

Cardiology: Electrophysiology (EP): Pacemaker/Implantable cardioverter-defibrillator (ICD) Generator Change Order Set

Order Set: Conceptual Structure

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

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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 11, 2018	Published
March 28, 2018	Published
March 28, 2018	Reviewed
February 8, 2018	Created

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	777b989f-24a2-522b-a22e-84c137e6b2a9	B11

Artifact Applicability

Table 4. Applicability Foci, Description and Codes

Focus	Description	Code System	Code	Value Set	Value Set Version
PatientAgeGroup	Adult patients			N/A	N/A
ClinicalVenue	Outpatient			N/A	N/A
ClinicalFocus	Previously received an ICD, CRT, or a similar device			N/A	N/A
ClinicalFocus	Is candidate for generator change			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

No externalData expression definitions and no trigger definitions are present.

Chapter 2. Expression Definitions

No expression definitions are present.

Chapter 3. Consults and Referrals

Electrophysiology generator change consult order.	
# Referral to electrophysiology for generator change	
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]	
statementType: Precoordinated Expression 385644000 Requested (qualifier value)	
topic: Precoordinated Expression 1291000205108 Referral to electrophysiology service (procedure)	
purpose[0]: Postcoordinated Expression [277132007 Therapeutic procedure (procedure)] ->(363702006 Has focus (attribute))->[1331000205100 Replacement of pulse generator of implantable cardioverter defibrillator (procedure)]	
# prompt: Operative report for device placement	
response: String (Single)	
# prompt: Currently implanted device interrogation report	
response: String (Single)	
Goal of Consult	
◆ prompt: Consult Goal:	
response: Code (Single)	
response range: EnumerationConstraint (List)	
item: Provide recommendation and return to Primary Care Provider (PCP) for therapy.	
item: Start treatment and return to PCP for follow up and maintenance.	
item: Start treatment, monitor for effect and when on stable therapy return to PCP.	
item: Provide recommendations and treat as long as necessary (or indefinitely).	
Consult Specialty: Electrophysiology	
Priority: Routine	
# prompt: Ordering Physician/Provider Name	
response: String (Single)	
# prompt: Ordering Physician/Provider Service/Section	
response: String (Single)	
# prompt: Ordering Physician/Provider Telephone Number	
response: String (Single)	
# prompt: Ordering Physician/Provider Pager	
response: String (Single)	
# prompt: Information required by receiving facility	
response: String (Single)	

Chapter 4. Imaging and Electrocardiogram

Consider ordering prior to the electrophysiology consultation. Resting 12-lead electrocardiogram is required if it has not been obtained within the past two months. Resting echocardiogram and chest x-ray are required if they have not been obtained within the past six months.

Resting 12-lead electrocardiogram to evaluate for antiarrhythmic benefit of previously implanted ICD device.

```
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 447113005 |12 lead electrocardiogram at rest (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[698247007 |Cardiac arrhythmia (disorder)]
    purpose[1]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[395218007 |Implantation of internal cardiac defibril-
    lator (procedure)]
```

Resting 12-lead electrocardiogram to evaluate for antiarrhythmic benefit of previously implanted pac-
er device.

```
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 447113005 |12 lead electrocardiogram at rest (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[307280005 |Implantation of cardiac pacemaker (pro-
    cedure)]
    purpose[1]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[698247007 |Cardiac arrhythmia (disorder)]
```

Resting 12-lead electrocardiogram to evaluate for antiarrhythmic benefit of previously implanted
CRT device.

```
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 447113005 |12 lead electrocardiogram at rest (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[41eae47f-3038-4b7b-b36f-d26521aaec56 |Implanta-
    tion of cardiac resynchronization therapy implantable pacemaker (procedure)]
    purpose[1]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[698247007 |Cardiac arrhythmia (disorder)]
```

Echocardiogram to evaluate for antiarrhythmic benefit of previously implanted ICD device.

```
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 40701008 |Echocardiography (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[395218007 |Implantation of internal cardiac defibril-
    lator (procedure)]
```

```

    purpose[1]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[698247007 |Cardiac arrhythmia (disorder)]
# Echocardiogram to evaluate for antiarrhythmic benefit of previously implanted pacer device.
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 40701008 |Echocardiography (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[307280005 |Implantation of cardiac pacemaker (pro-
    cedure)]
    purpose[1]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[698247007 |Cardiac arrhythmia (disorder)]
# X-ray chest to evaluate for antiarrhythmic benefit of previously implanted ICD device.
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 399208008 |Plain chest X-ray (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[395218007 |Implantation of internal cardiac defibril-
    lator (procedure)]
# X-ray chest to evaluate for antiarrhythmic benefit of previously implanted CRT device.
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 399208008 |Plain chest X-ray (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[1301000205107 |Implantation of cardiac resynchro-
    nization therapy implantable pacemaker (procedure)]
# X-ray chest to evaluate for antiarrhythmic benefit of previously implanted pacer device.
actionSentence[type=elm:Instance, classType=anf:ClinicalStatement]
    statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|
    topic: Precoordinated Expression 399208008 |Plain chest X-ray (procedure)|
    purpose[0]: Postcoordinated Expression [386053000 |Evaluation procedure (procedure)] -
    >(363702006 |Has focus (attribute))->[307280005 |Implantation of cardiac pacemaker (pro-
    cedure)]

```

Chapter 5. Laboratory Tests

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

Comprehensive metabolic panel

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

statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|

topic: Precoordinated Expression 1411000205104 |Comprehensive metabolic panel (procedure)

Complete blood count

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

statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|

topic: Precoordinated Expression 26604007 |Complete blood count (procedure)|

Brain natriuretic peptide

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

statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|

topic: Precoordinated Expression 390917008 |Brain natriuretic peptide measurement (procedure)|

Digoxin level

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

statementType: Precoordinated Expression 385644000 |Requested (qualifier value)|

topic: Precoordinated Expression 25514001 |Digoxin measurement (procedure)|

Chapter 6. Tabular List

Terminology Service Request (TSR) Mappings

Table 6.1. Terminology Versions

Name	Identifier	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 6.2. Terminology References

System	Code	Display Text ^a	References ^b
SNOMED CT	1291000205108 Referral to electrophysiology service (procedure)	Precoordinated Expression	1
SNOMED CT	1411000205104 Comprehensive metabolic panel (procedure)	Precoordinated Expression	1
SNOMED CT	25514001 Digoxin measurement (procedure)	Precoordinated Expression	1
SNOMED CT	26604007 Complete blood count (procedure)	Precoordinated Expression	1
SNOMED CT	385644000 Requested (qualifier value)	Precoordinated Expression	13
SNOMED CT	390917008 Brain natriuretic peptide measurement (procedure)	Precoordinated Expression	1
SNOMED CT	399208008 Plain chest X-ray (procedure)	Precoordinated Expression	3
SNOMED CT	40701008 Echocardiography (procedure)	Precoordinated Expression	2
SNOMED CT	447113005 12 lead electrocardiogram at rest (procedure)	Precoordinated Expression	3
SNOMED CT	[277132007 Therapeutic procedure (procedure)] -(363702006 Has focus (attribute))>[1331000205100 Replacement of pulse generator of implantable cardioverter defibrillator (procedure)]	Postcoordinated Expression	1
SNOMED CT	[386053000 Evaluation procedure (proce-	Postcoordinated Expression	1

System	Code	Display Text ^a	References ^b
	dure)] -(363702006 Has focus (at- tribute))-[1301000205107 Implantation of cardiac resynchronization thera- py implantable pacemaker (procedure)]		
SNOMED CT	[386053000 Evaluation procedure (procedure)] - >(363702006 Has focus (attribute))-[307280005 Implantation of cardiac pacemaker (procedure)]	Postcoordinated Expression	3
SNOMED CT	[386053000 Evaluation procedure (procedure)] - >(363702006 Has focus (attribute))-[395218007 Implantation of internal cardiac defibrillator (pro- cedure)]	Postcoordinated Expression	3
SNOMED CT	[386053000 Evalua- tion procedure (proce- dure)] -(363702006 Has focus (at- tribute))-[41eae47f-3038-4b7b- b36f-d26521aac56 Im- plantation of cardiac resyn- chronization therapy im- plantable pacemaker (pro- cedure)]	Postcoordinated Expression	1
SNOMED CT	[386053000 Evaluation procedure (procedure)] - >(363702006 Has focus (attribute))-[698247007 Cardiac arrhythmia (disor- der)]	Postcoordinated Expression	5

^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 7. Behavior Symbols

Table 7.1. Group Organizational Behavior

Sym- bol	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 7.2. Group Selection Behavior

Sym- bol	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 7.3. Required Behavior

Sym- bol	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 7.4. 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 7.5. 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 7.6. 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 7.7. 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: Electrophysiology (EP) Implanted Cardiac Devices Clinical Content White Paper*

[CSD] *Cardiology: Electrophysiology (EP): Pacemaker/Implantable cardioverter-defibrillator (ICD) Generator Change Order Set Conceptual Structure Document*

[KVRpt] *Cardiology: Electrophysiology (EP): Pacemaker/Implantable cardioverter-defibrillator (ICD) Generator Change Order Set KNART Validation Report*

Supporting Evidence

[Al-Khatib 2011] Al-Khatib SM, Hellkamp A, Curtis J, et al. Non-Evidence-Based ICD Implantations in the United States. *JAMA*. 2011;305(1):43-49 (link [<https://doi.org/10.1001/jama.2010.1915>])

[Epstein 2008] Epstein AE, DiMarco JP, Ellenbogen KA, et al. ACC / AHA / HRS 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm Abnormalities: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines [Writing Committee to Revise the ACC / AHA /National Association for Sport and Physical Education (NASPE) 2002 Guideline Update for Implantation of Cardiac Pacemakers and Antiarrhythmia Devices]: developed in collaboration with the American Association for Thoracic Surgery and Society of Thoracic Surgeons. *Circulation*. 2008;117(21):e350-e408 (link [<https://doi.org/10.1016/j.hrthm.2008.04.014>])

[Hess 2013] Hess PL, Grau-Sepulveda MV, Hernandez AF, et al. Get with The Guidelines Steering Committee and Hospitals. Age differences in the use of implantable cardioverter-defibrillators among older patients hospitalized with heart failure. *J Cardiovasc Electrophysiol*. 2013;24(6):664-671 (link [<https://doi.org/10.1111/jce.12100>])

[Hess 2016] Hess PL, Hernandez AF, Bhatt DL, et al. Sex and Race/Ethnicity Differences in Implantable Cardioverter-Defibrillator Counseling and Use Among Patients Hospitalized with Heart Failure: Findings from the Get with The Guidelines-Heart Failure Program. *Circulation*. 2016;134(7):517-526 (link [<https://doi.org/10.1161/CIRCULATIONAHA.115.021048>])

[Owens 2011] Owens DK, Qaseem A, Chou R, Shekelle P, Clinical Guidelines Committee of the American College of Physicians. A High-value, cost-conscious health care: concepts for clinicians to evaluate the benefits, harms, and costs of medical interventions. *Ann Intern Med*. 2011;154(3):174-180 (link [<https://doi.org/10.7326/0003-4819-154-3-201102010-00007>])

[Russo 2013] Russo AM, Stainback RF, Bailey SR, et al. American College of Cardiology Foundation (ACCF)/HRS / AHA / ASE / HFSA / SCAI / SCCT / SCMR 2013 appropriate use criteria for implantable cardioverter-defibrillators and cardiac resynchronization therapy: a report of the American College of Cardiology Foundation appropriate use criteria task force, Heart Rhythm Society, American Heart Association, American Society of Echocardiography, Heart Failure Society of America, Society for Cardiovascular Angiography and Inter-

ventions, Society of Cardiovascular Computed Tomography, and Society for Cardiovascular Magnetic Resonance. J Am Coll Cardiol. 2013;61(12):1318-1368 (link [<https://doi.org/10.1016/j.hrthm.2013.01.008>])