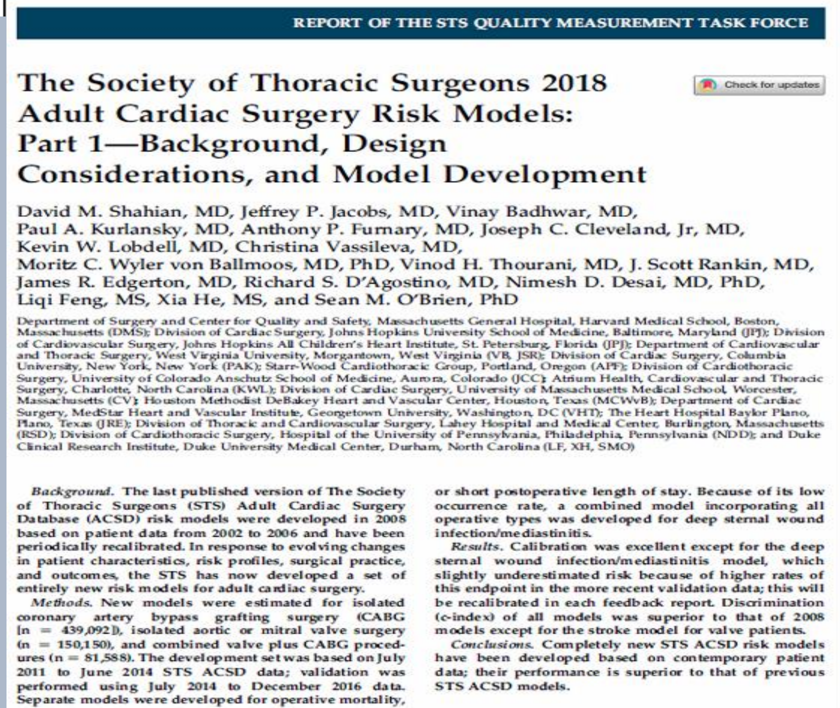
The Society of Thoracic Surgeons 2008 Cardiac Surgery Risk Models: Part 2—Isolated Valve Surgery

Sean M. O'Brien, PhD,[a] David M. Shahian, MD,[b] Giovanni Filardo, PhD, MPH,[c] Victor A. Ferraris, MD,[d] Constance K. Haan, MD,[e] Jeffrey B. Rich, MD,[f]

REPORT OF STS QUALITY MEASUREMENT TASK FORCE

The Society of Thoracic Surgeons 2008 Cardiac Surgery Risk Models: Part 3—Valve Plus Coronary Artery Bypass Grafting Surgery

David M. Shahian, MD,[a] Sean M. O'Brien, PhD,[b] Giovanni Filardo, PhD, MPH,[c] Victor A. Ferraris, MD,[d] Constance K. Haan, MD,[e] Jeffrey B. Rich, MD,[f] Sharon-Lise T. Normand, PhD,[g] Elizabeth R. DeLong, PhD,[b] Cynthia M. Shewan, PhD,[h] Rachel S. Dokholyan, MPH,[b] Eric D. Peterson, MD, MPH,[b] Fred H. Edwards, MD,[e] and Richard P. Anderson, MD[i†]


REPORT OF THE STS QUALITY MEASUREMENT TASK FORCE

Check for updates

The Society of Thoracic Surgeons 2018 Adult Cardiac Surgery Risk Models: Part 1—Background, Design Considerations, and Model Development

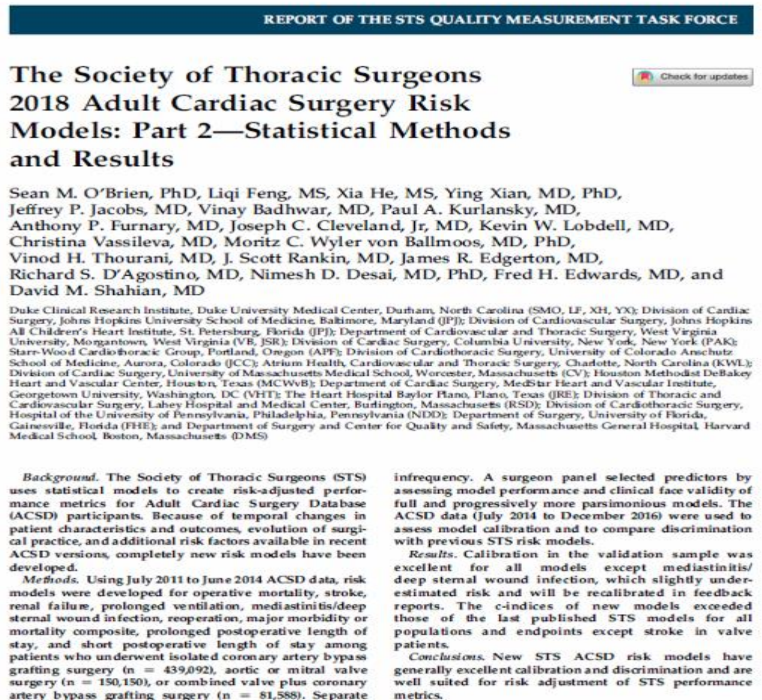
David M. Shahian, MD, Jeffrey P. Jacobs, MD, Vinay Badhwar, MD, Paul A. Kurlansky, MD, Anthony P. Furnary, MD, Joseph C. Cleveland, Jr, MD, Kevin W. Lobdell, MD, Christina Vassileva, MD, Moritz C. Wyler von Ballmoos, MD, PhD, Vinod H. Thourani, MD, J. Scott Rankin, MD, James R. Edgerton, MD, Richard S. D'Agostino, MD, Nimesh D. Desai, MD, PhD, Liqi Feng, MS, Xia He, MS, and Sean M. O'Brien, PhD

Background. The last published version of The Society of Thoracic Surgeons (STS) Adult Cardiac Surgery Database (ACSD) risk models were developed in 2008 based on patient data from 2002 to 2006 and have been periodically recalibrated. In response to evolving changes in patient characteristics, risk profiles, surgical practice, and outcomes, the STS has now developed a set of entirely new risk models for adult cardiac surgery.

Methods. New models were estimated for isolated coronary artery bypass grafting surgery (CABG [n = 439,092]), isolated aortic or mitral valve surgery (n = 150,150), and combined valve plus CABG procedures (n = 81,588). The development set was based on July 2011 to June 2014 STS ACSD data; validation was performed using July 2014 to December 2016 data. Separate models were developed for operative mortality, or short postoperative length of stay. Because of its low occurrence rate, a combined model incorporating all operative types was developed for deep sternal wound infection/mediastinitis.

Results. Calibration was excellent except for the deep sternal wound infection/mediastinitis model, which slightly underestimated risk because of higher rates of this endpoint in the more recent validation data; this will be recalibrated in each feedback report. Discrimination (c-index) of all models was superior to that of 2008 models except for the stroke model for valve patients.

Conclusions. Completely new STS ACSD risk models have been developed based on contemporary patient data; their performance is superior to that of previous STS ACSD models.


REPORT OF THE STS QUALITY MEASUREMENT TASK FORCE

Check for updates

The Society of Thoracic Surgeons 2018 Adult Cardiac Surgery Risk Models: Part 2—Statistical Methods and Results

Sean M. O'Brien, PhD, Liqi Feng, MS, Xia He, MS, Ying Xian, MD, PhD, Jeffrey P. Jacobs, MD, Vinay Badhwar, MD, Paul A. Kurlansky, MD, Anthony P. Furnary, MD, Joseph C. Cleveland, Jr, MD, Kevin W. Lobdell, MD, Christina Vassileva, MD, Moritz C. Wyler von Ballmoos, MD, PhD, Vinod H. Thourani, MD, J. Scott Rankin, MD, James R. Edgerton, MD, Richard S. D'Agostino, MD, Nimesh D. Desai, MD, PhD, Fred H. Edwards, MD, and David M. Shahian, MD

Background. The Society of Thoracic Surgeons (STS) uses statistical models to create risk-adjusted performance metrics for Adult Cardiac Surgery Database (ACSD) participants. Because of temporal changes in patient characteristics and outcomes, evolution of surgical practice, and additional risk factors available in recent ACSD versions, completely new risk models have been developed.

Methods. Using July 2011 to June 2014 ACSD data, risk models were developed for operative mortality, stroke, renal failure, prolonged ventilation, mediastinitis/deep sternal wound infection, reoperation, major morbidity or mortality composite, prolonged postoperative length of stay, and short postoperative length of stay among patients who underwent isolated coronary artery bypass grafting surgery (n = 439,092), aortic or mitral valve surgery (n = 150,150), or combined valve plus coronary artery bypass grafting surgery (n = 81,588). Separate infrequency. A surgeon panel selected predictors by assessing model performance and clinical face validity of full and progressively more parsimonious models. The ACSD data (July 2014 to December 2016) were used to assess model calibration and to compare discrimination with previous STS risk models.

Results. Calibration in the validation sample was excellent for all models except mediastinitis/deep sternal wound infection, which slightly underestimated risk and will be recalibrated in feedback reports. The c-indices of new models exceeded those of the last published STS models for all populations and endpoints except stroke in valve patients.

Conclusions. New STS ACSD risk models have generally excellent calibration and discrimination and are well suited for risk adjustment of STS performance metrics.

Risk Model Variable Chart

- **Shows you the variables that are in each Risk Model**

- **The purpose of risk adjustment is to allow STS database participants to compare their performance with other participants (e.g., overall STS, like participants, region or state). By accounting for and controlling patient risk factors that are present prior to surgery, risk adjustment “levels the playing field” as best as possible.**

CABG	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X	X	X	X	X	X

Valve (AVR, MVR, MVr)	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X	X	X	X	X	X

Valve + CABG (AVR + CABG, MVR + CABG, MVr + CABG)	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X	X	X	X	X	X

Multi-Valve +/- CABG	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Mortality	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X		X	X	X	X

There are 4 Risk Model Variable Charts

[Link to Risk Model Variable Chart: https://www.sts.org/sites/default/files/2025-02/ACSD%20Risk%20Model%20Variable%20Chart%204.20%20Updated%2002142025.pdf](https://www.sts.org/sites/default/files/2025-02/ACSD%20Risk%20Model%20Variable%20Chart%204.20%20Updated%2002142025.pdf)

[Link to Risk Model Endpoint Chart: https://www.sts.org/sites/default/files/ACSD%20endpoint-definitions-Feb2021.pdf](https://www.sts.org/sites/default/files/ACSD%20endpoint-definitions-Feb2021.pdf)

There are 4 Risk Model Variable Charts:

- CABG
- Valve (AVR, MVR, MVr)
- Valve + CABG (AVR + CABG, MVR + CABG, MVr + CABG)
- Multi-Valve +/- CABG

Each Risk Model Variable Chart has 9 Risk Model components:

- Operative Mortality
- Stroke
- Renal Failure
- Prolonged Ventilation
- Deep Sternal Infection
- Reop
- Mortality / Morbidity
- Length of Stay > 14 days
- Length of Stay < 6 days

Risk Variables that are in all 4 Models and all 9 Risk Model components for these 4 Models

1. CABG
2. Valve (AVR, MVR, MVr)
3. Valve + CABG (AVR + CABG, MVR + CABG, MVr + CABG)
4. Multi-Valve +/- CABG

Zero – there are no variables that are in all 4 Models and in all 9 components for these 4 Models

This is because the Deep Sternal Infection component in the Multi-Valve +/- CABG has very few variables

- For ProcIDs 1-8, STS grouped valve procedures together to ensure enough DSWI events for risk modeling.
- ProcIDs 9/10 there are too few DSWI events to model in this cohort.

Risk Variables that are in all 3 Models and all 9 Risk Model components for these 3 Models

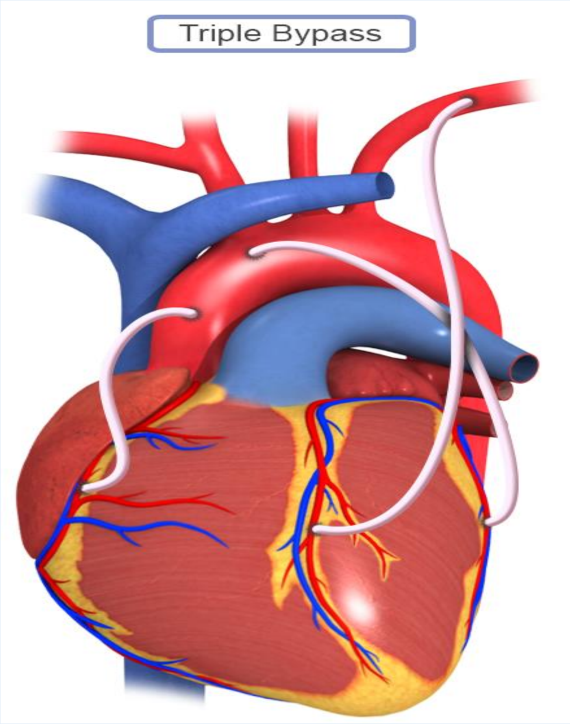
1. CABG
2. Valve (AVR, MVR, MVr)
3. Valve + CABG (AVR + CABG, MVR + CABG, MVr + CABG)

- Age
- Gender
- Height
- Weight
- HCT
- PLT
- CrtLst
- Dialysis
- HF Timing
- Arrythmia – Afib
- Arrythmia – Afib Type
- Resuscitation
- Status

Note – these same variables are in Multi-Valve +/- CABG except for the Deep Sternal Infection component

CABG Risk Model Variable Chart

CABG	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X	X	X	X	X	X
Gender (75)	X	X	X	X	X	X	X	X	X
RaceBlack (160)	X	X	X	X	X	X	X	X	X

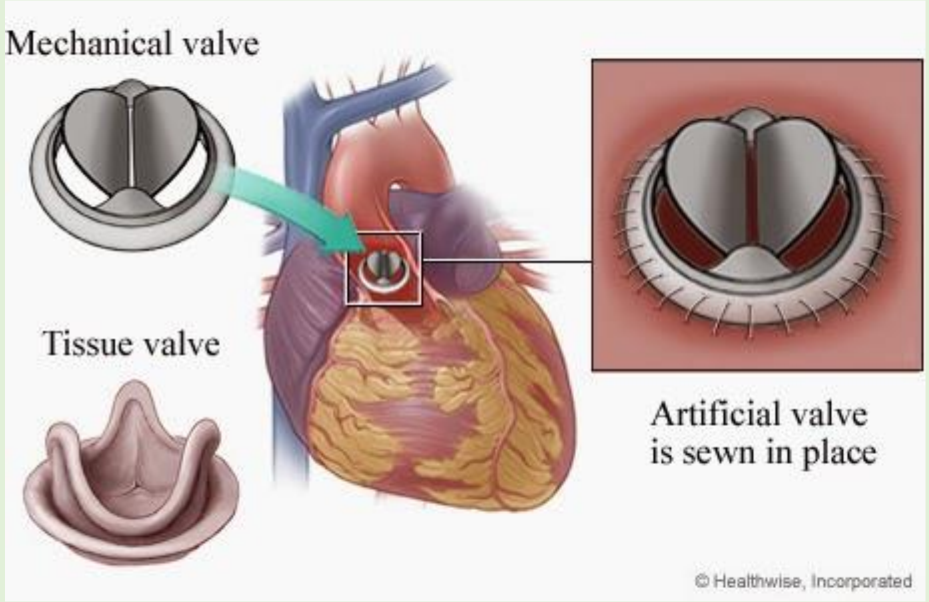


Risk Variables that are in all 9 Risk Model components

- Age
- Gender
- Race Black
- Payor Primary
- Payor Secondary
- Height
- Weight
- Diabetes
- Diabetes Control
- HCT
- WBC
- PLT
- CrtLst
- Dialysis
- PVD
- Alcohol
- HF Timing
- NYHA Class
- Arrythmia – Afib
- Arrythmia – Afib Type
- Arrythmia – Aflutter
- Arrythmia – Third Degree Heart Block
- Resuscitation
- Number of Diseased Vessels
- Status

AVR / MVR/ MV Repair Risk Model Variable Chart

Valve (AVRepl, MVRepl, MVRepr)	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Infx	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X	X	X	X	X	X
Gender (75)	X	X	X	X	X	X	X	X	X
RaceBlack (160)		X	X	X	X	X	X	X	X

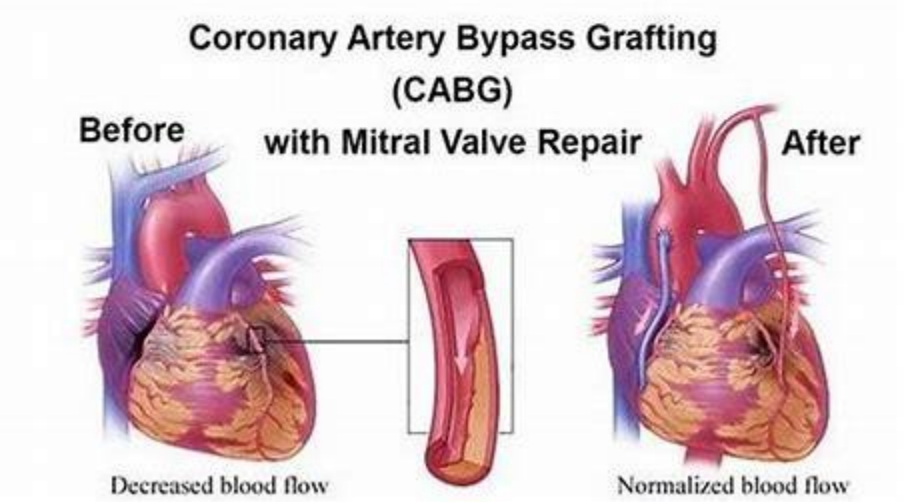


Risk Variables that are in all 9 Risk Model components

- Age
- Gender
- Payor Primary
- Payor Secondary
- Height
- Weight
- HCT
- WBC
- PLT
- CrtLst
- Dialysis
- Endocarditis Type
- Previous CAB
- Previous Valve
- HF Timing
- NYHA Class
- Arrythmia – Afib
- Arrythmia – Afib Type
- Arrythmia – Aflutter
- Arrythmia – Third Degree Heart Block
- Arrythmia – Second Degree Heart Block
- Arrythmia - SSS
- Resuscitation
- Incidence
- Status

Valve + CABG (AVR + CABG, MVR + CABG, MV Repair + CABG) Risk Model Variable Chart

Valve + CABG (AVR + CABG, MVR + CABG, MVr + CABG)	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Morbidity	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X	X	X	X	X	X

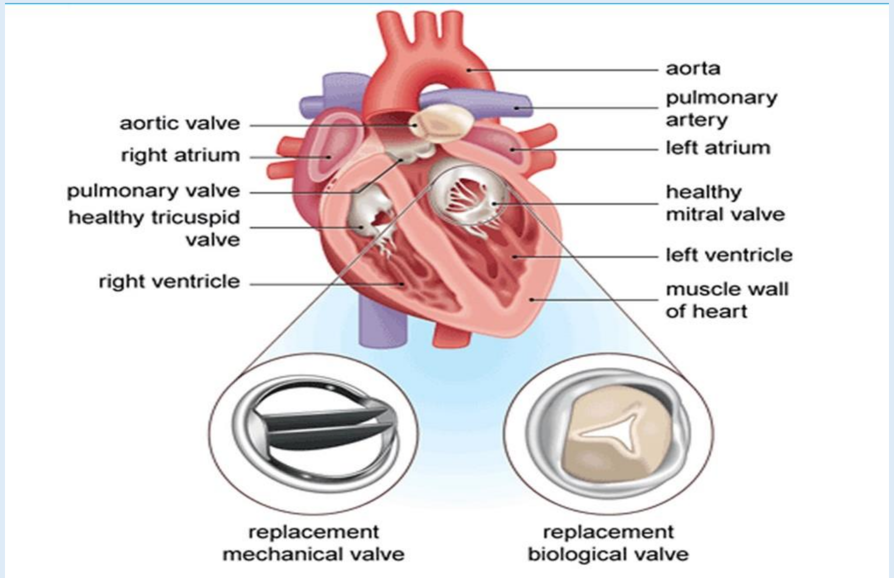


Risk Variables that are in all 9 Risk Model components

- Age
- Gender
- Height
- Weight
- Diabetes
- Diabetes Control
- HCT
- PLT
- CrtLst
- Dialysis
- Chronic Lung Disease
- HF Timing
- Arrythmia – Afib
- Arrythmia – Afib Type
- Resuscitation
- Number of Diseased Vessels
- Status

Multi- Valve +/- CABG Risk Model Variable Chart

Multi-Valve +/- CABG	Operative Mortality	Stroke	Renal Failure	Prolonged Ventilation	Deep Stern Inf	Reop	Mortality/ Mortality	Length of Stay>14	Length of Stay<6
B. Demographics									
Age (70)	X	X	X	X		X	X	X	X



The types of heart valve replacement

Risk Variables that are in all 9 Risk Model components

- **Other Previous Cardiac Interventions**

Risk Model Variable Chart – Operative Mortality

Risk Variables that are in all 4 Risk Model Variable Charts for Operative Mortality

- Age
- Gender
- Payor Primary
- Payor Secondary
- Weight
- Height
- Diabetes
- Diabetes Control
- HCT
- WBC
- PLT
- CreatLst
- Dialysis

- Chronic Lung Disease
- IMM
- PVD
- CVD
- CVA
- CVA When
- CVD TIA
- Alcohol
- Liver Disease
- Previous CAB*(Multi-Valve + CABG only)
- Heart Failure Timing
- NYHA
- Cardiogenic Shock

- Arrythmia – Afib
- Arrythmia – Afib Type
- Arrythmia – Aflutter
- Arrythmia – Third Degree Heart Block
- Arrythmia – Second Degree Heart Block
- Arrythmia - SSS
- Resuscitation
- Percent Stenosis Left main
- EF
- MV insufficiency
- Tricuspid Valve Insufficiency
- Status
- Temporary Assist Device When
- ECMO When

Risk Model Variable Chart – Stroke

Risk Variables that are in all 4 Risk Model Variable Charts for Stroke

- Age
- Gender
- Payor Primary
- Payor Secondary
- Weight
- Height
- Diabetes
- Diabetes Control
- HCT

- PLT
- CreatLst
- Dialysis
- Chronic Lung Disease
- CVD
- CVA
- CVA When
- CVD TIA
- Carotid Stenosis right
- Carotid Stenosis left

- Previous CAB
- Heart Failure Timing
- NYHA
- Arrythmia – Afib
- Arrythmia – Afib Type
- Resuscitation
- AV insufficiency
- Status

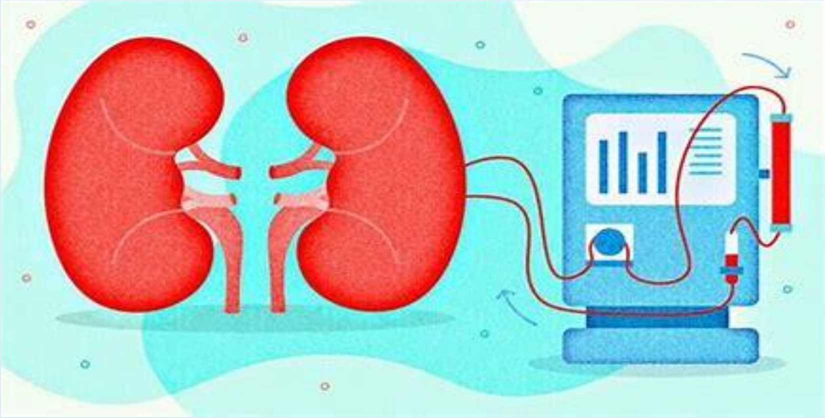
Risk Model Variable Chart – Renal Failure

Risk Variables that are in all 4 Risk Model Variable Charts for Renal Failure

- Age
- Gender
- Race Black
- Ethnicity
- Weight
- Height
- Diabetes
- Diabetes Control
- HCT
- WBC

- PLT
- CreatLst
- Dialysis
- HTN
- Chronic Lung Disease
- Liver Disease
- Heart Failure Timing
- NYHA
- CAD presentation
- Cardiogenic shock

- Arrythmia – Afib
- Arrythmia – Afib Type
- Arrythmia – Third degree heart block
- Resuscitation
- TV insufficiency
- Status
- IABP When
- Temporary Assist Device When
- ECMO When



Risk Model Variable Chart – Prolonged Ventilation

Risk Variables that are in all 4 Risk Model Variable Charts for Prolonged Ventilation

- Age
- Gender
- Race Black
- Ethnicity
- Surgery Date
- Payor Primary
- Payor Secondary
- Weight
- Height
- Diabetes
- Diabetes Control

- HCT
- WBC
- PLT
- CreatLst Dialysis
- Chronic Lung Disease
- PVD
- CVD
- CVA
- CVA When
- CVD TIA
- Carotid Stenosis right
- Carotid Stenosis left
- Alcohol
- Pneumonia

- Mediastinal Radiation
- Tobacco Use
- Home O2
- Liver Disease
- Unresponsive State
- Heart Failure Timing
- NYHA
- Cardiogenic shock
- Arrythmia – Afib
- Arrythmia – Afib Type
- Arrythmia – Aflutter
- Arrythmia – Third Degree Heart Block
- Arrythmia – Second Degree Heart Block
- Arrythmia – SSS

- Arrythmia – VT / VF
- Med Inotrope
- Med ADP
- Med ADP Discontinuation
- Resuscitation
- Number of Diseased Vessels
- EF
- MV insufficiency
- TV insufficiency
- Status
- IABP When
- Temporary Assist Device When
- ECMO When

Risk Model Variable Chart – Re-op

Risk Variables that are in all 4 Risk Model Variable Charts for Re-op

- Age
- Gender
- Race Black
- Ethnicity
- Surgery Date
- Payor Primary
- Payor Secondary
- Weight
- Height
- HCT
- PLT
- CreatLst
- Dialysis
- Liver Disease
- Heart Failure Timing
- Cardiogenic shock
- Arrythmia – Afib
- Arrythmia – Afib Type
- Med ADP
- Med ADP Discontinuation
- Resuscitation
- EF
- AV insufficiency
- Status
- Temporary Assist Device When
- ECMO When

Risk Model Variable Chart - Missing Data

**It is important to understand how missing data values are by assigning a likely substitute value. The algorithm used for missing data imputation is described below:

Required variable: Age is the only required variable for all models. If it is missing, no value for predicted risk will be calculated.

Categorical variables: Missing data are generally assumed to have the lowest risk category.

Continuous variables: Tables 6-8 below show the values assigned to missing data for continuous model variables.

Categorical Variables

Missing data are generally assumed to have the lowest risk category

For example:

- If diabetes was not coded, it would be assumed to be "No"
- If procedure priority were not coded, the procedure would be assumed to be "Elective."

In most cases, the lowest risk category is also the most frequent.

It is important to answer all Risk Model Variable Fields if possible.

Continuous Variables

Imputation of Missing Continuous Variables shows the values assigned to missing data for continuous model variables

For Example:

Ejection Fraction (EF)	If EF is missing or <10%: <u>CABG Model</u> If HeartFailTmg is Chronic or missing and gender is Male, set EF = 55% If HeartFailTmg is Chronic or missing and gender is Female, set EF = 58% If HeartFailTmg is Acute or Both and gender is Male, set EF = 40% If HeartFailTmg is Acute or Both and gender is Female, set EF = 45%

Update June 2021 – In the Risk Model, EF values that are less than 10% get imputed to 40%. If your patient has an EF value < 10% enter the EF as 10% in the Database

Complete Table found in Analysis Overview – page 18-22

Table 7: Imputation of Missing Continuous Variables for 2017 Models

Model Variable	Model Imputation Information
Body Surface Area (BSA)	If gender is Male set BSA = 2.00m2 If gender is Female set BSA = 1.75m2
Ejection Fraction (EF)	If EF is missing or <10% **<u>CABG Model</u>** If HeartFailTmg is Chronic or missing and gender is Male, set EF = 55% If HeartFailTmg is Chronic or missing and gender is Female, set EF = 58% If HeartFailTmg is Acute or Both and gender is Male, set EF = 40% If HeartFailTmg is Acute or Both and gender is Female, set EF = 45% **<u>Valve Model</u>** <u>AV Replace</u> If HeartFailTmg is Chronic or missing and gender is Male, set EF = 60% If HeartFailTmg is Acute or Both and gender is Male, set EF = 55% If gender is Female, set EF = 60% <u>MV Replace</u> If HeartFailTmg is Chronic or missing and gender is Male, set EF = 58%

Table 7: Imputation of Missing Continuous Variables for 2017 Models

If HeartFailTmg is Chronic or missing and gender is Female, set EF = 60%
If HeartFailTmg is Acute or Both and gender is Male, set EF = 55%
If HeartFailTmg is Acute or Both and gender is Female, set EF = 58%

MV Repair

If HeartFailTmg is Chronic or missing and gender is Male, set EF = 60%
If HeartFailTmg is Chronic or missing and gender is Female, set EF = 60%
If HeartFailTmg is Acute or Both and gender is Male, set EF = 56%
If HeartFailTmg is Acute or Both and gender is Female, set EF = 57%

Valve +CABG Model

AV Replace + CABG

If HeartFailTmg is Chronic or missing and gender is Male, set EF = 60%
If HeartFailTmg is Chronic or missing and gender is Female, set EF = 60%
If HeartFailTmg is Acute or Both and gender is Male, set EF = 53%
If HeartFailTmg is Acute or Both and gender is Female, set EF = 58%

MV Replace + CABG

If HeartFailTmg is Chronic or missing and gender is Male, set EF = 55%
If HeartFailTmg is Chronic or missing and gender is Female, set EF = 56%
If HeartFailTmg is Acute or Both and gender is Male, set EF = 50%
If HeartFailTmg is Acute or Both and gender is Female, set EF = 53%

MV Repair + CABG

If HeartFailTmg is Chronic or missing and gender is Male, set EF = 50%
If HeartFailTmg is Chronic or missing and gender is Female, set EF = 52%
If HeartFailTmg is Acute or Both and gender is Male, set EF = 37%
If HeartFailTmg is Acute or Both and gender is Female, set EF = 40%

Table 7: Imputation of Missing Continuous Variables for 2017 Models

Last Hematocrit (HCT)	If gender is Male, set HCT = 36.5 If gender is Female, set HCT = 40.0
Last WBC Count (WBC)	If WBC is missing, set WBC = 7.5
Platelets	If platelets are missing, set platelets = 204,000
Last Preop Creatinine	Set CreatLst = 1.0
ADP Inhibitors Discontinuation	If MedADPIDis is missing, set MedADPIDis = 2 Days

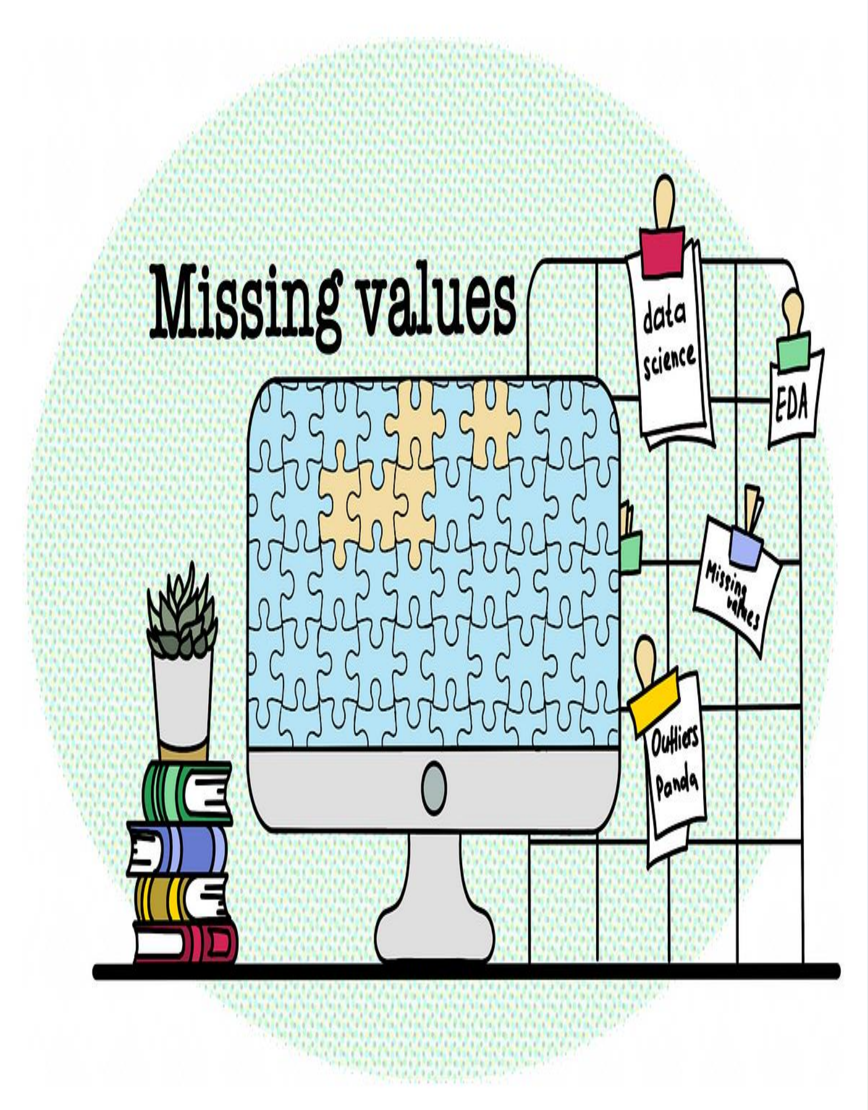


Table 8: Imputation of Missing Continuous Variables for 2021 Models

Model Variable	Model Imputation Information
Body Surface Area (BSA)	If gender is Male set BSA = 2.00m^2 If gender is Female set BSA = 1.75m^2
Ejection Fraction (EF)	If EF is missing or <10%: **<u>Multi-valve</u>** If HeartFailTmg is Chronic or missing and gender is Male, set EF = 58% If HeartFailTmg is Chronic or missing and gender is Female, set EF = 60% If HeartFailTmg is Acute or Both and gender is Male, set EF = 55% If HeartFailTmg is Acute or Both and gender is Female, set EF = 58% **<u>Multi-valve + CABG</u>** If HeartFailTmg is Chronic or missing and gender is Male, set EF = 55% If HeartFailTmg is Chronic or missing and gender is Female, set EF = 56% If HeartFailTmg is Acute or Both and gender is Male, set EF = 50% If HeartFailTmg is Acute or Both and gender is Female, set EF = 53%
Total Albumin	**<u>Male</u>** and missing TotAlbumin If Age < 50, then TotAlbumin = 4.04834 If Age 50 - 54, then TotAlbumin = 3.980843 If Age 55 - 59, then TotAlbumin = 3.967788 If Age 60 - 64, then TotAlbumin = 3.973756 If Age 65 - 69, then TotAlbumin = 3.957445 If Age 70 - 74, then TotAlbumin = 3.928383

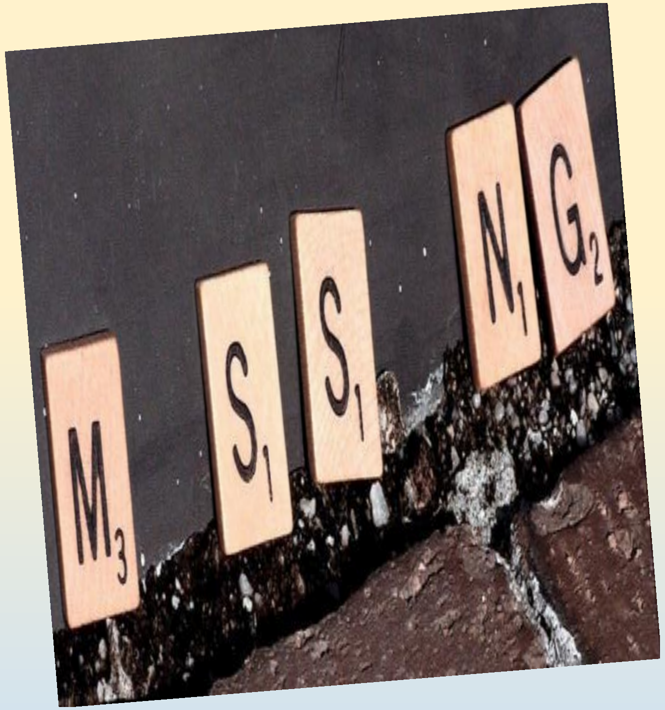


Table 8: Imputation of Missing Continuous Variables for 2021 Models

	If Age 75 - 79, then TotAlbumin = 3.888703 If Age 80 - 84, then TotAlbumin = 3.847635 If Age 85 - 89, then TotAlbumin = 3.792546 If Age > 90, then TotAlbumin = 3.758669 **Female** and missing TotalAlbumin If Age < 50, then TotAlbumin = 3.875357 If Age 50 - 54, then TotAlbumin = 3.863325 If Age 55 - 59, then TotAlbumin = 3.896507 If Age 60 - 64, then TotAlbumin = 3.907128 If Age 65 - 69, then TotAlbumin = 3.90026 If Age 70 - 74, then TotAlbumin = 3.897609 If Age 75 - 79, then TotAlbumin = 3.878276 If Age 80 - 84, then TotAlbumin = 3.837301 If Age 85 - 89, then TotAlbumin = 3.805836 If Age > 90, then TotAlbumin = 3.776916
Total Bilirubin	If TotBlrbn is missing, set TotBlrbn =1.0
INR	If INR < 1, then INR=1 If Status = Elective and MedCoum5Days or MedCoum = No, then INR = 1.1 If Status = Urgent and MedCoum5Days or MedCoum = No, then INR = 1.11 If Status = Emergent and MedCoum5Days or MedCoum = No, then INR = 1.3 If Status = Emergent Salvage and MedCoum5Days or MedCoum=No, then INR=1.3 If Status = Elective and MedCoum5Days or MedCoum = Yes, then INR = 1.3 If Status = Urgent and MedCoum5Days or MedCoum = Yes, then INR = 1.3 If Status = Emergent and MedCoum5Days or MedCoum = Yes, then INR = 1.85 If Status = Emergent Salvage and MedCoum5Days or MedCoum=Yes,then INR=1.3 If Status is missing and MedCoum5Days or MedCoum = No, then INR = 1.1

Discrimination and Calibration of Risk-Adjustment Models

Two important aspects of model performance assessed on a continual (per harvest) basis are calibration and discrimination.

Calibration:

- **A model is said to be well calibrated if there is a close match between the observed number of deaths and the number of deaths predicted by the model.**
- **To make the models more accurate, each model is re-calibrated each harvest. This recalibration ensures that the total number of "events" predicted by the model will exactly match the actual number of events that was observed in the data.**

Discrimination:

- **A model is said to have good discrimination if it can distinguish patients who are likely to have an event from those who are not likely to have an event.**
- **A commonly used measure of discrimination is the C- statistic (also known as the area under the ROC curve). The C-statistic represents the probability that a patient who experienced an event (e.g., died) had a higher predicted risk compared to a patient who did not experience the event.**

Predicted Risk Values

- After information has been entered on a given case, the STS risk model will provide a risk percentage for each of the outcomes.
- The risk percentage is the estimated percent chance of the outcome for a patient with the indicated risk factors.
- Please note that depending upon your vendor software, a risk percentage for each outcome might be calculated as each question is answered; therefore, the most reliable risk percentage will appear only after all available data have been entered.
- Risk Models for Multi-valve and Multi-valve + CABG are not yet distributed to the third-party vendors; therefore, a predicted risk score will not populate for these cases.

Data Manager Training Webinars

Session 1 – Tuesday Feb 25th at 12 pm CST – ACSD Educational Resources and Navigation of the STS Website (1.5 hr)

Session 2 – Tuesday March 4th at 12 pm CST - Overview of Data Specs, Software Specs, Risk Model Variables (2 hr)

Session 3 – Tuesday March 11th at 12 pm CST - Case Inclusion and Choosing the Index Procedure, PROC ID chart (1.5 hr)

Session 4 – Thursday March 20th at 12 pm CST - Harvesting your Data and the DQR report (1.5 hr)

Session 5 – Tuesday March 25th at 12 pm CST - National Report Overview and Process / Outcome Measures (1.5 hr)

Session 6 – Tuesday April 1st at 12 pm CST - Updating site forms, STS Helpdesk, and RedCap forms (1.5 hr)

Session 7 – Tuesday April 8th at 12 pm CST - IQVIA Reporting Overview (1.5 hr)

Please use the Q&A Function.

We will answer as many questions as possible.

We encourage your feedback and want to hear from you!