

ENTERING CYPRESS TEST PATIENTS INTO THE VISTA EHR FOR MEANINGFUL USE STAGE 2 TESTING

By: Nancy Vining Van Ness

In order for the Vista EHR to be certified for Meaningful Use Stage 2, it must be able to meet the requirements for entering test patients from the Cypress Testing and Certification Tool and performing the calculations that determine if the test patient record fulfills the quality measure that is being tested with each record. A comprehensive analysis of test patients shows that in order to be certified, the Vista EHR is not currently capable of entering a single patient in the format required by the test because many of the codes needed are from code systems which it does not use. The majority of those codes, though not all of them, are from the SNOMED system. A comprehensive analysis of a composite test patient from the Cypress site shows the extent of use of these codes not currently available to enter patients in the Vista system.

In addition to generating test patients, the Cypress downloadable "Bundle" includes descriptions of the quality measures (NQM), and other information necessary for this analysis. There is a link on that site to the code lists, related to the NQMs, that can be downloaded from the National Library of Medicine. The version of the code lists that applied to test patient Ricky Todd included 820 lists. The next version of Cypress used a revised list of 810 code lists. These lists can be found at the Value Set Authority of the National Library of Medicine, which is referenced at the end of this report.

The analysis in this report was based on the test patient record for Ricky Todd, one of the composite test patients from an early version of Cypress. These test patient records allowed the EHR to test for all the quality measures with one test. The resulting test patients, with entries for treatment of diseases for men, women, newborns, children, geriatric patients, and a wide range of conditions, were wildly improbable. Though convenient for analysis like this, they were determined not to be appropriate for testing and were discontinued for that purpose. A copy of the complete test patient record is included in the support documents listed at the end of this report.

Below is the first part of Encounter 1 of the Ricky Todd test patient record. Since this is a composite patient for testing all the measures, it contains 73 different Encounters. Some of the issues that are relevant to what must be done to make the Vista EHR capable of meeting the requirements for MU Stage 2 are evident in this short section of one Encounter.

Encounter 1

Encounters

| Description | Codes | Time | Status | Results | Fields |
|-------------|-------|------|--------|---------|--------|
|-------------|-------|------|--------|---------|--------|

| Description | Codes | Time | Status | Results | Fields |
|--|-------------------|---|-----------|---------|--------|
| Encounter, Performed: Emergency Department Visit (Code List: 2.16.840.1.113883.3.464.1003.101.12.1010) | CPT: 99281 | May 18th, 1974 00:09 - May 18th, 1974 15:33 | performed | | |

Laboratory Tests

| Description | Codes | Time | Status | Results | Fields |
|--|-----------------------|---|--------|---------|--------|
| Laboratory Test, Result: Prostate Specific Antigen Test (Code List: 2.16.840.1.113883.3.526.3.401) | LOINC: 10508-0 | December 16th, 1973 01:48 - December 16th, 1973 11:14 | | | |

Procedures

| Description | Codes | Time | Status | Results | Fields |
|---|---|---|-----------|---------|--------|
| Procedure, Performed: Primary THA Procedure (Code List: 2.16.840.1.113883.3.464.1003.198.12.1006) | SNOMED-CT: 15163009 CPT: 27130 HCPCS: S2118 | December 16th, 1973 16:53 - December 16th, 1973 23:17 | performed | | |
| Procedure, Performed: Cesarean Section (Code List: 2.16.840.1.113883.3.117.1.7.1.282) | ICD-10-PCS: 10D00Z0 SNOMED-CT: 11466000 ICD-9-CM: 74.0 | December 21st, 1973 07:55 - December 21st, 1973 12:31 | performed | | |

Diagnoses

| Description | Codes | Time | Status | Results | Fields |
|-------------|-------|------|--------|---------|--------|
|-------------|-------|------|--------|---------|--------|

| Description | Codes | Time | Status | Results | Fields |
|--|---------------------------------|---|--------|---------|--------|
| Diagnosis, Active: Allergy to Tamoxifen or Aromatase Inhibitor Therapy (Code List: 2.16.840.1.113883.3.526.3.1317) | SNOMED-CT: 293790002 | January 24th, 1974 01:17 - January 24th, 1974 20:15 | active | | |

The presence in this short section of Encounter 1 shows a test for prostate specific antigen and a Cesarean section, an example of those unrealistic situations that occur from the fact of testing all the measures with a single patient. It is possible, however to look at the entries on this record for general test information that is very helpful if one suspends reality about this test patient.

In the first entry, Code List 2.16.840.1.113883.3.464.1003.101.12.1010, which contains CPT code 99281, indicates an ED visit and the date. The VistA EHR can enter data with CPT codes.

The Loinc code for the laboratory test result might or might not be available in the VistA system. An analysis of Loinc codes as the only ones for entering test patient data is referenced below.

In the Procedures section that follows are things listed with codes from several systems which include CPT and ICD-9 codes that VistA can enter.

The first Diagnosis for this test patient record is of Active Allergy to Tamoxifen or Aromatase Inhibitor Therapy (Code List: 2.16.840.1.113883.3.526.3.1317). The only code for entry is a SNOMED code from that code list. This is the first of many entries where the only code to meet the test requirements is a SNOMED code.

Below is a section of the text description of this code list.

```
ID^2.16.840.1.113883.3.526.3.1317
|   : displayName^Allergy to Tamoxifen or Aromatase Inhibitor Therapy
|   : version^20121025
|   | ns0:ConceptList
|       Code      System      Description
|       293790002  SNOMEDCT    Tamoxifen allergy (disorder)
|   | ns0:Source American Medical Association-convened Physician
|   | ns0:Definition (2.16.840.1.113883.3.526.2.1383:Allergy to
|   | ns0:Type Grouping
|   | ns0:Binding Dynamic
|   | ns0>Status Active
|   | ns0:RevisionDate 2012-07-30
```

CATEGORY: Condition/Diagnosis/Problem
 CMS eMeasure ID: CMS140v1
 Endorsed By: National Quality Forum
 GUID: ac639794-cb3f-4f4f-8fa6-680300d5ed4e
 Meaningful Use Measures: CY 2014 EP
 Measure Developer: American Medical Association-convened Physician Consortium for Performance Improvement(R) (AMA-PCPI)
 Measure Steward: American Medical Association-convened Physician Consortium for Performance Improvement(R) (AMA-PCPI)
 Measure Type: PROCESS
NQF Number: 0387
 SHEETNAME: Onc_Breast_Cancer
 eMeasure Copyright: Copyright 2012 American Medical Association, American Society of Clinical Oncology, and National Comprehensive Cancer Network. All Rights Reserved.

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This code list contains only one code, a SNOMED-CT code. Any entry with this code list will mean that SNOMED code must be entered to meet the requirements for certification. There are many entries among the 73 encounters of the Ricky Todd test patient record for which the code list includes only one or more SNOMED codes and none from other systems.

Although the VistA EHR can enter medications with RxNorm, another kind of entry from the Ricky Todd Cypress test patient record illustrates a kind of entry that will need a SNOMED code in addition. Below is a section from Encounter 5 on the Ricky test patient record.

Medications

| Description | Codes | Time | Status | Results | Fields |
|--|---------------------------------|---|--------------|---------|---|
| Medication, Administered: Hospital measures-IV Hysterectomy-Antibiotics (Code List: 2.16.840.1.113883.3.666.5.729) | RxNorm: 204929 | December 31st, 1975 17:20 - January 1st, 1976 04:38 | administered | | Route: code_system: SNOMED-CT code: 255560000 title: |
| Medication, Ordered: Leucovorin (Code List: 2.16.840.1.113883.3.464.1003.196.12.1205) | RxNorm: 105691 | January 21st, 1976 14:42 - January 22nd, 1976 13:25 | ordered | | |

| Description | Codes | Time | Status | Results | Fields |
|--|---------------------------------|--|--------------|---------|---|
| Not Done: Medication, Administered: Warfarin (Code List: 2.16.840.1.113883.3.117.1.7.1.232) | RxNorm: 855288 | February 13th, 1976 11:24 - February 13th, 1976 19:14 | administered | | Negation Reason: code_system: SNOMED- CT code: 105480006 |

This part of the medications section shows two examples of a prevalent kind of entry on the Cypress test. The first shows an entry of a medication with an RxNorm code, from code list 2.16.840.1.113883.3.666.5.729 which only includes RxNorm codes.

Below is the list of codes from the description of that code list:

```
ID^2.16.840.1.113883.3.666.5.729
|   : displayName^Hospital measures-IV Hysterectomy-Antibiotics
|   : version^20130401
|   | ns0:ConceptList
|       Code      System      Description
204929  RXNORM      Cefuroxime 15 MG/ML Injectable Solution
204931  RXNORM      Cefotetan 10 MG/ML Injectable Solution
240984  RXNORM      Ampicillin 100 MG/ML / Sulbactam 50 MG/ML Injectable
Solution
245239  RXNORM      Cefuroxime 250 MG/ML Injectable Suspension
308208  RXNORM      Ampicillin 250 MG/ML / Sulbactam 125 MG/ML Injectable
Solution
309051  RXNORM      Cefazolin 10 MG/ML Injectable Solution
309052  RXNORM      Cefazolin 20 MG/ML Injectable Solution
309053  RXNORM      Cefazolin 225 MG/ML Injectable Solution
309069  RXNORM      Cefotetan 100 MG/ML Injectable Solution
309070  RXNORM      Cefotetan 40 MG/ML Injectable Solution
309071  RXNORM      Cefotetan 500 MG/ML Injectable Solution
309072  RXNORM      Cefoxitin 200 MG/ML Injectable Solution
309074  RXNORM      Cefoxitin 20 MG/ML Injectable Solution
309075  RXNORM      Cefoxitin 180 MG/ML Injectable Solution
309099  RXNORM      Cefuroxime 90 MG/ML Injectable Solution
309100  RXNORM      Cefuroxime 30 MG/ML Injectable Solution
309101  RXNORM      Cefuroxime 95 MG/ML Injectable Solution
313920  RXNORM      Cefazolin 200 MG/ML Injectable Solution
313925  RXNORM      Cefotetan 20 MG/ML Injectable Solution
313929  RXNORM      Cefazolin 330 MG/ML Injectable Solution
342904  RXNORM      Cefoxitin 40 MG/ML Injectable Solution
343049  RXNORM      Cefotetan 400 MG/ML Injectable Solution
387065  RXNORM      Cefuroxime 50 MG/ML Injectable Solution
387066  RXNORM      Cefuroxime 60 MG/ML Injectable Solution
562058  RXNORM      Cefoxitin 95 MG/ML Injectable Solution
562062  RXNORM      Cefazolin 250 MG/ML Injectable Solution
796301  RXNORM      Cefazolin 100 MG/ML Injectable Solution
854220  RXNORM      Cefazolin 40 MG/ML Injectable Solution
895924  RXNORM      Cefotetan 200 MG/ML Injectable Solution
904288  RXNORM      Cefuroxime 100 MG/ML Injectable Solution
993109  RXNORM      Ampicillin 20 MG/ML / Sulbactam 10 MG/ML Injectable
Solution
997632  RXNORM      Cefuroxime 225 MG/ML Injectable Suspension
.....
```

CATEGORY: Medication
CMS eMeasure ID: CMS172v3
Endorsed By: National Quality Forum
GUID: feea3922-f61f-4b05-98f9-b72a11815f12
Meaningful Use Measures: FY 2014 EH
Measure Developer: Oklahoma Foundation for Medical Quality
Measure Steward: Centers for Medicare & Medicaid Services
Measure Type: PROCESS
NQF Number: 0528
SHEETNAME: SCIP Antibiotic Selection
...

Any of these RxNorm codes might appear in a test patient record on the MU Stage 2 test. Those codes are currently used by the VistA EHR to enter patients.

The problem for this entry and the second one after it is the code in the Fields column, the far right one. Each of them includes an additional code, a different SNOMED code in each entry.

As has been seen from samples of code list descriptions above, the code list data gives the NMQs being tested. These codes in the far right hand Fields column don't usually have a code list. The description of the quality measure includes the code lists which support that measure. Below is a link to a site where the descriptions of the EH, that is the eligible hospital measures and the EP or eligible provider measures for out patients can be found. Requirements for the calculations are specified there as well as the code lists that give the data elements, which are what is important for this analysis

<http://download.opensourcevista.net/downloads/QualityMeasures2014/>

Quality measure 0528, which is indicated for this entry from the code list 2.16.840.1.113883.3.666.5.729 used to enter it as was seen above, indicates one or more Route codes. Below is a section of the description of NQM 0528 which gives the code lists. Since there are both hospital and outpatient sets of quality measures, this one is clearly in the EH, hospital, list.

Below is a section of the code lists from quality measure 0528.

Data criteria (QDM Data Elements)

- "Device, Applied: Hospital measures-Pacemaker or implantable defibrillator device" using "Hospital measures-Pacemaker or implantable defibrillator device ICD-9 Value Set (2.16.840.1.113883.3.666.5.1086) "
- "Diagnosis, Active: Hospital Measures - Any infection" using "Hospital Measures - Any infection Grouping Value Set (2.16.840.1.113883.3.666.5.696) "
- "Diagnosis, Active: Hospital Measures-Infection diagnosis" using "Hospital Measures-Infection diagnosis Grouping Value Set (2.16.840.1.113883.3.666.5.695) "

- "Diagnosis, Active: Hospital Measures-MRSA Colonization or Infection" using "Hospital Measures-MRSA Colonization or Infection ICD-9 Value Set (2.16.840.1.113883.3.666.5.716)"
- "Encounter, Performed: Encounter Inpatient" using "Encounter Inpatient SNOMED-CT Value Set (2.16.840.1.113883.3.666.5.307)"
- "Encounter, Performed: Hospital Measures-Nursing home or extended care facility" using "Hospital Measures-Nursing home or extended care facility SNOMED-CT Value Set (2.16.840.1.113883.3.666.5.717)"
- "Intervention, Performed: Hospital Measures-Chronic Wound Care" using "Hospital Measures-Chronic Wound Care SNOMED-CT Value Set (2.16.840.1.113883.3.666.5.719)"
- "Medication, Active: Hospital measures-IV, IM, PO Antimicrobial medications" using "Hospital measures-IV, IM, PO Antimicrobial medications RxNorm Value Set (2.16.840.1.113883.3.666.5.693)"
- "Medication, Active: Hospital Measures-PO Colon and Hysterectomy Antibiotics-Metronidazole" using "Hospital Measures-PO Colon and Hysterectomy Antibiotics-Metronidazole RxNorm Value Set (2.16.840.1.113883.3.666.5.1088)"
- "Medication, Active: Hospital measures-PO Erythromycin" using "Hospital measures-PO Erythromycin RxNorm Value Set (2.16.840.1.113883.3.666.5.1970)"
- "Medication, Active: Hospital measures-PO Neomycin sulfate" using "Hospital measures-PO Neomycin sulfate RxNorm Value Set (2.16.840.1.113883.3.666.5.1953)"
- "Medication, Administered: Hospital measures-IV, IM, PO Antimicrobial medications" using "Hospital measures-IV, IM, PO Antimicrobial medications RxNorm Value Set (2.16.840.1.113883.3.666.5.693)"
- "Medication, Administered: Hospital Measures-IV Aminoglycosides" using "Hospital Measures-IV Aminoglycosides RxNorm Value Set (2.16.840.1.113883.3.666.5.727)"
- "Medication, Administered: Hospital measures-IV arthroplasty and colon antibiotics" using "Hospital measures-IV arthroplasty and colon antibiotics RxNorm Value Set (2.16.840.1.113883.3.666.5.732)"
- "Medication, Administered: Hospital Measures-IV Aztreonam" using "Hospital Measures-IV Aztreonam RxNorm Value Set (2.16.840.1.113883.3.666.5.728)"
- "Medication, Administered: Hospital Measures-IV Cardiac or Vascular Antibiotics" using "Hospital Measures-IV Cardiac or Vascular Antibiotics RxNorm Value Set (2.16.840.1.113883.3.666.5.768)"
- "Medication, Administered: Hospital Measures-IV Clindamycin" using "Hospital Measures-IV Clindamycin RxNorm Value Set (2.16.840.1.113883.3.666.5.893)"
- "Medication, Administered: Hospital Measures-IV Colon-Antibiotics" using "Hospital Measures-IV Colon-Antibiotics RxNorm Value Set (2.16.840.1.113883.3.666.5.724)"
- "Medication, Administered: Hospital Measures-IV Ertapenem" using "Hospital Measures-IV Ertapenem RxNorm Value Set (2.16.840.1.113883.3.666.5.725)"
- "Medication, Administered: Hospital Measures-IV Hysterectomy and Colon Quinolones" using "Hospital Measures-IV Hysterectomy and

Colon Quinolones RxNorm Value Set
(2.16.840.1.113883.3.666.5.767) "

- "Medication, Administered: Hospital measures-IV Hysterectomy-Antibiotics" using "Hospital measures-IV Hysterectomy-Antibiotics RxNorm Value Set (2.16.840.1.113883.3.666.5.729) "

...

This section includes the code list 2.16.840.1.113883.3.666.5.729 that was used to enter this medication in the Ricky test patient record. At the end of this list are found three route codes:

- Attribute: "Route: Hospital measures-Route IV" using "Hospital measures-Route IV SNOMED-CT Value Set (2.16.840.1.113883.3.666.5.1108) "
- Attribute: "Route: Hospital measures-Route IV, oral or IM" using "Hospital measures-Route IV, oral or IM SNOMED-CT Value Set (2.16.840.1.113883.3.666.5.1111) "
- Attribute: "Route: Hospital measures-Route oral" using "Hospital measures-Route oral SNOMED-CT Value Set (2.16.840.1.113883.3.666.5.1072) "

Since this is clearly marked "Hospital measures-IV Hysterectomy-Antibiotics" in the entry, the code list 2.16.840.1.113883.3.666.5.1108 would appear to be the correct one for this code. That code list shows the SNOMED code 255560000 to be there and below the codes indicates that the list supports quality measure 0528, confirming the choice for this entry.

```
ID^2.16.840.1.113883.3.666.5.1108
| : displayName^Hospital measures-Route IV
| : version^20121025
| | ns0:ConceptList
| |   Code      System      Description
| |   255560000 SNOMEDCT    Intravenous (qualifier value)
| |   385228000 SNOMEDCT    Intravenous infusion (qualifier value)
| |   418114005 SNOMEDCT    Intravenous central route (qualifier value)
| |   419993007 SNOMEDCT    Intravenous peripheral route (qualifier value)
| |   447963004 SNOMEDCT    Intravenous push technique (qualifier value)
| |   449137004 SNOMEDCT    Intravenous piggyback technique (qualifier value)
| |   47625008  SNOMEDCT    Intravenous route (qualifier value)
| | ns0:Source Oklahoma Foundation for Medical Quality
| | ns0:Type Extensional
| | ns0:Binding Dynamic
| | ns0:Status Active
| | ns0:RevisionDate 2012-08-16
```

The second medication after this one is marked **Not Done** in bold in the test patient record. Many of these occur throughout the Ricky test record. A SNOMED code for the **Negation Reason** occurs in the Fields column for these entries. For this entry, which used code list 2.16.840.1.113883.3.117.1.7.1.232 a number of measures are indicated in that code list: ADE and TTR, 0375, 0376, 0373, 0371, 0372.

For the quality measures that are tested with this code list, some have no indication that this medication was not administered; there is no code list in the data criteria for patient refusal of this medication. These include the ADE Prevention and Time in Therapeutic Range quality measure (ADE and TTR) and quality measure 0375.

For those where the code lists indicate that the medication was not in fact administered-- 0376, 0373, 0371, 0372-- the code list 2.16.840.1.113883.3.117.1.7.1.93 was the one for Patient Refusal.

This same reason, Patient Refusal, as with some of the other attributes indicated with SNOMED codes in the Fields column, appears in more than one code list in different quality measure data sets. The quality measures, as shown above, were found with the original code list used to enter the clinical data from the test patient record. A cross check of the code lists for these attribute codes in the Fields column, once they are located, will indicate the quality measures for which it is tested as well.

In the entire Ricky test patient record there are 409 times when a SNOMED code is the only one that will meet the requirements of the test. A revision of the Cypress test tool has created new test patients. Though a comprehensive analysis of them is not presented here, a cursory examination of some of the new test patients revealed that there may be even more entries where only a SNOMED code is used. In some instances where the code list for the entry included the ICD-9 codes which can be used to enter data in the VistA EHR, only the SNOMED code was allowed in the revised tests. Those SNOMED codes are not included in this analysis which is of SNOMED code only entries on the Ricky test patient record, so there are likely to be more in the new patient records used for testing. Below is an instance of this difference between the Ricky Todd test patient record and the Ellen Arnold test patient record from a newer version of the test.

| Ricky Todd Test Patient Record | Ellen Arnold Test Patient Record |
|--|---|
| Procedure, Performed: Cesarean Section (Code List: 2.16.840.1.113883.3.117.1.7.1.282) ICD-10-PCS: 10D00Z0 SNOMED-CT: 11466000 ICD-9-CM: 74.0 | Procedure, Performed: Cesarean Section (Code List: 2.16.840.1.113883.3.117.1.7.1.282) SNOMED-CT: 11466000 |

The same SNOMED code is a choice for entry in the Ricky Todd test patient, but so are ICD-9 and ICD-10 codes. In the Ellen Arnold patient from the most recent version of the Cypress test tool, the only code is that SNOMED code.

It is evident that the VistA EHR must be able to enter SNOMED codes in order to be certified for Meaningful Use Stage 2. Much is at stake for users of the VistA EHR in the United States.

Supporting Documentation and References:

For the Cypress testing site:
<http://cypress2.vistaewd.net>

For the Value Set Authority Center, source of all of the Code Lists:
<https://vsac.nlm.nih.gov/>

For the Ricky Todd and Ellen Arnold test patient records:
https://github.com/glilly/cqmttest/tree/master/cypress2-2/qrda/Analysis_Cyress2-2

For the Code Lists used in this analysis:
https://github.com/glilly/cqmttest/tree/master/cypress2-2/qrda/Analysis_Cyress2-2

For the Quality Measures:
<http://download.opensourcevista.net/downloads/QualityMeasures2014/>

For the documents below:
https://github.com/glilly/cqmttest/tree/master/cypress2-2/qrda/Analysis_Cyress2-2

ENTRIES WITH ONLY SNOMED CODES FOR TEST PATIENT RICKY TODD
An analysis of every instance with quality measure tested indicated.
report_snomed_only.doc

SNOMED ONLY
A list of all the SNOMED codes on the Ricky Todd test patient record that are the only possibility with the Code Lists in which they appear.
discreet_snomed_ricky.doc

SNOMED ONLY CODES ON SEVERAL ENTRIES FROM RICKY TODD AND MORE RECENT TEST PATIENTS
An analysis of test patient entries on Ricky and an more recent test patient Ellen Arnold in which only the SNOMED code from the Code List is used in the Ellen test patient record where ICD-9 and ICD-10 codes were possibilities in the earlier Ricky test patient.
most_recent_patients_Ricky.doc

For the LOINC codes report:
https://github.com/glilly/cqmttest/tree/master/cypress2-2/qrda/Analysis_Cyress2-2
LoincMU_test.doc
LoincMU_test.pdf