EHRs, Interoperability and Quality Reporting

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Encore CE!
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Trends in Clinical Informatics: A Nursing Perspective
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If you have any questions, concerns or need additional information, contact NENIC’s Program Planning Chair (program@nenic.org). All feedback will be addressed in a timely manner.
At the end of this independent study module, you will be able to define:

- One national initiative related to quality reporting from HER’s as directed by meaningful use criteria.
- One relationship between informatics standards, care documentation, quality reporting and evidenced based nursing practice.
- The components of the knowledge Model for Nursing Informatics.
INTRODUCING

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Christine A. Hartley Centennial Professor, (Retired)

University of Kansas School of Nursing

EHRs, Interoperability and Quality Reporting
“If nursing data is organized in a standard way, it can also be shared and compared across regional or national databases to identify trends, report outcomes, and research new opportunities to improve nursing practice.”

- TIGER Initiative
THE TIPPING POINT: ENSURING NURSING’S ROLE IN HEALTH IT

- Result of some nurses talking about the future of meaningful use at a conference in July 2010
- Tipping Point invitational meeting in August 2010, funded by University of Colorado College of Nursing and Thomson Reuters
- Tipping Point 2 and 3 sponsored by ANA
- Engaged in strategic planning
  + Where do we need to be
  + Who do we know who is there
  + Who can we place there
A MEANINGFUL ROLE FOR NURSING

- Nursing documentation can be a tool to transform practice and outcomes
- Clinical data needs to be in a discrete format for electronic data exchange
- Need to transition from expensive retrospective chart reviews to quality reporting as a byproduct of nursing practice
- Secondary use of data is a by-product of patient care documentation
A REPLICABLE PROCESS TO CREATE INTEROPERABILITY

1. Evaluate the Evidence
2. Leverage Clinical Expertise
3. Develop Optimum Clinical Data Sets
4. Harmonize the Data
5. Map to Reference Terminologies
6. Formalize the Model in UML
7. Link to HL7 with a CDA
8. Validate the Model

Chow & Beene, 2011
A REPLICABLE PROCESS TO CREATE INTEROPERABILITY

1. Evaluate the Evidence
2. Leverage Clinical Expertise
3. Develop Optimum Data Sets
   a. Clinical data
   b. Quality Metrics
4. Harmonize the Data
5. Map to Reference Terminologies
6. Formalize the Model in UML
7. Link to HL7 with a CDA
8. Validate the Model

Warren adaption of Chow & Beene, 2011
STEP 1: EVALUATE THE BASE OF EVIDENCE

- Literature reviews
  - Conducted by NDNQI and their Pressure Ulcer Panel of Experts

- National Quality Forum (NQF)
  - Review requirements of the Data Quality Model
  - Review requirements of the eMeasures specifications

- Strategies for automatically generating these reports from data that is documented during the course of care delivery within the EHR
The Quality Data Model (QDM) is an “information model” that clearly defines concepts used in quality measures and clinical care and is intended to enable automation of electronic health record (EHR) use. It provides a way to describe clinical concepts in a standardized format so individuals (i.e., providers, researchers, measure developers) monitoring clinical performance and outcomes can clearly and concisely communicate necessary information. The QDM describes information so that EHR and other clinical electronic system vendors can consistently interpret and easily locate the data required.
Electronic Specifications

What are Electronic Specifications?

In order to report clinical quality measures (CQMs) from an electronic health record (EHR), electronic specifications must be developed that include the data elements, logic and definitions for that measure in a format that can be captured or stored in the EHR so that the data can be sent or shared electronically with other entities in a structured, standardized format, and unaltered.

EHR Incentive Program Electronic Specifications

Introduction to Electronic Specifications

These electronic specifications are derived from certified EHRs. As part of the criteria for satisfying meaningful use, CQM results (numerators, denominators, and exclusions) must be reported to CMS. Specific details regarding the reporting of the specifications for EPs and eligible hospitals/CAHs are described below.

Each electronic specification contains four main components:

1. Measure Overview/Description - This contains the measure title, description, number, measurement period, measure steward, and other relevant information to the measure.
2. Measure Logic - This contains the population criteria and measure logic for the numerator, denominator and exclusion categories. The measure logic contains the algorithm used to calculate performance.
3. Measure Code Lists - This contains all of the codes pertaining to the measure.
4. QDS Elements - This lists and describes each Quality Data Set (QDS) data element associated with the measure. The QDS is a model of information that contains the standard element, the quality data element, and the data flow attributes. It is a way to describe clinical concepts in a standardized format so individuals (i.e., providers, researchers, measure developers) monitoring clinical performance and outcomes can clearly and concisely communicate necessary information. The QDS model also describes information in a manner that allows EHR and other clinical electronic system vendors to unambiguously interpret the data and clearly locate the data required.

HTTPS://WWW.CMS.GOV/QUALITYMEASURES/03_ELECTRONICSPECIFICATIONS.ASP
STEP 2: LEVERAGE CLINICAL EXPERTS

- NDNQI Panel of Experts
  + Chaired by Sandra Bergquist-Beringer
  + Members: Expertise supplied by
    - National Pressure Ulcer Advisory Panel (NPUAP) and Wound, Ostomy and Continence Nurses (WOCN)
    - Nurse Researchers specializing in Wound and Skin Care
- Requirements developed with use of APNs, use cases, terminology specialists, quality measures, and tools
  + Workflow diagrams, MindMaps, and UML
- Use Cases developed (clinical scenarios) for numerous collections of indicator information
Use Cases - (Use Case diagram)

Source System

Assess Pressure Ulcer Risk

Create Care Plan

Update Care Plan

Plan Intervention

Update Intervention

Destination System

Receive Summary Documentation

Legend

In Scope

Out of Scope

*Update Pressure Ulcer Risk Assessment* is a coherent activity with a beginning and an end. Ad hoc changes to the patient record do not automatically update the assessment; the assessment must be attested by a person at a point in time. Logically, there is no *Update Assessment* use case (though systems may accommodate the modification of unattended assessments).

The Care Plan does not have any logical links to the Risk Assessment (indications, or goals, e.g.) at this point. This linkage may be undertaken in the Care Plan model. Links would be clinically complex at least, possibly not supported, and not in scope for this effort.

This use case is purely to indicate that the assessment is being provided to a stakeholder. It may result from human intervention, a stakeholder request, a timetable, or any other trigger.

Like *Produce Summary Documentation*, this case is provided for context only. Whether this is a push or a pull (whether the sender sends based on some trigger, e.g., phone call, or the receiver requests or subscribes to the summary) is immaterial at this point.
Admission to Hospital
- Pressure Ulcer present
  - Community acquired
  - Not present

Admission to Unit
- Pressure Ulcer present
  - Acquired elsewhere in hospital
  - Not present

Care on Unit
- Ongoing skin and risk assessment
- Ulcer prevention

Prevalence Study
- Unit based
- Conducted quarterly
- Report to NDNQI
Subject matter experts reviewed spreadsheets and created mind maps to ensure content is comprehensive.

Then:
Determined the optimal data set per use case based on both evidence based practice and context of scenario.

Chow & Beene, 2011
Data Set
Model for Nursing Units
### STEP 4: HARMONIZE THE DATA

**EXAMPLE FROM KAISER/VA**

<table>
<thead>
<tr>
<th>VA Nursing Intervention: Manage Moisture</th>
<th>KP Nursing Intervention: Incontinence / Moisture Mgt</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maintain clean and dry skin</td>
<td>GAP</td>
</tr>
<tr>
<td>Apply condom catheter</td>
<td>Urinary containment device in place</td>
</tr>
</tbody>
</table>
| Apply fecal collector (especially if skin breakdown) | Fecal containment device in place
| Apply protective barrier ointment       | Applied moisture barrier ointment / cream
|                                       | Applied skin barrier film / wipe
|                                       | Applied skin barrier film / wipe                      |
| Offer bedpan at scheduled intervals if patient is bed-bound | GAP                                                  |
| Offer urinal at scheduled intervals if patient is bed-bound | Prompted voiding                                     |
| Schedule toileting                     | Prompted voiding                                     |
| Instruct patient/caregiver to request assistance as needed | GAP                                                  |
| GAP                                     | Absorbent underpad in place                          |

Chow & Beene, 2011
## Step 4: Harmonize the Data

<table>
<thead>
<tr>
<th>NDNQI Pressure Ulcer Indicator</th>
<th>HL7 Pressure Ulcer Domain Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Assessment</td>
<td>Skin Color</td>
</tr>
<tr>
<td></td>
<td>(many more)</td>
</tr>
<tr>
<td>Risk Assessment</td>
<td>Scale used</td>
</tr>
<tr>
<td></td>
<td>(many more)</td>
</tr>
<tr>
<td>Prevention Interventions</td>
<td>Nutrition management</td>
</tr>
<tr>
<td></td>
<td>(many more)</td>
</tr>
</tbody>
</table>
### Step 5: Map to Reference Terminologies

<table>
<thead>
<tr>
<th>NDNQI element</th>
<th>SNOMED CT Concept</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure ulcer stage</td>
<td>pressure ulcer stage (observable entity)</td>
<td>420592002</td>
</tr>
<tr>
<td>Pressure ulcer stage I</td>
<td>pressure ulcer stage 1 (disorder)</td>
<td>421076008</td>
</tr>
<tr>
<td>Pressure ulcer stage II</td>
<td>pressure ulcer stage 2 (disorder)</td>
<td>420324007</td>
</tr>
<tr>
<td>Pressure ulcer stage III</td>
<td>pressure ulcer stage 3 (disorder)</td>
<td>421927004</td>
</tr>
<tr>
<td>Pressure ulcer stage IV</td>
<td>pressure ulcer stage 4 (disorder)</td>
<td>420597008</td>
</tr>
<tr>
<td>Pressure ulcer unstagable</td>
<td>nonstageable pressure ulcer (disorder)</td>
<td>421594008</td>
</tr>
<tr>
<td>Pressure ulcer indeterminable</td>
<td>pressure ulcer not visible (disorder)</td>
<td>421434007</td>
</tr>
<tr>
<td>Deep tissue injury</td>
<td></td>
<td>Gap</td>
</tr>
<tr>
<td>NDNQI element</td>
<td>SNOMED CT Concepts</td>
<td>Code</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>-----------------------------------------------------------------------------------</td>
<td>--------------------</td>
</tr>
<tr>
<td>community acquired pressure ulcer</td>
<td>community acquired pressure ulcer present</td>
<td></td>
</tr>
<tr>
<td></td>
<td>pressure sore (disorder); community acquired (qualifier value)</td>
<td>399912005; 277057000</td>
</tr>
<tr>
<td>community acquired pressure ulcer absent</td>
<td>pressure sore (disorder); community acquired (qualifier value)</td>
<td>399912005; 277057001</td>
</tr>
<tr>
<td>hospital acquired pressure ulcer</td>
<td>hospital acquired pressure ulcer present</td>
<td></td>
</tr>
<tr>
<td></td>
<td>hospital acquired pressure ulcer (disorder)</td>
<td>446261004</td>
</tr>
<tr>
<td>hospital acquired pressure ulcer absent</td>
<td>hospital acquired pressure ulcer (disorder)</td>
<td>446261005</td>
</tr>
<tr>
<td>unit acquired pressure ulcer</td>
<td>unit acquired pressure ulcer present</td>
<td></td>
</tr>
<tr>
<td></td>
<td>unit acquired pressure ulcer</td>
<td></td>
</tr>
<tr>
<td></td>
<td>unit acquired pressure ulcer present</td>
<td></td>
</tr>
</tbody>
</table>
**STEP 6: FORMALIZE THE MODEL IN UML**

Classes as major categories or “building blocks”

Attributes as specific questions

Enumerations as *value sets* for attributes

---

Chow & Beene, 2011
Has not been validated outside of NDNQI; contains unabstracted elements
STEP 7: LINK CONCEPT MODELS TO HL7

HL7 Quality Standards
CDA - based
(Structured Documents)

CDA Document
(a structured form-human readable)

XML code

Chow & Beene, 2011
STEP 8: VALIDATE THE MODEL

- Utilize professional organization expertise (e.g., NPUAP, WOCN) and NQF to review information model
- Validate use cases against information model
- Compare information model to current EHR systems
- Address reference terminology gaps with standards development organizations (IHTSDO and LOINC)
- Publish information model for public consumption, including terminology mappings
  - National Library of Medicine UMLS
- Publish process to encourage others to participate in nursing information model development
ISSUES

- Terminology overlaps and gaps—terminology models
  + SNOMED CT does not identify all pressure ulcer sites
    - Will need to submit request for inclusion
  + There is overlap on what is covered in SNOMED CT and LOINC
    - How do we determine which terminology to use where

- Queries are needed
  + Temporal patterns
  + Calculating denominators
**NEXT STEPS**

- Steps 6 and 7: Harmonize the information model and terminology bindings with the Skin Assessment and Care domain models
  - Collaborate with
    - NQF/Joint Commission/NDNQI
    - HL7
    - IHTSDO
    - LOINC

- Lobby for inclusion in MU Stage Three Criteria

- Other NDNQI Indicators?
  - Tipping Point recommends Falls Prevention as next domain
COMPLEXITY OF THE EHR: MODELING MANAGES COMPLEXITY AND LET’S US LINK TO THE LEARNING HEALTH SYSTEM
INTEROPERABILITY DEFINITION

The ability of two or more Health Information Technology systems or elements to exchange information and to use the information that has been exchanged.

Why Do We Model?

- Models give us a template that guides us in constructing a system.
- If you want to make a building you first make a blueprint of the building to make, in the same way you should make a model of the system you want to make.
- Models help us visualize a system at different levels of abstraction, this makes it easier to manage complexity and to understand the system.
- Provides the framework for interoperability
In context of health policy and regulations.

Conduct research

Develop evidence based guidelines

Use Case

HL7 Domain Analysis Model for Pressure Ulcer Prevention

Nursing Knowledge for Practice ©

Select p.name_full_formatted from clinical_event ce, person p
plan ce where ce.event_title_text = "Skin Color" and ce.result_val = "Cyanotic"
join p where p.person_id = ce.person_id
order by ce.active_status_dt_tm, p.name_full_formatted

Query retrieved

Database structure that holds information

Developed by Judith Warren,
jjwarren@live.com
Susan Matney,
samatney@mmm.com

Mapping to Standard Terminology

NQF Quality Data Model

Concept | SNOMED CT Code
---|---
Skin Color | 364533002
Cyanotic | 119419001
Flushed | 248213001
Jaundiced | 18165001

Tie terminology to value set

Build data element

Design and build user interface
KNOWLEDGE

- Conduct research
- Engage domain experts
- Develop evidence based guidelines
RESEARCH

- Subject matter experts were asked to provide source materials for use in informing the DAM.
- Source materials include existing models, data dictionaries, works in progress, email threads, and other references.
- The source material is analyzed to discover behavioral or structural requirements.
- One-on-one dialog between the DAM analyst and the submitter of source material help to improve understanding and implications for the DAM.
EVIDENCE-BASED PRACTICE AS KNOWLEDGE MANAGEMENT (KM)

- Strategies of KM used in designing EHR functionality
  - Searching the literature and regulations for best practices and quality metrics
  - Documentation of selected information and knowledge

- Deconstructing evidence and quality metrics
  - Documentation strategies designed
  - Clinical decision support implemented
**Use Cases** - *(Use Case diagram)*

- **Informant**
- **Patient**
- **Attester**
- **Clinician**

**Source System**

- **Assess Pressure Ulcer Risk**
- **Create Care Plan**
- **Update Case Plan**
  - include
  - include

**Destination System**

- **Receive Summary Documentation**
- **Recipient**

**Legend**

- In Scope
- Out of Scope

*Update Pressure Ulcer Risk Assessment* is a coherent activity with a beginning and an end. Ad hoc changes to the patient record do not automatically update the assessment; the assessment must be attested by a person at a point in time. Logically, there is no "Update Assessment" use case (though systems may accommodate the modification of unattended assessments).

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Insights gained from research are used to adjust or confirm the DAM.

Functional scope is reflected in a Use Case diagram.

Activity control and information flows are reflected in Activity diagrams.

Information requirements are reflected in Class diagrams.

Questions and open issues related to modeling are noted for use in model review.
REVISE

- The peer review comments create an improved understanding of requirements.
- Comments also reveal difficulty in understanding the model.
- The model is revised to reflect the improved understanding or to make the model content more comprehensible.
- The revised model is then used during analysis of additional input.
CLINICAL DOMAIN MODELING

- Looks like a lot of work, BUT.....

- If done well, modeling supports
  + Data mining strategies
  + Semantic interoperability
  + Transformation of practice
  + Creation of Wisdom
NQF’s Health Information Framework

Measurement Perspective
- Populations
- Payers
- Employers
- Health System
- Individual

Healthy People / Healthy Communities

Individual Characteristics
- Behaviors
- Social/Cultural Factors
- Resources
- Preferences

Community / Environmental Characteristics

Health Status
- Cross-Cutting Aims: Prevention, Safety, Quality, Efficiency

Clinical Data

Health Related Experience
- Patient, Consumer, Care Giver

Data Sources
- EHR
- PHR
- HIE
- Public Health Survey
- Registry
- Etc.

(Structured / unstructured, clinical, claims)
Quality Data Model Information Structure

**Category**
- Adverse Effect
- Experience
- Care Goal
- Characteristic
- Communication
- Condition
- Device
- Diagnostic Study
- Encounter
- Functional Status
- Laboratory Test
- Medication
- Procedure
- Risk Evaluation
- Etc.

**State**
- Ordered
- Performed
- Documented
- Declined
- Etc.

**Attributes**
- Timing
- Data flow
- Actors
- Category Specific

**Asthma**
- Category: Diagnosis/Condition/Problem
- State: Active
- Start date
- End date
- Source, patient, Recorder: clinician
- Data flow: NA
- Category Specific: NA
BUILD THE QUESTION AND RESPONSE VALUES

<table>
<thead>
<tr>
<th>Unique Mnemonic:</th>
<th>FN Skin color</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description:</td>
<td>Skin color</td>
</tr>
<tr>
<td>Activity Type:</td>
<td>Patient Care</td>
</tr>
<tr>
<td>Result Type:</td>
<td>Alpha</td>
</tr>
</tbody>
</table>

### Numeric Details

<table>
<thead>
<tr>
<th>Description</th>
<th>Sequence</th>
<th>Result</th>
<th>Concept CKI</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Normal for ethnicity</strong></td>
<td>1</td>
<td>0</td>
<td>297952003</td>
</tr>
<tr>
<td>Ashen</td>
<td>2</td>
<td>0</td>
<td>445394005</td>
</tr>
<tr>
<td>Cyanotic</td>
<td>3</td>
<td>0</td>
<td>119419001</td>
</tr>
<tr>
<td>Flushed</td>
<td>5</td>
<td>0</td>
<td>248213001</td>
</tr>
<tr>
<td>Jaundiced</td>
<td>6</td>
<td>0</td>
<td>18165001</td>
</tr>
<tr>
<td>Pale</td>
<td>7</td>
<td>0</td>
<td>267029006</td>
</tr>
<tr>
<td>Mottled</td>
<td>8</td>
<td>0</td>
<td>406128001</td>
</tr>
</tbody>
</table>

Current Reference Range: 0 Years - 0 Years
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Notes</th>
<th>Constraints and tags</th>
</tr>
</thead>
<tbody>
<tr>
<td>skin color</td>
<td>A holistic evaluation of the color of the patient's skin adjusted for ethnicity, used as an indicator of systemic problems</td>
<td>Vocabulary: { LOINC: Color (39107-8) }</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Vocabulary: { SNOMED CT: color of skin (observable entity) (364533002) }</td>
</tr>
</tbody>
</table>
DESIGN THE FORM

Adult Skin Assessment

Inspection

Skin Color
- Normal for ethnicity
- Ashen
- Cyanotic
- Flushed
- Jaundiced

Variations in Skin Color
- Pale
- Mottled
- Other:
- Birthmarks
- Calluses
- Coining
- Cupping
- Freckles
- Moles
- Striae
- Tattoo
- Other:
The Usability Iceberg

- 10% Look (visuals, layout, colors, etc.)
- 30% Feel (menus, buttons, controls, etc.)
- 60% User Task Goals (workflow, navigation, objects and relationships, etc.)

Adapted from “Common User Access Guide to User Interface Design”, copyright 1991 IBM
TOOLS TIE VALUES TO TABLES:
DATA CAN BE STORED AND QUERIED
select
p.name_full_formatted from clinical_event, person p
plan where
ce.event_title_text = "Skin Color" and result_val = "Cyanotic"
join p where p.person_id = person_id
order by
active_status_dt_tm, p.name_full_formatted
go
select p.name_full_formatted from clinical_event ce, person p plan ce where ce.event_title_text = "Skin Color" and ce.result_val = "Cyanotic" join p where p.person_id = ce.person_id order by ce.active_status_dt_tm, p.name_full_formatted

develop evidence based guidelines

Use Case

HL7 Domain Analysis Model for Pressure Ulcer Prevention

Mapping to Standard Terminology

NQF Quality Data Model

Design and build user interface

Relational database structure that holds information

Query for data

Query retrieved

Nursing Knowledge for Practice

Developed by Judith Warren, jjwarren@live.com
Susan Matney, samatney@mmm.com
A METHOD BEGINS WITH A SINGLE STEP

- Takes a team
- Team members can join along the path
- The path is iterative
- The path leads to the Emerald City
  + aka Semantic Interoperability
Modeling WITH MIND MAPS

- Download FreeMind
  - Free mind mapping software
TRACKING AND ORGANIZING TOOLS

- Microsoft Outlook or other email program
- Microsoft OneNote
  + File emails
  + To do list
Judith J. Warren, PhD, RN, BC, FAAN, FACMI
Warren Associates, LLC
NDNQI Consultant

jjwarren@live.com
CE EVALUATION AND CERTIFICATE

To obtain 1.25 Ceu’s for this presentation go to the link below for evaluation