Cardiology: Chest Pain/Coronary artery disease (CAD) Order Set

Order Set: Conceptual Structure

Contract: VA118-16-D-1008, Task Order (TO): VA-118-16-F-1008-0007, CLIN0004AD

Department of Veterans Affairs (VA)

Cardiology: Chest Pain/Coronary artery disease (CAD) Order Set: Order Set: Conceptual Structure

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

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Table 1. Revision History

Date	Life Cycle Event
May 29, 2018	Published
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Table 2. Clinical White Paper Contributors

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Table 3. Artifact Identifier

Domain	Artifact ID	Name
urn:va.gov:kbs:knart:artifact:r1	ce30ff93-c0ab-572b-bcfe-fbd34a085d21	B5

Artifact Applicability

Table 4. Applicability Foci, Description and Codes

Focus	Description	Code System	Code	Value Set	Value Set Version
PatientAgeGroup	Adult patients	SNOMED CT	133936004 |Adult (person)|	N/A	N/A
ClinicalFocus	Adult with stable CP being considered for cardiology consultation (excluding unstable symptoms and ACS)			N/A	N/A
ClinicalVenue	Outpatient	SNOMED CT	33022008 |Hospital-based outpatient department (environment)|	N/A	N/A
TargetUser	Provider in Primary Care Clinic			N/A	N/A
WorkflowTask	noninvasive diagnostic orders (stress testing)			N/A	N/A

Models

Table 5. Model References

Referenced Model	Description
urn:solor.io:anf-model:0.8	VA Analysis Normal Form Model

Chapter 1. External Data Definitions

Definitions

Table 1.1. resting12LeadElectrocardiogram

Expression: type=elm:Retrieve , dataType=anf:ElectricalActivityEvaluationOfBodyStructureAction, codeProperty=topicFocus, dateProperty=dateTime
Annotation:
Codes: elm:element[elm:Code]: [de405a38-1cc8-44ef-81e7-fd1c0acf9421]
dateRange[elm:Interval]   low: elm:Add(elm:Today() elm:Quantity(-2 Month))   high: elm:Today()

Triggers

No trigger definitions are present.

Chapter 2. Expression Definitions

No expression definitions are present.

Chapter 3. Clinical Stability

This order set is not applicable for use with patients who are unstable based on clinician judgement. Examples of unstable patients include, but are not limited to, patients with chest pain pattern suggestive of ACS (e.g., those with new onset resting CP, CP with minimal exertion, new unstable angina pattern, ST-segment elevation, non–ST-segment elevation myocardial infarction on ECG, or suspected aortic dissection), and patients with any of the following symptoms or findings. Consider transferring unstable patients to the nearest emergency department immediately

Ongoing resting chest pain for > 20 minutes with ST elevation or depression on ECG

  prompt: Ongoing resting chest pain for > 20 minutes with ST elevation or depression on ECG

response: Boolean (Single)

responseBinding: Property ("hasOngoingRestChestPain")

Onset of new resting chest pain episodes within the past week

  prompt: Onset of new resting chest pain episodes within the past week

response: Boolean (Single)

responseBinding: Property ("hasOnsetOfNewRestChestPainEpisodes")

New onset, recurrent chest pain with minimal exertion over the past 2 months.

  prompt: New onset, recurrent chest pain with minimal exertion over the past 2 months.

response: Boolean (Single)

responseBinding: Property ("hasNewOnsetRecurrentChestPain")

Previously stable exertional angina now occurring with minimal activity over the past 2 months.

  prompt: Previously stable exertional angina now occurring with minimal activity over the past 2 months.

response: Boolean (Single)

responseBinding: Property ("hasPreviouslyStableExertionalAnginaNowOccurring")

Chapter 4. Consults and Referrals

Conditions
Condition:elm:IsFalse (elm:Or(elm:Or(elm:Property("hasOngoingRestChestPain" from: elm:ParameterRef(Responses)) elm:Property("hasOnsetOfNewRestChestPainEpisodes" from: elm:ParameterRef(Responses))) elm:Or(elm:Property("hasNewOnsetRecurrentChestPain" from: elm:ParameterRef(Responses)) elm:Property("hasPreviouslyStableExertionalAnginaNowOccurring" from: elm:ParameterRef(Responses)))))

\# | Cardiology consult order

Consider other consult modalities which might be available (e.g., e-consult or other rapidly iterative consult method. A simple consult is included here as the overarching clinical intent.

\# Referral to cardiology to evaluate chest pain (routine)

actionSentence[type=elm:Instance, classType=anf:TSR-NoModel]

TSR: Referral to cardiology TSR-NoCode

\# Reason for cardiology consultation

prompt: Reason for cardiology consultation

response: Code (Multiple)

response range: EnumerationConstraint (List)

item: typical angina(429559004)

item: atypical chest pain(102589003)

item: progressive angina symptoms in a stable patient with known CAD (if the patient is unstable based upon clinical or test results, direct physician-to-physician communication is required)(371806006)

☞ item: other

\# Goal of cardiology consultation

prompt: Goal of cardiology consultation

response: String (Single)

response range: EnumerationConstraint (List)

☞ item: Goal

Chapter 5. Imaging and ECG

Electrocardiogram/Chest X-ray

Consider ordering prior to the cardiology consultation. Resting 12-lead electrocardiogram is required if it has not been obtained within the past two months.

Condition:elm:Not (elm:Exists(resting12LeadElectrocardiogram))

Order sentence: resting 12-lead electrocardiogram to evaluate chest pain (routine)

actionSentence[type=elm:Instance, classType=anf:ElectricalActivityEvaluationOfBodyStructureRequest]

> topicFocus: Electrical activity evaluation de405a38-1cc8-44ef-81e7-fd1c0acf9421
>
> bodyStructure: Heart structure 80891009
>
> usingDevice: Electrocardiographic monitor and recorder, device 86184003
>
> physiologicPatientState: Resting state 128975004
>
> indicationForProcedure: Chest pain 29857009
>
> priority: routine 50811001

Order sentence: x-ray chest to evaluate chest pain (routine)

actionSentence[type=elm:Instance, classType=anf:RadiographicImagingOfBodyStructureRequest]

> topicFocus: x-ray chest 278110001
>
> bodyStructure: Thoracic structure 51185008
>
> usingDevice: Radiographic unit, device 68080007
>
> indicationForProcedure: Chest pain 29857009
>
> priority: routine 50811001

Coronary CTA

Consider ordering prior to the cardiology consultation.

> # prompt: Is Coronary CTA (cCTA) availability at the facility
>
> response: Boolean (Single)

responseBinding: Property ("cCTAAvailability")

Condition:elm:IsTrue (elm:Property("cCTAAvailability" from: elm:ParameterRef(Responses)))

Coronary CTA angiogram (cCTA) chest to evaluate chest pain (routine)

actionSentence[type=elm:Instance, classType=anf:ComputedTomographyImagingOfBodyStructure]

> topicFocus: coronary CTA chest to evaluate chest pain 312251004
>
> bodyStructure: Coronary artery structure 41801008
>
> usingDevice: Computerized axial tomography scanner, device 54953005
>
> usingSubstance: X-ray contrast media 419098001
>
> indicationForProcedure: Chest pain 29857009

priority: routine 50811001

Echocardiogram

Consider for patients with suspected pericarditis, myocarditis, hypertrophic cardiomyopathy, or pulmonary hypertension.

prompt: Is the patient suspected with pericarditis, myocarditis, hypertrophic cardiomyopathy, or pulmonary hypertension.

response: Boolean (Single)

responseBinding: Property ("patientSuspectedWithPericarditis")

Condition:elm:IsTrue (elm:Property("patientSuspectedWithPericarditis" from: elm:Parameter-Ref(Responses)))

Resting echocardiogram to evaluate chest pain (routine)

actionSentence[type=elm:Instance, classType=anf:UltrasoundImagingOfBodyStrutureRequest]

topicFocus: Resting echocardiogram to evaluate chest pain 278292003

bodyStructure: Heart structure 80891009

physiologicPatientState: Resting state 128975004

usingDevice: Cardiovascular ultrasound imaging system 467663007

indicationForProcedure: Chest pain 29857009

priority: routine 50811001

Chapter 6. Laboratory Tests

Consider the following tests to be completed prior to the cardiology consultation.

basic metabolic profile (routine)

actionSentence[type=elm:Instance, classType=anf:MeasurementOfLaboratoryTestRequest]

> topicFocus: Basic metabolic profile bd01faa8-443c-4ad6-9cb6-ea50b4d7a093
>
> priority: routine 50811001

complete blood count (routine)

actionSentence[type=elm:Instance, classType=anf:MeasurementOfLaboratoryTestRequest]

> topicFocus: Complete blood count 26604007
>
> priority: routine 50811001

fasting lipid profile (routine)

actionSentence[type=elm:Instance, classType=anf:MeasurementOfLaboratoryTestRequest]

> topicFocus: Fasting lipid profile 16254007
>
> priority: routine 50811001

thyroid function testing (routine)

actionSentence[type=elm:Instance, classType=anf:MeasurementOfLaboratoryTestRequest]

> topicFocus: Thyroid function testing 35650009
>
> priority: routine 50811001

brain natriuretic peptide (routine)

actionSentence[type=elm:Instance, classType=anf:MeasurementOfLaboratoryTestRequest]

> topicFocus: Brain natriuretic peptide 390917008
>
> priority: routine 50811001

Chapter 7. Cardiac Risk Stratification

For stable patients, these orders may assist in cardiac risk stratification. A link to the ACC/AHA clinical practice guideline for stress testing should be made available to ordering providers:

([Gibbons 2002]) ACC/AHA 2002 guideline update for exercise testing: summary article: A report of the American college of cardiology/American heart association task force on practice guidelines (committee to update the 1997 exercise testing guidelines) link [https://doi.org/10.1016/S0735-1097(02)02164-2]

Assess for contraindications to stress testing such as: Acute Congestive Heart Failure (CHF), acute MI or unstable angina, severe aortic stenosis, unstable rhythm, aortic aneurysm/dissection, endocarditis, acute pericarditis, acute pulmonary embolus/infarction, acute systemic illness/infection, severe hypertension, inability to cooperate, inability to exercise (<5 METs), left bundle branch block (LBBB), etc.	
	Exercise Stress Testing
	Consider for patients with no known or prior coronary artery disease, low probability for coronary artery disease, ability to exercise, normal electrocardiogram, and heart rate > 60 beats per minute.
	# Exercise ECG (routine)
	actionSentence[type=elm:Instance, classType=anf:ElectricalActivityEvaluationOfBodyStructure]
	topicFocus: Electrical activity evaluation de405a38-1cc8-44ef-81e7-fd1c0acf9421
	bodyStructure: Heart structure 80891009
	physiologicPatientState: Exercise state 128976003
	usingDevice: Electrocardiographic monitor and recorder, device 86184003
	priority: routine 50811001
	Stress Testing with Echocardiography
	Consider for patients with no known or prior coronary artery disease, low to intermediate probability for coronary artery disease, ability to exercise, and no evidence of significant regional wall motion abnormalities or conduction abnormalities (IVCD/bundle branch block or pacing) of 12-lead electrocardiogram.
	# Exercise Echocardiography (routine)
	actionSentence[type=elm:Instance, classType=anf:UltrasoundImagingOfBodyStructure]
	topicFocus: Exercise Echocardiography 278292003
	bodyStructure: Heart structure 80891009
	physiologicPatientState: Exercise state 128976003
	usingDevice: Cardiovascular ultrasound imaging system 467663007
	priority: routine 50811001

Dobutamine Stress Testing with Myocardial Perfusion Imaging (MPI)

Consider for patients with no known or prior coronary artery disease, intermediate probability for coronary artery disease, inability to exercise, and normal electrocardiogram.

dobutamine stress myocardial perfusion imaging (routine)

actionSentence[type=elm:Instance, classType=anf:RadionuclideImagingOfBodyStructureRequest]

   topicFocus: Dobutamine stress myocardial perfusion imaging 312421008

   bodyStructure: Myocardium structure 74281007

   usingDevice: Gamma camera 261802008

   usingSubstance[0]: Dobutamine 387145002

   usingSubstance[1]: Radioactive isotope 89457008

   physiologicPatientState: Cardiac stress state 432655005

   priority: routine 50811001

Exercise Stress Testing with MPI

Consider for patients with known or prior CAD, ability to exercise, and normal ST-T.

exercise stress myocardial perfusion imaging (routine)

actionSentence[type=elm:Instance, classType=anf:RadionuclideImagingOfBodyStructureRequest]

   topicFocus: Radionuclide imaging 312421008

   bodyStructure: Myocardium structure 74281007

   usingDevice: Gamma camera 261802008

   usingSubstance[0]: Radioactive isotope 89457008

   physiologicPatientState: Exercise state 128976003

   priority: routine 50811001

Vasodilator Stress Testing with MPI

Consider for patients with known or prior CAD and abnormal electrocardiogram/PPM. This subsection should also be made available to the provider for patients with known or prior CAD, abnormal electrocardiogram, and history of prior myocardial infarction or regional wall motion abnormalities.

✪ Regadenoson (Lexiscan) stress myocardial perfusion imaging (routine)

actionSentence[type=elm:Instance, classType=anf:RadionuclideImagingOfBodyStructureRequest]

   topicFocus: Radionuclide imaging 312421008

   bodyStructure: Myocardium structure 74281007

   usingDevice: Gamma camera 261802008

usingSubstance[0]: Regadenoson 430242005

usingSubstance[1]: Radioactive isotope 89457008

physiologicPatientState: Cardiac stress state 432655005

priority: routine 50811001

✪ Adenosine stress testing myocardial perfusion imaging (routine)

actionSentence[type=elm:Instance, classType=anf:RadionuclideImagingOfBodyStructureRequest]

topicFocus: Radionuclide imaging 312421008

bodyStructure: Myocardium structure 74281007

usingDevice: Gamma camera 261802008

usingSubstance[0]: Adenosine 35431001

usingSubstance[1]: Radioactive isotope 89457008

physiologicPatientState: Cardiac stress state 432655005

priority: routine 50811001

✪ Dipyridamole stress testing myocardial perfusion imaging (routine)

actionSentence[type=elm:Instance, classType=anf:RadionuclideImagingOfBodyStructureRequest]

topicFocus: Radionuclide imaging 312421008

bodyStructure: Myocardium structure 74281007

usingDevice: Gamma camera 261802008

usingSubstance[0]: Dipyridamole 387371005

usingSubstance[1]: Radioactive isotope 89457008

physiologicPatientState: Cardiac stress state 432655005

priority: routine 50811001

Dobutamine Stress Testing with Echocardiography or MPI

Consider for patients with known or prior CAD, inability to exercise, normal electrocardiogram, and no prior myocardial infarction. Only one should be selected.

✪ Dobutamine stress testing echocardiography (routine)

actionSentence[type=elm:Instance, classType=anf:UltrasoundImagingOfBodyStructureRequest]

topicFocus: Ultrasound imaging 278292003

bodyStructure: Heart structure 80891009

usingDevice: Cardiovascular ultrasound imaging system 467663007

usingSubstance[0]: Dobutamine 387145002

physiologicPatientState: Cardiac stress state
432655005

priority: routine 50811001

✪ Dobutamine stress testing myocardial perfusion imaging (routine)

actionSentence[type=elm:Instance, classType=anf:RadionuclideImagingOfBodyStructureRequest]

topicFocus: Radionuclide imaging 312421008

bodyStructure: Myocardium structure 74281007

usingDevice: Gamma camera 261802008

usingSubstance[0]: Dobutamine 387145002

usingSubstance[1]: Radioactive isotope
89457008

physiologicPatientState: Cardiac stress state
432655005

priority: routine 50811001

Coronary CT Angiogram

Consider for patients without known coronary artery disease, low or intermediate probability for coronary artery disease, especially in presence of a history of prior inconclusive or discrepant diagnostic testing, recurrent symptoms or significant family history of CAD/multiple risk factors in young patients. Additional postprocessing (CT-FFR) or CTA stress perfusion may be ordered where available.

coronary CT angiogram (routine)

actionSentence[type=elm:Instance, classType=anf:ComputedTomographyImagingOfBodyStructureRequest]

topicFocus: Computed tomography imaging
312251004

bodyStructure: Coronary artery structure
41801008

usingDevice: Computerized axial tomography
scanner, device 54953005

usingSubstance[0]: X-ray contrast media
419098001

priority: routine 50811001

Chapter 8. Medications

Consider the following medications for stable patients to be initiated prior to the cardiology consultation.

Antianginal Therapy
✪ metoprolol tartrate 25 mg tablet oral twice daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]
 	
    topicType.code: Administration 129445006
 	
    topicFocus: metoprolol tartrate 25 mg tablet oral 866924
 	
    routeOfAdministration: Oral route 26643006
 	
    dosage.unit: milligram 258684004
 	
    dosage.lowerBound: 25
 	
    dosage.upderBound: 25
 	
    frequency: twice daily 229799001
 	
    priority: routine 50811001

✪ metoprolol tartrate 50 mg tablet oral twice daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]
 	
    topicType: Administration 129445006
 	
    topicFocus: metoprolol tartrate 50 mg tablet oral 866514
 	
    routeOfAdministration: Oral route 26643006
 	
    dosage.unit: milligram 258684004
 	
    dosage.lowerBound: 50
 	
    dosage.upderBound: 50
 	
    frequency: twice daily 229799001
 	
    priority: routine 50811001

✪ amlodipine 5 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]
 	
    topicType: Administration 129445006
 	
    topicFocus: amlodipine 5 mg tablet 197361
 	
    routeOfAdministration: Oral route 26643006
 	
    dosage.unit: milligram 258684004
 	
    dosage.lowerBound: 5
 	
    dosage.upderBound: 5
 	
    frequency: once daily 229797004
 	
    priority: routine 50811001

Nitroglycerin
nitroglycerin 0.4 mg tablet sub-lingual every 5 minutes as needed for chest pain; maximum 3 tablets (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]
 	
    topicType: Administration 129445006
 	
    topicFocus: nitroglycerin 0.4 mg tablet 198039

routeOfAdministration: sublingual 37839007

indicationForProcedure: Chest pai 29857009

dosage.lowerBound: 0.4

dosage.upperBound: 1.2

dosage.includeLowerBound: 1

dosage.includeUpperBound: 1

dosage.unit: milligram 258684004

frequency: every 5 minutes as needed for chest pain 471000175102

priority: routine 50811001

Antiplatelet Therapy

aspirin 81 mg enteric coated tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: aspirin 81 mg enteric coated tablet 308416

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 81

dosage.upperBound: 81

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

Risk Factor Reduction

✪ atorvastatin 20 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: atorvastatin 20 mg tablet 617310

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 20

dosage.upperBound: 20

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

✪ atorvastatin 40 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: atorvastatin 40 mg tablet 617311

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 40

dosage.upperBound: 40

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

✪ simvastatin 20 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: simvastatin 20 mg tablet 312961

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 20

dosage.upperBound: 20

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

✪ simvastatin 40 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: simvastatin 40 mg tablet 198211

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 40

dosage.upperBound: 40

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

✪ rosuvastatin 5 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: rosuvastatin 5 mg tablet 859424

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 5

dosage.upperBound: 5

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

✪ rosuvastatin 10 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: rosuvastatin 10 mg tablet 859747

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 10

dosage.upperBound: 10

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

✪ rosuvastatin 20 mg tablet oral daily (routine)

actionSentence[type=elm:Instance, classType=anf:AdministrationOfMedicationRequest]

topicType: Administration 129445006

topicFocus: rosuvastatin 20 mg tablet 859751

routeOfAdministration: Oral route 26643006

dosage.lowerBound: 20

dosage.upperBound: 20

dosage.unit: milligram 258684004

frequency: once daily 229797004

priority: routine 50811001

Chapter 9. Tabular List

Terminology Service Request (TSR) Mappings

Table 9.1. Terminology Versions

Name	Identifer	Version
SNOMED CT	2.16.840.1.113883.6.96	United States Edition 20180301
RXNorm	2.16.840.1.113883.6.88	5-Mar-18
LOINC	2.16.840.1.113883.6.1	2.61

Table 9.2. Terminology References

System	Code	Display Text[a]	References[b]
RXNorm	197361	amlodipine 5 mg tablet	1
RXNorm	198039	nitroglycerin 0.4 mg tablet	1
RXNorm	198211	simvastatin 40 mg tablet	1
RXNorm	308416	aspirin 81 mg enteric coated tablet	1
RXNorm	312961	simvastatin 20 mg tablet	1
RXNorm	617310	atorvastatin 20 mg tablet	1
RXNorm	617311	atorvastatin 40 mg tablet	1
RXNorm	859424	rosuvastatin 5 mg tablet	1
RXNorm	859747	rosuvastatin 10 mg tablet	1
RXNorm	859751	rosuvastatin 20 mg tablet	1
RXNorm	866514	metoprolol tartrate 50 mg tablet oral	1
RXNorm	866924	metoprolol tartrate 25 mg tablet oral	1
SNOMED CT	102589003	atypical chest pain	1
SNOMED CT	128975004	Resting state	2
SNOMED CT	128976003	Exercise state	3
SNOMED CT	129445006	Administration	12
SNOMED CT	133936004 |Adult (person)|	Adult patients	1
SNOMED CT	16254007	Fasting lipid profile	1
SNOMED CT	229797004	once daily	9
SNOMED CT	229799001	twice daily	2
SNOMED CT	258684004	milligram	12
SNOMED CT	261802008	Gamma camera	6
SNOMED CT	26604007	Complete blood count	1
SNOMED CT	26643006	Oral route	11
SNOMED CT	278110001	x-ray chest	1
SNOMED CT	278292003	Resting echocardiogram to evaluate chest pain	3

System	Code	Display Text[a]	References[b]
SNOMED CT	29857009	Chest pain	5
SNOMED CT	312251004	coronary CTA chest to evaluate chest pain	2
SNOMED CT	312421008	Dobutamine stress myocardial perfusion imaging	6
SNOMED CT	33022008 |Hospital-based outpatient department (environment)|	Outpatient	1
SNOMED CT	35431001	Adenosine	1
SNOMED CT	35650009	Thyroid function testing	1
SNOMED CT	371806006	progressive angina symptoms in a stable patient with known CAD (if the patient is unstable based upon clinical or test results, direct physician-to-physician communication is required)	1
SNOMED CT	37839007	sublingual	1
SNOMED CT	387145002	Dobutamine	3
SNOMED CT	387371005	Dipyridamole	1
SNOMED CT	390917008	Brain natriuretic peptide	1
SNOMED CT	41801008	Coronary artery structure	2
SNOMED CT	419098001	X-ray contrast media	2
SNOMED CT	429559004	typical angina	1
SNOMED CT	430242005	Regadenoson	1
SNOMED CT	432655005	Cardiac stress state	6
SNOMED CT	467663007	Cardiovascular ultrasound imaging system	3
SNOMED CT	471000175102	every 5 minutes as needed for chest pain	1
SNOMED CT	50811001	routine	31
SNOMED CT	51185008	Thoracic structure	1
SNOMED CT	54953005	Computerized axial tomography scanner, device	2
SNOMED CT	68080007	Radiographic unit, device	1
SNOMED CT	74281007	Myocardium structure	6
SNOMED CT	80891009	Heart structure	5
SNOMED CT	86184003	Electrocardiographic monitor and recorder, device	2
SNOMED CT	89457008	Radioactive isotope	6
SNOMED CT	bd01faa8-443c-4ad6-9cb6-ea50b4d7a093	Basic metabolic profile	1

System	Code	Display Text[a]	References[b]
SNOMED CT	de405a38-1cc8-44e-f-81e7-fd1c0acf9421	Electrical activity evaluation	3
TSR	TSR-NoCode[c]	Referral to cardiology	1

[a]If a code is used multiple times in the KNART, only the display text of the first instance is shown.

[b]Count of the number of times the given code system and code pair is used in the KNART.

[c]TSR-NoCode is a placeholder indicating a code was requested, but was not provided.

Chapter 10. Behavior Symbols

Table 10.1. 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 10.2. 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 10.3. 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.

Sym-bol	Name	Definition
◇	Could	An action with this behavior may be included in the set of actions processed by the end user.
➢	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 10.4. Precheck Behavior

Sym-bol	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 10.5. Cardinality Behavior

Sym-bol	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 10.6. Item Flags

Sym-bol	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 10.7. Read Only Behavior

Sym-bol	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: Chest Pain/Coronary artery disease (CAD) Order Set Conceptual Structure Document*

[CSD] *Cardiology: Chest Pain/Coronary artery disease (CAD) Order Set Conceptual Structure Document*

[KVRpt] *Cardiology: Chest Pain/Coronary artery disease (CAD) Order Set KNART Validation Report*

Supporting Evidence

[FHS 2017] *Cardiovascular disease (10-year risk) [Internet].: Framingham Heart Study; cited 2017]. Cardiovascular Disease (10-year risk). Available from: https://www.framinghamheartstudy.org/risk-functions/cardiovascular-disease/10-year-risk.php.* (link [https://www.framinghamheartstudy.org/risk-functions/cardiovascular-disease/10-year-risk.php])

[D'Agostino 2008] *D'Agostino RB S, Vasan RS, Pencina MJ, Wolf PA, Cobain M, Massaro JM, et al. General cardiovascular risk profile for use in primary care: the Framingham Heart Study. Circulation. 2008 February 12;117(6):743-53* (link [http://circ.ahajournals.org/content/117/6/743.long])

[Fihn 2015] *Fihn SD, Blankenship JC, Alexander KP, Bittl JA, Byrne JG, Fletcher BJ, et al. 2014 ACC/AHA/AATS/PCNA/SCAI/STS focused update of the guideline for the diagnosis and management of patients with stable ischemic heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines, and the American Association for Thoracic Surgery, Preventive Cardiovascular Nurses Association, Society for Cardiovascular Angiography and Interventions, and Society of Thoracic Surgeons. J Thorac Cardiovasc Surg. 2015 March 01;149(3):5*

[Gibbons 2002] *Gibbons RJ, Balady GJ, Bricker JT, Chaitman BR, Fletcher GF, Froelicher VF, et al. ACC/AHA 2002 guideline update for exercise testing: summary article: A report of the American college of cardiology/American heart association task force on practice guidelines (committee to update the 1997 exercise testing guidelines). Circulation. 2002 October 01;106(14):1883-92.* (link [https://doi.org/10.1016/S0735-1097(02)02164-2])

[NLM 2017a] *LABEL: ASPIRIN 81 MG- aspirin tablet, coated [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=b4064039-2345-4227-b83d-54dc13a838d3.* (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=b4064039-2345-4227-b83d-54dc13a838d3])

[NLM 2017b] *LABEL: CLOPIDOGREL- clopidogrel bisulfate tablet, film coated [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=edae8df1-caf9-ff72-1304-5ae8b355f8e7.* (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=edae8df1-caf9-ff72-1304-5ae8b355f8e7])

[NLM 2017c] *LABEL: LIPITOR- atorvastatin calcium tablet, film coated [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/daily-*

med/drugInfo.cfm?setid=7fe85155-bc00-406b-b097-e8aece187a8a. (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=7fe85155-bc00-406b-b097-e8aece187a8a])

[NLM 2017d] *LABEL: METOPROLOL SUCCINATE EXTENDED-RELEASE - metoprolol succinate tablet, film coated, extended release [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=2d948600-35d8-4490-983b-918bdce488c8.* (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=2d948600-35d8-4490-983b-918bdce488c8])

[NLM 2017e] *LABEL: NITROGLYCERIN- nitroglycerin tablet [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=67bf2a15-b115-47ac-ae28-ce2dafd6b5c9.* (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=67bf2a15-b115-47ac-ae28-ce2dafd6b5c9])

[NLM 2017f] *LABEL: NORVASC- amlodipine besylate tablet [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=abd6a2ca-40c2-485c-bc53-db1c652505ed.* (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=abd6a2ca-40c2-485c-bc53-db1c652505ed])

[NLM 2017g] *LABEL: SIMVASTATIN - simvastatin tablet [Internet].: National Library of Medicine; 2017. Available from: https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=5c1c694c-4b08-469e-b538-08e69df06146.* (link [https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=5c1c694c-4b08-469e-b538-08e69df06146])

[Skinner 2010] *Skinner JS, Smeeth L, Kendall JM, Adams PC, Timmis A, Chest Pain Guideline Development Group. NICE guidance. Chest pain of recent onset: assessment and diagnosis of recent onset chest pain or discomfort of suspected cardiac origin. Heart. 2010 June 01;96(12):974-8.* (link [http://heart.bmj.com/content/96/12/974.long])