

Cardiology: Pre-Op Risk Assessment Documentation Template

Documentation Template: Conceptual Structure

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Department of Veterans Affairs (VA)



**Knowledge Based Systems (KBS)
Office of Informatics and Information Governance (OIIG)
Clinical Decision Support (CDS)**

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Cardiology: Pre-Op Risk Assessment Documentation Template: Documentation Template: Conceptual Structure

by Knowledge Based Systems (KBS), Office of Informatics and Information Governance (OIIG), and Clinical Decision Support (CDS)

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Preface

Table 1. Revision History

Date	Life Cycle Event
June 12, 2018	Published
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April 24, 2018	Published
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April 4, 2018	Reviewed
December 29, 2017	Pre-published
August 10, 2017	Created

Table 2. Clinical White Paper Contributors

Name	Role	Affiliation
Bruce Bray, MD	Author	Professor, Cardiovascular Medicine University of Utah School of Medicine Staff Cardiologist, Salt Lake City VAMC
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Aiden Abidov, MD PhD	Author	Professor of Medicine Wayne State University Section Chief, Cardiology John Dingell VA Medical Center

Table 3. Artifact Identifier

Domain	Artifact ID	Name
urn:va.gov:kbs:knart:artifact:r1	39398641-f6f4-5cc7-b295-eccff0549ae5	B37

Artifact Applicability

Table 4. Applicability Foci, Description and Codes

Focus	Description	Code System	Code	Value Set	Value Set Version
PatientAgeGroup	Population 18 years old or older	SNOMED CT	133936004 Adult (person)	N/A	N/A
ClinicalFocus	Adult being considered for elective, non-emergent, non-cardiac surgery			N/A	N/A
TargetUser	Primary Care	SNOMED CT	453231000124104 Primary care provider (occupation)	N/A	N/A
ClinicalVenue	Outpatient	SNOMED CT	33022008 Hospital-based outpatient department (environment)	N/A	N/A

Models

Table 5. Model References

Referenced Model	Description
urn:solor.io:anf-model:1.0	VA Analysis Normal Form Model

Chapter 1. External Data Definitions

Definitions

Table 1.1. Basic Metabolic Panel Lab Result

Expression: type=elm:Query Annotation: Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [1421000205106 Basic metabolic panel (procedure)]

Table 1.2. Complete Blood Count Lab Result

Expression: type=elm:Query Annotation: Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [26604007 Complete blood count (procedure)]

Table 1.3. 12-Lead Electrocardiogram

Expression: type=elm:Query Annotation: Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [268400002 12 lead electrocardiogram (procedure)]

Table 1.4. Resting 12-Lead Electrocardiogram Interpretation

Expression: type=elm:Query Annotation: Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[268400002 12 lead electrocardiogram (procedure)]]

Table 1.5. Chest X-Ray

Expression: type=elm:Query Annotation: Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [399208008 Plain chest X-ray (procedure)]

Table 1.6. Chest X-Ray Interpretation

Expression: type=elm:Query Annotation: Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[399208008 Plain chest X-ray (procedure)]]

Table 1.7. Stress Electrocardiography

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value) elm:value[elm:Code]: [46136006 Electrocardiogram with exercise test (procedure)]

Table 1.8. Stress Electrocardiography Interpretation

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value) elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[46136006 Electrocardiogram with exercise test (procedure)]]

Table 1.9. Resting Echocardiogram/Doppler

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value) elm:value[elm:Code]: [50871731-ba83-45bb-a582-a14943f1d06d Echocardiography at rest (procedure)]

Table 1.10. Resting Echocardiogram/Doppler Interpretation

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value) elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[50871731-ba83-45bb-a582-a14943f1d06d Echocardiography at rest (procedure)]]

Table 1.11. Stress Echocardiogram

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value) elm:value[elm:Code]: [433233004 Exercise stress echocardiography (procedure)]

Table 1.12. Stress Echocardiogram Interpretation

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value) elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[433233004 Exercise stress echocardiography (procedure)]]

Table 1.13. Stress MPI

Expression: type=elm:Query

Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [16545191000119100 |Radionuclide myocardial perfusion stress study (procedure)]]

Table 1.14. Stress MPI Interpretation

Expression: type=elm:Query
 Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [[370851004 |Evaluation of diagnostic study results (procedure)] ->(363702006 |Has focus (attribute))-
 >[16545191000119100 |Radionuclide myocardial perfusion stress study (procedure)]]

Table 1.15. Stress MRI

Expression: type=elm:Query
 Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [431609005 |Magnetic resonance imaging stress study of cardiac function (procedure)]]

Table 1.16. Stress MRI Interpretation

Expression: type=elm:Query
 Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [[370851004 |Evaluation of diagnostic study results (procedure)] ->(363702006 |Has focus (attribute))-
 >[431609005 |Magnetic resonance imaging stress study of cardiac function (procedure)]]

Table 1.17. Rest MRI

Expression: type=elm:Query
 Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [431392001 |Magnetic resonance imaging of rest perfusion of heart (procedure)]]

Table 1.18. Rest MRI Interpretation

Expression: type=elm:Query
 Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [[370851004 |Evaluation of diagnostic study results (procedure)] ->(363702006 |Has focus (attribute))-
 >[431392001 |Magnetic resonance imaging of rest perfusion of heart (procedure)]]

Table 1.19. Chest CT

Expression: type=elm:Query
 Annotation:
 Codes: elm:value[elm:Code]: [398166005 |Performed (qualifier value)|elm:value[elm:Code]:
 [169069000 |Computed tomography of chest (procedure)]]

Table 1.20. Chest CT Interpretation

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[169069000 Computed tomography of chest (procedure)]]

Table 1.21. Cardiac CT

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [241547009 Computed tomography of heart (procedure)]

Table 1.22. Cardiac CT Interpretation

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[241547009 Computed tomography of heart (procedure)]]

Table 1.23. Coronary CT Angiography

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [419545005 Computed tomography angiography of coronary arteries (procedure)]

Table 1.24. Coronary CT Angiography Interpretation

Expression: type=elm:Query
Annotation:
Codes: elm:value[elm:Code]: [398166005 Performed (qualifier value)]elm:value[elm:Code]: [[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[419545005 Computed tomography angiography of coronary arteries (procedure)]]

Triggers

No trigger definitions are present.

Chapter 2. Expression Definitions

No expression definitions are present.

Chapter 3. Documentaton Template

Applicability

This documentation template is not applicable to emergency surgery patients or patients with an acute coronary syndrome. It is intended for patients anticipating an elective, non-cardiac surgery.

prompt: Acknowledge

response: Boolean (Single)

Chapter 4. Procedure Risk

With respect to the surgical procedure that the patient requires, define the procedure as Low, Medium or High surgical risk by selecting the appropriate checkbox from just one of the three category options shown below. Note that a NON-LOW-RISK PROCEDURE is defined as any surgery that is medium or high risk, based on the modified Johns Hopkins surgical criteria (Donati 2004). To assist the clinical provider in decision making, representative examples of procedures that would be defined as Low, Medium, or High risk appear below the checkbox options.

([Donati 2004]) A new and feasible model for predicting operative risk link [<https://doi.org/10.1093/bja/ae210>]

♦ Procedure Risk

prompt:

response: Code (Single)

response EnumerationConstraint (List)

range:

item: LOW Risk Procedure(723505004 |Low risk (qualifier value)|)

The following are representative examples of LOW Risk procedures: Breast biopsy, Removal of minor skin or subcutaneous lesions, Myringotomy tubes, Hysteroscopy, Cystoscopy, Vasectomy, Fiber-optic bronchoscopy, Diagnostic laparoscopy, Dilation and curettage, Fallopian tube ligation, Arthroscopy, Inguinal hernia repair, Laparoscopic lysis of adhesion, Tonsillectomy/rhinoplasty, Breast biopsy

valueMeaning: minimal to moderately invasive procedure

item: MEDIUM Risk Procedure(583b1831-0bcb-470a-8e50-1f34454cd4e3 |Moderate risk (qualifier value)|)

The following are representative examples of MEDIUM Risk procedures: Thyroidectomy, Hysterectomy, Myomectomy, Cystectomy, Cholecystectomy, Laminectomy, Hip/knee replacement, Nephrectomy, Major laparoscopic procedures, Resection/reconstructive surgery of the digestive tract

valueMeaning: moderately to significantly invasive procedures (Note: Medium Risk is a NON-LOW RISK Procedure)

item: HIGH Risk Procedure(723509005 |High risk (qualifier value)|)

The following are representative examples of HIGH Risk procedures: Major orthopedic-spinal reconstruction, Major reconstruction of the gastrointestinal tract, Major genitourinary surgery (e.g., radical retropubic prostatectomy), Major vascular repair without postoperative ICU stay, Cardiothoracic procedure Intracranial procedure, Major procedure on the oropharynx, Major vascular, skeletal, neurological repair

valueMeaning: highly invasive procedure (Note: High Risk is a NON-LOW RISK Procedure)

Chapter 5. Patient Risk

Revised Cardiac Risk Index (RCRI)

prompt: Medium or High Risk procedure

response: Boolean (Single)

prompt: Ischemic heart disease

itemCode: [a997cc03-3e99-40eb-833a-6374c7750a3a |Observation procedure (procedure)] ->(363702006 |Has focus (attribute))->[414545008 |Ischemic heart disease (disorder)]

response: Boolean (Single)

prompt: History of congestive heart failure

itemCode: [a997cc03-3e99-40eb-833a-6374c7750a3a |Observation procedure (procedure)] ->(363702006 |Has focus (attribute))->[42343007 |Congestive heart failure (disorder)]

response: Boolean (Single)

prompt: History of cerebrovascular disease

itemCode: [a997cc03-3e99-40eb-833a-6374c7750a3a |Observation procedure (procedure)] ->(363702006 |Has focus (attribute))->[62914000 |Cerebrovascular disease (disorder)]

response: Boolean (Single)

prompt: Insulin-dependent (type 1) diabetes mellitus

itemCode: [a997cc03-3e99-40eb-833a-6374c7750a3a |Observation procedure (procedure)] ->(363702006 |Has focus (attribute))->[23045005 |Insulin dependent diabetes mellitus type IA (disorder)]

response: Boolean (Single)

Risk of Major Adverse Cardiac Event (MACE)

The Risk of MACE is estimated by totaling the number of variables that apply from the Revised Cardiac Risk Indicator.

prompt: The patient's estimated risk of a major adverse cardiac event (RISK of MACE) is:

itemCode: f6c7549f-9616-40ca-99d7-133305c01233 |Assessment using Revised Cardiac Risk Index (procedure)

response: Real (Single)

responseBinding: Property ("mace")

Condition:elm:Less (elm:Property("mace" from: elm:ParameterRef(Response)) elm:Literal())

RISK OF MACE is less than 1%

Consider proceeding to surgery without cardiology consultation since the patient's estimated risk of a major adverse cardiac event is less than 1%.

prompt: Acknowledge

response: Boolean (Single)

◆ **Condition:**elm:GreaterOrEqual (elm:Property("mace" from: elm:ParameterRef(Response)) elm:Literal())

RISK OF MACE is NOT less than 1%

Can the patient perform activity of at least 4 metabolic equivalents (METs)? (Examples of 4 METs would include: light yard work, walking slowly on a flat surface at a 15-minute mile pace, or a moderate amount of work around the house like sweeping floors or carrying groceries.) (Fleisher 2014)

prompt: MET activity evaluation

response: String (Single)

response range: EnumerationConstraint (List)

item: Yes, the patient can perform at least 4 METs

item: No, the patient cannot perform at least 4 METs

prompt: If the patient is able to perform at least 4 METs, the patient may proceed to surgery since their functional capacity is at least 4 METs.

response: String (Single)

Chapter 6. Laboratory Studies

prompt: Basic Metabolic Panel Lab Result

response: Tuple (Single)

initalValue: Basic Metabolic Panel Lab Result

prompt: Complete Blood Count Lab Result

response: Tuple (Single)

initalValue: Complete Blood Count Lab Result

Chapter 7. Imaging and Diagnostic Studies

For this documentation template, the following information should be included, if available from the prior year.

12-Lead Electrocardiogram
Attach or link results: Resting 12-Lead Electrocardiogram Interpretation
prompt: Resting 12-Lead Electrocardiogram Interpretation response: Tuple (Single) initialValue: Resting 12-Lead Electrocardiogram Interpretation
Attach or link images: 12-Lead Electrocardiogram
prompt: 12-Lead Electrocardiogram response: Tuple (Single) initialValue: 12-Lead Electrocardiogram
Stress Electrocardiography
Attach or link results: Stress Electrocardiography
prompt: Stress Electrocardiography Interpretation response: String (Multiple) initialValue: Stress Electrocardiography Interpretation
Attach or link images: Stress Electrocardiography
prompt: Stress Electrocardiography response: Tuple (Multiple) initialValue: Stress Electrocardiography
Resting Echocardiogram/Doppler
Link results: Resting Echocardiogram/Doppler Interpretation
prompt: Resting Echocardiogram/Doppler Interpretation response: Tuple (Single) initialValue: Resting Echocardiogram/Doppler Interpretation
Link images: Resting Echocardiogram/Doppler Electrocardiography
prompt: Resting Echocardiogram/Doppler response: Tuple (Single) initialValue: Resting Echocardiogram/Doppler
Stress Echocardiogram
Link results: Stress Echocardiogram Interpretation
prompt: Stress Echocardiogram Interpretation response: String (Multiple) initialValue: Stress Echocardiogram Interpretation
Link images: Stress Echocardiogram
prompt: Stress Echocardiogram

	response: Tuple (Multiple)
# Stress MPI	initialValue: Stress Echocardiogram
	Link results: Stress MPI Interpretation
	# prompt: Stress Myocardial Perfusion Imaging (MPI) Interpretation
	response: Tuple (Multiple)
	initialValue: Stress MPI Interpretation
	Link images: Stress MPI
	# prompt: Stress Myocardial Perfusion Imaging (MPI)
	response: Tuple (Multiple)
	initialValue: Stress MPI
# Stress MRI	
	Link Results: Rest/Stress MRI Interpretation
	# prompt: Stress Magnetic Resonance Imaging (MRI) Interpretation
	response: Tuple (Single)
	initialValue: Stress MRI Interpretation
	Link images: Rest/MRI
	# prompt: Stress Myocardial Perfusion Imaging (MPI)
	response: Tuple (Single)
	initialValue: Stress MRI
# Rest MRI	
	Link Results: Rest/Stress MRI Interpretation
	# prompt: Rest Magnetic Resonance Imaging (MRI) Interpretation
	response: Tuple (Single)
	initialValue: Rest MRI Interpretation
	Link images: Rest/MRI
	# prompt: Rest Myocardial Perfusion Imaging (MPI)
	response: Tuple (Single)
	initialValue: Rest MRI
# Chest CT	
	Link results: Chest CT Interpretation
	# prompt: Chest CT Interpretation
	response: Tuple (Single)
	initialValue: Chest CT
	Link results: Chest CT
	# prompt: Chest CT
	response: Tuple (Single)
	initialValue: Chest CT Interpretation
# Cardiac CT	
	Link results: Cardiac CT Interpretation

	<p># prompt: Cardiac CT Interpretation response: Tuple (Single)</p> <p>initialValue: Cardiac CT Interpretation</p> <p>Link images: Cardiac CT</p>
#	<p># prompt: Cardiac CTA response: Tuple (Single)</p> <p>initialValue: Cardiac CT</p> <p>Coronary CT Angiography (CTA)</p> <p>Link results: Coronary CT Angiography (CTA) Interpretation</p>
	<p># prompt: Coronary CT Angiography (CTA) Interpretation response: Tuple (Single)</p> <p>initialValue: Coronary CT Angiography Interpretation</p> <p>Link images: Coronary CT Angiography (CTA)</p>
#	<p># prompt: Coronary CT Angiography (CTA) response: Tuple (Single)</p> <p>initialValue: Coronary CT Angiography</p> <p>X-Ray Chest</p> <p>Link results: X-Ray Chest Interpretation</p>
	<p># prompt: X-Ray Chest Interpretation response: String (Single)</p> <p>initialValue: Chest X-Ray Interpretation</p> <p>Link images: X-Ray Chest</p>
	<p># prompt: X-Ray Chest response: Tuple (Single)</p> <p>initialValue: Chest X-Ray</p>

Chapter 8. Tabular List

Terminology Service Request (TSR) Mappings

Table 8.1. Terminology Versions

Name	Identifier	Version
SNOMED CT	2.16.840.1.113883.6.96	United States Edition 20180301

Table 8.2. Terminology References

System	Code	Display Text ^a	References ^b
SNOMED CT	133936004 Adult (person)	Population 18 years old or older	1
SNOMED CT	1421000205106 Basic metabolic panel (procedure)	Precoordinated Expression	1
SNOMED CT	16545191000119100 Radionuclide myocardial perfusion stress study (procedure)	Precoordinated Expression	1
SNOMED CT	169069000 Computed tomography of chest (procedure)	Precoordinated Expression	1
SNOMED CT	241547009 Computed tomography of heart (procedure)	Precoordinated Expression	1
SNOMED CT	26604007 Complete blood count (procedure)	Precoordinated Expression	1
SNOMED CT	268400002 12 lead electrocardiogram (procedure)	Precoordinated Expression	1
SNOMED CT	33022008 Hospital-based outpatient department (environment)	Outpatient	1
SNOMED CT	398166005 Performed (qualifier value)	Precoordinated Expression	24
SNOMED CT	399208008 Plain chest X-ray (procedure)	Precoordinated Expression	1
SNOMED CT	419545005 Computed tomography angiography of coronary arteries (procedure)	Precoordinated Expression	1
SNOMED CT	431392001 Magnetic resonance imaging of rest perfusion of heart (procedure)	Precoordinated Expression	1

System	Code	Display Text ^a	References ^b
SNOMED CT	431609005 Magnetic resonance imaging stress study of cardiac function (procedure)	Precoordinated Expression	1
SNOMED CT	433233004 Exercise stress echocardiography (procedure)	Precoordinated Expression	1
SNOMED CT	453231000124104 Primary care provider (occupation)	Primary Care	1
SNOMED CT	46136006 Electrocardiogram with exercise test (procedure)	Precoordinated Expression	1
SNOMED CT	50871731-ba83-45bb-a582-a14943f1d06d Echocardiography at rest (procedure)	Precoordinated Expression	1
SNOMED CT	583b1831-0bc6-470a-8e50-1744d10c4433 Moderate risk (qualifier value)	Moderate Risk Procedure	1
SNOMED CT	723505004 Low risk (qualifier value)	LOW Risk Procedure	1
SNOMED CT	723509005 High risk (qualifier value)	HIGH Risk Procedure	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))->[16545191000119100 Radionuclide myocardial perfusion stress study (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))->[169069000 Computed tomography of chest (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))->[241547009 Computed tomography of heart (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study	Postcoordinated Expression	1

System	Code	Display Text ^a	References ^b
	results (procedure)] - >(363702006 Has focus (attribute))->[268400002 12 lead electrocardiogram (procedure)]		
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[399208008 Plain chest X-ray (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[419545005 Computed tomography angiography of coronary arteries (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[431392001 Magnetic resonance imaging of rest perfusion of heart (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[431609005 Magnetic resonance imaging stress study of cardiac function (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))- >[433233004 Exercise stress echocardiography (procedure)]	Postcoordinated Expression	1
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] - >(363702006 Has focus (attribute))->[46136006 Electrocardiogram with exercise test (procedure)]	Postcoordinated Expression	1

System	Code	Display Text ^a	References ^b
SNOMED CT	[370851004 Evaluation of diagnostic study results (procedure)] ->(363702006 Has focus (attribute))->[50871731-ba83-45bb-a582-a14943f1d06d Echocardiography at rest (procedure)]	Postcoordinated Expression	1
SNOMED CT	[a997cc03-3e99-40eb-833a-6374c775d03a Observation procedure (procedure)] ->(363702006 Has focus (attribute))->[23045005 Insulin dependent diabetes mellitus type IA (disorder)]	Postcoordinated Expression	1
SNOMED CT	[a997cc03-3e99-40eb-833a-6374c775d03a Observation procedure (procedure)] ->(363702006 Has focus (attribute))->[414545008 Ischemic heart disease (disorder)]	Postcoordinated Expression	1
SNOMED CT	[a997cc03-3e99-40eb-833a-6374c775d03a Observation procedure (procedure)] ->(363702006 Has focus (attribute))->[42343007 Congestive heart failure (disorder)]	Postcoordinated Expression	1
SNOMED CT	[a997cc03-3e99-40eb-833a-6374c775d03a Observation procedure (procedure)] ->(363702006 Has focus (attribute))->[62914000 Cerebrovascular disease (disorder)]	Postcoordinated Expression	1
SNOMED CT	f6c7549f-9616-40ca-99d7-1f3305011b3a Assessment using Revised Cardiac Risk Index (procedure)	Postcoordinated Expression	1

^aIf a code is used multiple times in the KNART, only the display text of the first instance is shown.

^bCount of the number of times the given code system and code pair is used in the KNART.

Chapter 9. Behavior Symbols

Table 9.1. Group Organizational Behavior

Symbol	Name	Definition
#	Sentence Group	A group of related alternative actions is a sentence group if the item referenced by the action is the same in all the actions, and each action simply constitutes a different variation on how to specify the details for that item. For example, two actions that could be in a SentenceGroup are "aspirin, 500 mg, 2 times per day" and "aspirin, 300 mg, 3 times per day". In both cases, aspirin is the item referenced by the action, and the two actions represent two different options for how aspirin might be ordered for the patient. Note that a SentenceGroup would almost always have an associated selection behavior of "AtMostOne", unless it's a required action, in which case, it would be "ExactlyOne".
#	Logical Group	A group with this behavior logically groups its sub-elements, and may be shown as a visual group to the end user, but it is not required to do so.
➤	Visual Group	Any group marked with this behavior should be displayed as a visual group to the end user.

Table 9.2. Group Selection Behavior

Symbol	Name	Definition
#	Any	Any number of the items in the group may be chosen, from zero to all.
#	All	All the items in the group must be selected as a single unit.
#	AllOrNone	All the items in the group are meant to be chosen as a single unit: either all must be selected by the end user, or none may be selected.
#	ExactlyOne	The end user must choose one and only one of the selectable items in the group. The user may not choose none of the items in the group.
⬠	AtMostOne	The end user may choose zero or at most one of the items in the group.
✱	OneOrMore	The end user must choose a minimum of one, and as many additional as desired.

Table 9.3. Required Behavior

Symbol	Name	Definition
◆	Must	An action with this behavior must be included in the actions processed by the end user; the end user may not choose not to include this action.
◇	Could	An action with this behavior may be included in the set of actions processed by the end user.

Symbol	Name	Definition
➤	MustUnlessDocumented	An action with this behavior must be included in the set of actions processed by the end user, unless the end user provides documentation as to why the action was not included.

Table 9.4. Precheck Behavior

Symbol	Name	Definition
▲	Yes	An action with this behavior is one of the most frequent actions that is, or should be, included by an end user, for the particular context in which the action occurs. The system displaying the action to the end user should consider "pre-checking" such an action as a convenience for the user.
#	No	An action with this behavior is one of the less frequent actions included by the end user, for the particular context in which the action occurs. The system displaying the actions to the end user would typically not "pre-check" such an action.

Table 9.5. Cardinality Behavior

Symbol	Name	Definition
◆	Single	An action with this behavior may only be completed once.
❖	Multiple	An action with this behavior may be repeated multiple times.

Table 9.6. Item Flags

Symbol	Name	Definition
☞	fillIn	This item, in a list entry, allows the user to enter a fill in value that is not present in the set of presented choices.

Table 9.7. Read Only Behavior

Symbol	Name	Definition
#	true	For a particular action or action group, specifies whether the elements are read only.

Appendix A. References

This appendix contains the list of related resources and supporting documents used in creating this KNART.

List of References

Related Resources

[CCWP] *Cardiology: Pre-Op Risk Assessment Clinical Content White Paper*

[CSD] *Cardiology: Pre-Op Risk Assessment Documentation Template Conceptual Structure Document*

[KVRpt] *Cardiology: Pre-Op Risk Assessment Documentation Template KNART Validation Report*

[ACS, 2017] *ACS NSQIP Surgical Risk Calculator 2017* (link [<http://riskcalculator.facs.org/RiskCalculator/index.jsp>])

Supporting Evidence

[Daley, 2015] Daley B.J., Cecil W, Clarke PC, Cofer JB, Guillaumondegui OD. *How slow is too slow? Correlation of operative time to complications: an analysis from the Tennessee Surgical Quality Collaborative. J Am Coll Surg.* 2015;220(4):550-558 (link [<https://doi.org/10.1016/j.jamcollsurg.2014.12.040>])

[Donati 2004] Donati A., Adrario M. *A new and feasible model for predicting operative risk. Br J Anaesth.* 2004;93(3):393-399 (link [<https://doi.org/10.1093/bja/aeh210>])

[Fleisher, 2014] Fleisher LA, Fleischmann KE, Auerbach AD. *2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing non-cardiac surgery: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. Circulation.* 2014;130(24):e278-e333 (link [<https://doi.org/10.1007/s12350-014-0025-z>])

[Hlatky , 1989] Hlatky MA, Boineau RE, Higginbotham MB. *A brief self-administered questionnaire to determine functional capacity (the Duke Activity Status Index). Am J Cardiol.* 1989;64(10):651-654 (link [[http://www.ajconline.org/article/0002-9149\(89\)90496-7/pdf](http://www.ajconline.org/article/0002-9149(89)90496-7/pdf)])

[Hu, 2016] Hu WH, Chen HH, Lee KC. *Assessment of the addition of hypoalbuminemia to ACS-NSQIP surgical risk calculator in colorectal cancer. Medicine (Baltimore).* 2016;95(10):e2999 (link [<https://doi.org/10.1097/MD.0000000000002999>])

[Lee , 1999] Lee TH, Marcantonio ER, Mangione CM. *Derivation and prospective validation of a simple index for prediction of cardiac risk of major non-cardiac surgery. Circulation.* 1999;100(10):1043-1049 (link [<http://circ.ahajournals.org/content/100/10/1043.long>])

[McMillan, 2017] McMillan MT, Allegrini V, Asbun HJ. *Incorporation of procedure-specific risk into the ACS-NSQIP surgical risk calculator improves the prediction of morbidity and mortality after pancreatoduodenectomy. Ann Surg.* 2017;265(5):978-986 (link [<https://doi.org/10.1097/SLA.0000000000001796>])

[Neuberger, 2017] Neuberger JM, Bechstein WO, Kuypers DR. *Practical recommendations for long-term management of modifiable risks in kidney and liver transplant recipients: a guidance report and clinical checklist by the Consensus on Managing Modifiable Risk in Transplantation (COMMIT) Group. Transplantation.* 2017;101(4S Suppl 2):S1-S56 (link [<https://doi.org/10.1097/TP.0000000000001651>])