From the Past to the Future: Sharable and Comparable Nurse-Generated Data

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If we can not name it [nursing], we can not control it, teach it, finance it, research it, or put it into public policy. – N. Lang

Until lions have their historians, tales of the hunt shall always glorify the hunters. ~African Proverb

Standardized Terminologies

[Diagram showing timeline and abbreviations]
Nursing Knowledge Conference Proceedings

Where do We Need to Go in the Future?

- What infrastructure is needed for the following situations?
- How does that relate to health care?
- How important are nurses for facilitating health?
- What is the infrastructure needed for nursing to contribute to health in the world of big data?
- How does that relate to today’s presentations?

http://mashable.com/2012/06/22/data-created-every-minute/
How Banks Are Detecting Credit Fraud

http://www.computerweekly.com/feature/How-banks-are-detecting-credit-fraud

Using Genetic Algorithms To Forecast Financial Markets


Big Data Science is Not New

Ocean Science

- Ocean cover 70% of the earth
- Complex biome
- Influences global health
- How do we understand it?

Multiple types of data input
- Sensors
- Video
- Internet - connecting countries’ computers
- Longitudinal data
- Satellite sensed ocean data
Consider

- What infrastructure was needed in the previous situations?
- How does that relate to health care?
- What is the infrastructure needed for nursing to contribute to health in the world of big data?

Value Proposition

- Each presentation is focused on the value of implementing shareable and comparable nurse-generated or nursing workforce data
- Observe the secondary (continuing) use of data if captured correctly
- Listen for the value proposition of standardization of data and processes
- Note the barriers and opportunities for actions that need to be included in the National Action Plan
- If other industries can create usable big data – so can we!

Thank you
Upon completion learners will be able to
- Articulate an example of continuing use of nurse generated data to support nursing workforce
- Discuss how nursing documentation practices impact the ability to share and compare data
- Generate ideas for the continuing use of nurse generated data

I do serve as CNO for Cerner Corporation
I will illustrate key points of the presentation with Cerner Clairvia and Capacity Management
I stand on the shoulders of giants
The Evidence: Staffing Does Matter

- National Database of Nursing Quality Indicators
  - Dunton
- Comparative research
  - Needleman, Beurhaus, Aiken, Blegen
- Veterans Administration
- Experience of California mandates
- Unit level research

The Evidence: Many factors impact staffing.

- Skill mix
- Nurse certification
- Agency/contract nurses
- International education
- Culture
- Care delivery models
- Physical environment
- Workflow
- Patient flow
- Resources
- Technology

Today: Silos of Management Processes

Results:
- Inefficient care
- High cost
- Poor communication

- Lack of care coordination
- Lower patient satisfaction
- Lower staff satisfaction
Reflective clinical reasoning works well with continuing use of data.
Managing to LOS with clinical dependency

**Patient Pattern Management**

<table>
<thead>
<tr>
<th>Name</th>
<th>Age</th>
<th>Sex</th>
<th>Race</th>
<th>Diagnosis</th>
<th>Discharge Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>John</td>
<td>45</td>
<td>M</td>
<td>White</td>
<td>Heart Failure</td>
<td>12/31/2021</td>
</tr>
<tr>
<td>Mary</td>
<td>32</td>
<td>F</td>
<td>Black</td>
<td>Stroke</td>
<td>1/15/2022</td>
</tr>
</tbody>
</table>

**Acuity Level and Hours Per Patient Day (HPPD)**

- Observation
- Surgical
- Medical
- Pediatric
- Critical Care

**I. Functional Health**

**II. Physiologic Health**

**III. Psychosocial Health**

**IV. Health Knowledge & Behavior**

**V. Perceived Health**

**VI. Family Health**

**VII. Community Health (continuum of care)**

Mapping nursing data to domains resolved issues of sharable and comparable data.
<table>
<thead>
<tr>
<th>Outcome Label</th>
<th>Outcome Definition</th>
<th>Observations</th>
<th>Intervention and Sideline Procedures</th>
<th>Vitals</th>
<th>Devices</th>
<th>Lab Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respiratory Status</td>
<td>Movement of air in and out of the lungs and exchange of carbon dioxide and oxygen at the alveolar level</td>
<td>Respiratory Rhythm</td>
<td>Respiratory Effort</td>
<td>Breathing</td>
<td>Oxygen Delivery</td>
<td>PaCO2, pH, HCO3, BE, PaO2</td>
</tr>
</tbody>
</table>

**Respiratory Procedures**
- Endotracheal Tubes
- Nasal Cannula
- Continuous Positive Airway Pressure
- Bi-Level Positive Airway Pressure
- Facemask
- Chest Tubes
- Tracheostomy Tubes
- Bronchodilator Respiratory Devices

**Respiratory Treatments**
- Aspiration Precautions

**Respiratory Problems**
- Hypoxia
- Hypercapnia
- Acidosis
- Alkalosis

**Respiratory Indicators**
- Pulse Oximetry
- Oxygen Saturation

**Respiratory Devices**
- Ventilator
- Bi-PAP
- Nasal Cannula
- Non-invasive Ventilation

**Respiratory Observations**
- Pulse
- Respiratory Rate
- Breath Sounds
- Airway Type
- Secretion Characteristics

**Respiratory and Beside Procedures**
- Medications
- Devices
- Lab Values

**Likert Scale**

<table>
<thead>
<tr>
<th>Severe deviation</th>
<th>Substantial deviation</th>
<th>Moderate deviation</th>
<th>Mild deviation</th>
<th>No deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Least Desirable</td>
<td>Least Desirable</td>
<td>Least Desirable</td>
<td>Most Desirable</td>
<td>Most Desirable</td>
</tr>
</tbody>
</table>

**Definition:** Movement of air in and out of the lungs and exchange of carbon dioxide and oxygen at alveolar level
Likert Rating for Respiratory Status

Aerosol Mask

Difficulty Breathing at rest

pCO2 Art = 48 (mm)

Aspiration Risk = Decreased ability to handle secretions

O2 Therapy = Nasal Cannula @ 2L

Breath Sounds = Coarse, Crackles RLL

Chest Tube Inserted

EHR

Patient Acuity Assessment

Clinical Documentation Assessment by Patient
### Assignment of Staff to Patient

<table>
<thead>
<tr>
<th>Staff Name</th>
<th>Shift</th>
<th>Start Time</th>
<th>End Time</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>John Doe</td>
<td>AM</td>
<td>08:00</td>
<td>10:00</td>
<td>2 hours</td>
</tr>
<tr>
<td>Jane Smith</td>
<td>PM</td>
<td>14:00</td>
<td>16:00</td>
<td>2 hours</td>
</tr>
<tr>
<td>Mike Brown</td>
<td>AM</td>
<td>08:00</td>
<td>10:00</td>
<td>2 hours</td>
</tr>
</tbody>
</table>

### Acuity Summary Report

**Graphs showing recent trends and data analysis**
The shortened stay in each level of care results in a savings of nearly 20% of total expected costs.
Thoughts on nursing generated big data

- Nurses document across the continuum of care
- It takes real work to extract and use the data
- Inconsistent documentation practices
  - Timeliness
  - Within and between facilities
  - Multiple languages
  - Documenting to exception
- Untapped potential to transform health care
- Continuous use of data is a step toward a continuously learning health system

Your questions and thoughts?
Benefits of Implementing an International Nursing Terminology

Amy Coenen RN, PhD, FAAN
Professor, University of WI-Milwaukee USA
Director, International Classification for Nursing Practice Programme
International Council of Nurses

Demonstrating the Value of Sharable and Comparable Nurse-generated Data
2015 Nursing Knowledge: Big Data & Science Conference
University of Minnesota
June 3-5, 2015

Outline of Presentation

Benefits and Examples

• Structure
  – Policy

• Process
  – Partnerships

• Outcomes
  – Products and Resources
  – Evaluation & Research Findings

Structure: Policies

Policies endorsing use of standard nursing terminologies can support implementation and strategic planning for eHealth at local, regional, national and international levels.

• National endorsement via law by Ministry of Health
  – Example: Poland

• Endorsement by Professional Associations
  – Example: Norwegian Nurses Organization

• Local endorsement via state law
  – Example: Minnesota
### Structure: Portugal Example

**Portuguese Health Ministry (2014)**

- **Secondary care**
  - 93.1% of public hospitals or hospital centers use systems that are based on ICNP.
  - 43 of 58 public hospital/hospital centers (74.1%) use the Health Ministry’s nursing information system based on ICNP.
  - The remaining 15 (25.9%) use information systems from a range of vendors – 11 based on ICNP.
  - Several private hospitals also use systems that are based on ICNP.

- **Primary Care**
  - 91% of the 348 health centers across Portugal also use the Health Ministry’s information system based on ICNP.
  - 90% of Portuguese nurses use ICNP daily to support their practice (equating to more than 50,000 nurses).

### Process: Partnerships

- Partnerships are established, strengthened, and maintained through the implementation and use of standard nursing terminologies in eHealth tools and solutions (e.g. EHR, NMDS)

- Contributions of nursing to global health outcomes are better recognized through mutually beneficial partnerships

### Process: Examples of Partners

- Healthcare Policy Makers
- Healthcare Providers
- Software Vendors
- Health Terminology Standard Development Organizations
- Health Professional Associations and Organizations
- Research Institutes and Universities
- Consumer Advocates
Process: Partnerships

- The development and testing of ICNP Catalogues (subsets) required nurses with expertise in a specific specialty or area of practice to be involved as content experts.
  - Examples:
    - Palliative care nurses (Promoting Dignified Dying) with Nurse Researchers in US
    - Community health nurses (Scottish Community Dataset) with Scottish NHS
    - Paediatric nurses (Paediatric Pain Management) with National Children’s Medical Center, Washington DC

OUTCOMES

- PRODUCTS & RESOURCES for Implementation
  - Translations
  - Browser
  - Equivalence Tables
  - Catalogues (Subsets)
  - Others

- EVALUATION & RESEARCH
  - Examining nursing practice through secondary analysis of clinical data captured using standardized nursing terminologies

Products: ICNP Products Example

- Multilingual Terminology Browser
- Mappings and Equivalency Tables
- Delivered to IHTSDO and NLM: SNOMED-CT, CCC, ICH
- Catalogues: Subsets of content for specific nursing specialties and settings
- Decision-Support Application for: Nurses, Caregivers, and Patients
Outcomes: Examples of Harmonizing ICNP

- ICNP is a related classification in the WHO Family of International Classifications (ICD, ICF, ICHI)
  - ICN provided nursing content submission to International Classification of Health Interventions (ICHI)

- Harmonisation agreement in place with IHTSDO
  - First IHTSDO product released May 2015: Terminology Preview of Nursing Problem Subset (over 500 SNOMED CT concepts with ICNP source, required ICN submission of over 120 new concepts to IHTSDO)

- Collaborative agreement in place with Sabacare Inc. (CCC)
  - Equivalency tables
  - Using CCC 21 framework (21 Care Components) to organise ICNP nursing diagnoses, outcomes and interventions

Outcomes: Research Examples from Portugal

CONTINUITY OF CARE

- Promoting continuity of care (Pereira, 2001)
  - Nursing shift change should be prospective rather than retrospective
  - Most of the relevant information is within the NIS, a significant part of the not documented information can be included in nursing documentation, using ICNP

- Implementation of an automated articulation of NIS between hospitals and health centres (Sousa, 2005)
  - The use of ICNP in NIS promotes continuity of care

- Evaluation of the impact of an automated articulation of NIS between hospitals and health centres on (Azevedo, 2010; Silva, 2010)
  - Evaluation of the impact on nursing care quality and on the access to nursing care after hospital discharge. Caregiver nursing information exchange is a relevant dimension for care transition
Outcomes: Research Examples from Portugal

CONTINUITY OF CARE

- Nursing Information Systems: Exploration of information shared with physicians (Mota, 2010)
  - An emerging model for design and (re) engineering the models of information shared between nurses and physicians, contributing thus to the interoperability between applications and thus improving the continuity and quality of care.

- Family caregiving (Bessa Leite, 2012)
  - In many cases, family caregivers continue to have many weaknesses, specifically related to their level of knowledge and skills.

- Self management (Padilha, 2012)
  - Findings that nurses play a significant role in promoting self-management and in ensuring adherence to treatment plans. Guidelines specifying contents and strategies aimed at facilitating of implementation in context, and strategies to promote patient learning.

IMPROVING QUALITY OF NURSING CARE

- Palliative Care (Abreu, Padilha, & Alves, 2015)
  - Although relevant, the physical dimension of care was not sufficient, exposing opportunity for psychological, social, cultural and spiritual dimensions to emerge (e.g. fatigue, grief, family communication).

- Nurses satisfaction with NIS incorporating ICNP (Campos, 2012; Moreira, 2014)
  - NIS incorporating ICNP have higher levels of users satisfaction than others. The use of ICNP in NIS promotes nursing clinical decision.

- Nursing Data Clinical Model: The person dependent for Standing; Self turning or Self transferring (Mendes, 2013)
  - The recommendation of a clinical data model that includes diagnoses and nursing interventions encourages a concept of care that includes best nursing knowledge.

PORTUGUESE NMDS

1. Structure in place (EHR with standardized nursing data)
2. Identification of Outcome Indicators
   - Indicators of Structure (staffing), Process (discharge teaching completed) and Outcome
   - Indicators focused on outcomes or “health gains” can be a complementary and useful model to the dominant paradigm; e.g. mortality and morbidity rates of the diseases
   - With these kind of nursing quality indicators, nurses can not only describe what “nurses do” (process indicators), but what clients gain with “what nurses do”
3. Develop Measures of Indicators
4. Develop a Data Aggregation Model (Pereira, 2007)
   - Requirements = availability, reliability, protection and comparability of data
   - Model allowed for the automatic production of nursing sensitive indicators from the registered data “at patient bedside”, across the country
Example of eMeasure for NMDS: Effectiveness rate in prevention of complications

Number of cases with risk of a specified problem or complication that did not develop that problem or complication, and that had at least one documented intervention, in a specified time period

\[ \text{Number of cases with documented risk, in the same time period} \times 100 \]

Another Example: Positive changes in status of actual nursing diagnosis

Number of cases where a specified condition or diagnosis was resolved and that had at least one documented intervention, in a given time period

\[ \text{Number of cases with this condition/diagnosis, documented in the same time period} \times 100 \]

Nursing Minimum Data Set
Core Focal Element (Hospital)
Outcomes: Research Examples from Portugal

There are several hospital institutions and health centres that are already producing indicators of process, structure and result (outcomes) from existing nursing data (using ICNP) in health information systems.

For example:
- Centro Hospitalar Povoa/Vila do Conde
- Unidade Local de Saúde de Matosinhos
- Centro Hospitalar do Porto
### Examples of NMDS Reports

<table>
<thead>
<tr>
<th>Rate of diagnostic effectiveness of risk</th>
<th>Rate of Nursing diagnosis resolution Or Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure Ulcer</td>
<td>Self-care dependence/independence</td>
</tr>
</tbody>
</table>

**Outcomes: Other Research Examples**

**SOUTH KOREA**

- Examined gaps between required nursing care time and actual nursing care time (n = 12,4416)
  - Gap in paediatric and geriatric hospital units (understaffing) (Park, Cho, Chung, 2011)

- Explore practice variations by nurses in preventive pressure-ulcer care (n = 41,891)
  - No significant difference by patient characteristics
  - Significant differences by nurse characteristics
    - More frequent - younger than 24 and BSN degree
    - Less frequent – longer work experience and ICU
  - Recommend an increase in frequency of prevention interventions to comply with guidelines (Choa, Park, Chung, 2011)
Outcomes: Research Examples

• SCOTLAND
  – Described Practice of Community Nurses in Scotland (Strachan & Wallis, 2011)

• ITALY
  – Nursing Diagnoses/Problem list (Italian Medical and Surgical Hospital)
  – A subset of ICNP nursing diagnoses informed by an Italian nursing conceptual model: a multi-centre cross-sectional study (Ausili, Vanalli, Alberio, & diMauro, 2015)

Questions and Comments

Thank You!

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Electronic Data Capture from Information Systems for Magnet Recognition

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EBP Scientist
University of Iowa Hospitals and Clinics
Iowa City, IA

Conflict of Interest

- Financial:
  - EBP Training & Implementation resources
    (Cullen, et., al., 2012; Cullen & Titler, 2004; Cullen, Titler & Rempel, 2011)

- Intellectual bias:
  - NIC experience (B, Wagner, 2013)
  - EBP Implementation resources (Cullen & Adams, 2012)
  - Application at bedside

Team

Engineering
Mark Schall, PhD, AEP
Howard Chen, MS
Priya Pennathur, PhD

Information Technology
Keith Burrell, BS
Nicholas May, BS
Pam Kunert, MSN, RN-BC

Nursing
Laura Cullen, DNP, RN, FAAN
Grace Matthews, MSN, RN, BC
Background

- National health care agenda
  - Regulatory standards (TJC, 2015)
  - VBP (CMS, 2011)
  - Triple Aim (IHI) (Berwick, Nolan & Whittington, 2008)
  - Transparency (CMS, 2005)
  - Consumer expectations (http://consumers.cochrane.org/)
  - Continuous learning in health care (IOM, 2013)
  - Core Metrics for Health and Health Care (IOM, 2015)
  - NDNQI
- Other priorities

440,000 premature deaths are associated with medical errors every year (James, 2013)

Leading Causes of Death in the United States

- Heart Disease: 597,689
- Cancer: 574,743
- Medical Errors: 440,000
- Respiratory: 118,080
- Stroke: 129,476

Source: CDC

Economic impact of medical errors is estimated to total $1 trillion! (Andel et al., 2012)

[Graph showing Health Care Spending as Percentage of GDP]
Rationale

- Improving Care Outcomes
- Benchmarking
  - NDNQI

**Process**

Structure ➔ Outcome

Magnet Recognition Program®

- Transformational leadership
- Structural empowerment
- Exemplary professional practice
- New knowledge, innovations, and improvements

Background

Health Information Technology systems and evidence-based quality indicators may substantially reduce the incidence and severity of medical errors (IOM, 2013)

**Examples:**
- Electronic patient records
- Real-time patient vitals monitors
- Clinician decision-support tools
- Virtual dashboards
- Smartphone applications
**Problem and Specific Aim**

**Problem**
Lack of health information technology systems using evidence-based indicators in the clinical environment

**Specific Aim**
Design a health information technology dashboard to communicate real-time patient risk information to hospital clinicians

Keeping Human Factors principles in mind!

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**Review Process**

- Approval: IRB Review (formal)
  - Determined not to be human subjects research
- Communicating in organization (informal):
  - Senior administrative support
  - Nursing Research, EBP and Quality
  - Hospital quality office
  - Nursing committees

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**IV Pump Philosophy**

- [Diagram of IV pump philosophy]
- Counting IV drips
- Monitors infusion devices
Human Factors

The study of human beings and the systems with which they interact

Use Symbols Effectively

Maximize Awareness

Minimize Errors

Human Centered Design

Requires Minimal Training

Provide Support

Use Symbols Effectively

Minimize Errors

Human Centered Design

Requires Minimal Training

Provide Support

Iterative Process

Design
- Focus Groups
- Prototype

Refine
- Implement changes
- Establish areas to improve

Assess
- Heuristic Evaluation
- Usability survey

Refine
- Implement changes
- Establish areas to improve

Assess
- Heuristic Evaluation
- Usability survey

Design: Focus Group

- Eight participants
  - 4 nurse managers and staff
  - 2 physicians
  - 2 hospital quality professionals
- Questions to facilitate discussion
  - Example: How would you prefer quality indicators be sorted in the display?
  - Elicit participants’ experiences with health information technology
- Used responses to design a prototype dashboard
Design: Focus Group Results

Status
- When was the system last updated
- Who made last changes
- Indicator trends

Quality Indicators
- Pain Acceptable
- Fall risk
- Pressure ulcer risk
- Delirium risk
- Barthel Index
- Restraint in Use
- Urinary Catheter Days
- Central line days
- Readmission in last 30 days

Patient
- Patient name
- Unit number
- Bed number
- Attending Physician
- Length of Stay

Design: Prototype

Custom program written using Microsoft Visual Basic for Applications
Assess: Heuristic Evaluation

- Two human factors professionals & three focus group members
- Each evaluator worked independently for 20 min identifying problems with the system based on ten heuristics or design principles (Nielsen, 1994)

<table>
<thead>
<tr>
<th>Heuristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Clarity of objectives</td>
</tr>
<tr>
<td>2. Visibility of system states</td>
</tr>
<tr>
<td>3. Match between system and the real world</td>
</tr>
<tr>
<td>4. User control and freedom</td>
</tr>
<tr>
<td>5. Consistency and standards</td>
</tr>
<tr>
<td>6. Error prevention</td>
</tr>
<tr>
<td>7. Recognition rather than recall</td>
</tr>
<tr>
<td>8. Flexibility and efficiency of use</td>
</tr>
<tr>
<td>9. Aesthetic and minimal/size design</td>
</tr>
<tr>
<td>10. Help and documentation</td>
</tr>
</tbody>
</table>

Assess: System Usability Scale

- Ten items regarding an individual's assessment of a system's usability (Brooke, 1996)
- Yields a composite score between 0 and 100
  - > 90 = exceptional
  - 80-90 = good
  - 70-80 = acceptable
  - < 70 = marginal

(System Usability Score)

(mean score of 83 (SD = 7.6)
Prototype was “good”, but with potential for improvement

Results: Prototype System Usability Scale

Example Heuristic Evaluator Recommendations
- Include a cover sheet to describe goal of display
- Length of stay indicator in days rather than hours
- Remove quality indicator scores that are present vs. absent

System Usability Score
- Mean score of 83 (SD = 7.6)
- Prototype was “good”, but with potential for improvement
Iterative Process: Phase II

Design
- Dashboard trial
- Dashboard adoption

Refine
- IT revisions
- Rollout from trial

Assess
- Usability
- Impact on NSI

Refine: Initial Dashboard

Quality Indicators
- Pain – acceptable
- Fall risk
- Pressure ulcer risk
- Delirium risk
- Barthel Index
- Restraints
- Urinary catheter days
- Central line days
- Readmission risk
- Length of stay – actual
- Length of stay – expected
Evaluation Methods: Dashboard

- Tasks - Planning patient care, documenting or changing orders related to patient risks
- EHR - Playground functioning with test patients
- Interface with research lab at College of Engineering for data capture
- Participants
  - 6 staff nurses (in pairs)
  - 1 physician, quality officer
- Location: Training lab in hospital

Evaluation Methods: Dashboard

- Orient to dashboard
- Randomize order of use (EHR patient list vs dashboard) and 8 tasks to complete
  - Document removal of a urinary catheter
- Alternate user completion of activities
- Data collection:
  - Elicit participants’ perceptions and suggestions
  - System Usability Scale
  - Post-Study System Usability Questionnaire
  - Activity completion
  - Qualitative feedback from “talk aloud”
- Use responses to design next version of dashboard

Results: Dashboard System Usability Scale

Example Heuristic Evaluator Recommendations

- Easy to interpret color coding; most self-explainable
- Content fit to screen (avoid scrolling)
- Link individual score/cell to associated area in patient’s record (e.g., flowsheet or MAR)
- Suggestions to rearrange, add, delete indicators/columns

System Usability Score

- Mean score of 87.5 (SD = 9.6)
- Initial dashboard was “good”, but with potential for improvement
Results: Post-Study System Usability Questionnaire

- Users’ perceived satisfaction with their computer systems
  - 16 items
  - 7-point scale (1=Strongly Agree to 7=Strongly Disagree)

Findings:
- Overall usability = 1.7
- System usefulness = 1.5
- Information quality = 1.8
- Interface quality = 1.8

Results: Overall Usability

Preliminary
- Task completion - Screen flips/time
- Qualitative feedback from “talk aloud”
- General suggestions

Other needs:
- Quick upload during rounding
- Ease of “refresh” for updating data displayed

Next Steps

- Finish usability data analysis
- Revise dashboard
- Install dashboard displays (underway)
- Implement
- Disseminate

Methods

- Standardized Language
- Comparative Effectiveness Research
- Evidence-Based Practice
- Safe, Quality Care

Another Perspective

Theoretical Perspectives of Sherlock Holmes


Example

- Outcomes: Fall rates
- Processes:
  - Assess risk
  - Identify patients at risk
  - Identify patients with injury risk
  - Promote functional recovery
- Structures:
  - Leaders
  - Program
  - Expert(s)
- Balancing

AHRQ, 2013: IHI
Guiding Principles

- Application at point of care
- Use of human factors design
  - Interface with technology
  - Address cognitive work and system factors contributing to complexity
- Bottom line

Return on Investment

- Quality care
  - Plan: statistical process control evaluation (Carey & Lloyd, 2001)
  - Plan: Benchmark (NDNQI)
- Reduced costs
  - Hospital acquired conditions
    - Central line infections = $32-174,000 (Dick, et al., 2015; Coutlie, et al., 2014; Hsu, et al., 2014; Stevens, et al., 2014)
    - Ventilator associated pneumonia = $40,000 (Kollef, et al., 2012; Zimlichman, et al., 2013)
    - Falls = $13-24,000 (Wong, et al., 2011; Zecovic, et al., 2012)
    - Clostridium difficile = $3-35,000 (Dubberke, et al., 2015; Gabriel, et al., 2014; Yongeza, et al., 2013)

Return on Investment

- Reduced cost
  - Capture return on investment
  - Health system cost from performance monitoring ~ 50-100 FTE; $3.5-12 million/annually (IOM, 2015)
- Magnet Recognition®
  - New knowledge, innovations, and improvements
- Other recognition
  - Certified programs
  - Reputation
Lessons Learned

- Technology
- Complexity
- Interdisciplinary
- Standards
- Patients & families

Summary & Conclusions

- Health information technology and evidence-based quality indicators may prevent errors
- Adoption of human factor principles is essential
- Comparable data is essential to achieve the national quality agenda
  - Standardized nursing language
- Innovation:
  - Real time data from EHR
  - Potential to impact current care processes

Questions

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Lessons Learned from Integrating the Pressure Ulcer eMeasures

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Nancy Dunton, PhD, FAAN
Sandra Bergquist-Beringer, PhD, RN, CWCN
University of Kansas School of Nursing

Objectives

▪ Discuss the implications for developing and implementing an eMeasure
▪ Described the lessons learned about nursing documentation
  – data integrity,
  – education, and
  – practice issues.

It Takes an Expert Development Team

▪ Nancy Dunton, PhD, FAAN
  – NDNQI Director
▪ Sandra Bergquist-Beringer, PhD, RN, CWCN
  – Project Lead and Pressure Ulcer Expert
▪ NDNQI Analytics and IT Staff
▪ Judith Warren and Rosemary Kennedy
  – Informatics consultants
▪ Professional organizations
  – ANA
  – NPUAP
▪ Performance Improvement organization
  – Press Ganey Associates

(c) Warren Associates LLC
New Report from ANA, 2015

• Authors
  – Judith J. Warren, PhD, RN, FAAN, FACMI
  – Nancy Dunton, PhD, FAAN

Keeping Up with Standards

• HL7
  – QRDA (Quality Reporting Document Architecture)
  – HQMF (Health Quality Message Format)
  – vMR (Virtual Medical Record for Clinical Decision Support)
  – FHIR (Fast health Interoperable Resources)
    • QUICK Data Model

Keeping Up with Standards

• S&I Framework Initiative
• CMS
  • Quality Data Model (QDM)
  • Measure Authoring Tool (MAT)
    o Bonnie, the logic testing tool
    o CMS Measures. Management System
• NLM
  • Value Set Authority Center (VSAC)
  • Insures terminology standards usage
    • SNOMED CT and LOINC
• ONC
• NQF
Keeping up with Guidelines

- NPUAP
  - Pressure Ulcer Risk and Prevention Guidelines
  - Pressure Ulcer Staging/Classification System
  - www.npuap.org

Determining what is really needed to calculate the metrics

- Review the data received from NDNQI manual extraction from patient charts
- Are there artifacts in the EHR that can be substituted for the decisions made in manual extraction
- Review NPUAP Pressure Ulcer metrics
- What are we REALLY trying to determine

Selecting data types

- Character
- Integer
- Decimal
- Numeric
- Date
- Time
- Timestamp
- Interval
Requirements for Recognition and CMS Use

- National Quality Forum (NQF) designated to recognize eMeasures
  - Reliability, validity and feasibility testing
  - Multiple vendors
  - Multiples implementations
- NQF committees and panel recommend measures to CMS for use and adoption

Changing Model for Intellectual Property (IP)

- Measures to be posted in MAT are searchable
  - Provides usable eMeasures
  - May provide an opportunity to harmonize measures
- Value sets for the measures are accessible at the NLM Value Set Authority Center

It Takes an Expert Hospital Team

- Practitioners
  - Generalist and specialists
- Quality professionals
- Executive nurses
- Informatics nurses
- IT professionals
No Standard of Care Documentation

- While the standard of care for pressure ulcers has been determined through research and the harmonization efforts of NPUAP
  - Numerous quality metrics requiring non-harmonized data elements exists
  - There is no standard for documentation, YET
  - Reimbursement needs do drive some common data elements

- Thus interoperability is not possible and the querying of EHRs to gather eMeasures is not possible

Education in Pressure Ulcer Care

- Undergraduate nurses are taught pressure ulcer care YET
- Employers do not trust that knowledge and so do not use their documentation
  - State it is costly to teach staff
  - Therefore use experts for reliable data
- Identification and staging of pressure ulcers is the most critical need
  - Within RN scope of practice
  - NDNQI has an online tutorial to improve reliability between and among clinicians and hospitals

Selecting Data Types

- Different builds
  - Questions and answers
- Different value sets and terminologies
- Different documentation standards and approaches
Different Workflows

- Institutional capacity
  - Professional makeup
- Wound and skin care specialists
- Staff nurse responsibility and expectations
- Consultations
- Reimbursement

Source of Truth in Charting

- Where is the TRUTH charted
  - What form or data elements
    - Are there more than one
- Whose documentation is used for eMeasures
  - Generalists
  - Specialists
- Can the TRUTH be obtained through queries
  - Narrative notes
  - Shadow charts

Queries

- Not everyone can write queries
  - Growing need for people with this skill
  - Novices may take weeks to months to write one query
- Long waits for queries to be written
  - So, need for queries related to reimbursement take precedence
  - Quality and eMeasures may suffer
  - Delays in Meaningful Use for Nursing
Clinical Context
• Data for eMeasures and other uses must be de-identified
• If de-identification is not done accurately, then clinical context is destroyed
• Major implications for use of Big Data to understand care delivery!

Submission of Data
• Most data for eMeasure calculation and benchmarking must be submitted to a third party
  – Usually through the use of a spreadsheet or database
• Many have difficulty in transferring the data from a query to a ‘submission container’
• The massive size of the submission requires an upload or ETL (extract, transform, load) process

Implications
• Policy
  – Government
  – Professional organization
  – Practice organization
• Standards development
• Different sites of care delivery
• Education
• Practice
• Research
• Informatics
Questions for YOU to Consider

- What are the implications of what you just heard for your practice/setting/job?
- What actions can you take now to implement or optimize a similar project?
- What barriers would you anticipate or have you experienced?
- What would you recommend to overcome barriers?

Please contact
- Judith Warren, jjwarren@live.com
- Nancy Dunton, ndunton@kumc.edu
Toward Personalized Algorithms to Improve Nursing Care Quality and Efficiency
Karen A. Monsen PhD, RN, FAAN
Nursing Knowledge: 2015 Big Data Science
Pre-Conference
June 3, 2015

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  – Providence/University of Washington Spokane
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  – University of Minnesota School of Nursing and Institute for Health Informatics
• Oscar Garcia PhD et al.
  – University of Minnesota College of Pharmacy
• Sagundha Rajput et al.
  – University of Minnesota MHA Student
• Minnesota Omaha System Users Group
  – International grass-roots organization
• UMN SON Center for Nursing Informatics
  – Omaha System Partnership

Lots of Work – Worth it?
• Building a big data infrastructure
  – Representing evidence-based practice
  – Incorporating practical wisdom
  – Using a standardized terminology
  – Achieving consensus of clinicians as well as scholars
Evidence of need for guideline development

When clustering a big data set of interventions from 15 agencies

- If no agency ID included
- no clusters were formed


Consensus process for development of EBP guidelines

- 2010 – Nurse Maude, New Zealand, Home Care
- 2011 – International Home Care (NZ, NL, CA, US)
- 2012 – Peer review process
- 2013 – Omaha System Guidelines process, libraries
- 2014 – Additional libraries/disciplines
- 2015 – Instrument normalization

Omaha System Guidelines

omahasystemguidelines.org
Guidelines incorporated within EHRs
Generating data and new knowledge


Observational process to confirm use of interventions

- TimeCat.org (The Ohio State University)
  - Time-Motion study with inter-rater reliability, data analysis, and workflow analysis capabilities
  - Customizable for any setting and practice
  - Available without charge for academic research

Mean: 1.24 min
Range 0.017-48.9 min
Fratzke (2013) mean 1.1 min


Interface Development

- Omaha System in TimeCat
- Observation shorthand
- 3 dimensions
- Icons
- Usability
### Omaha System Content Mapping

<table>
<thead>
<tr>
<th>Task</th>
<th>Problem/Category</th>
<th>Target</th>
<th>Case Management</th>
<th>Case Study</th>
<th>Case Management [definition of care description]</th>
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<tbody>
<tr>
<td>Supervision</td>
<td>Health Care Supervision</td>
<td>Interventions</td>
<td>Management</td>
<td>Case Study</td>
<td>Accountability &amp; Patient Participation</td>
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<td>Interventions</td>
<td>Management</td>
<td>Case Study</td>
<td>Communication</td>
</tr>
</tbody>
</table>

#### Icons:
- **Terminology Visualized**
- % Teaching, Guidance & Counseling
- * Treatments & Procedures
- :: Case Management
- ✓ Surveillance

#### Interventions per Category

<table>
<thead>
<tr>
<th>Category</th>
<th>ICU</th>
<th>MS</th>
<th>Tele</th>
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<td>196</td>
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<tr>
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<td>Case Mgmt</td>
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70% of interventions were in the problem: Health Care Supervision
Multidisciplinary Guidelines
Sickle Cell Disease (Rajput, 2015)

• 130 interventions for 19 problems

Multidisciplinary Research
Pharmacy documentation (Garza, 2015)

• Pharmacists provided/recommended 6.7 interventions per patient (Range: 1-16)

Data inform us:
How Guidelines are Used

Value of this when it comes to reuse of data

• Consensus on knowledge representation
• Clear meaning and shared understanding
• High quality data
• Enables meaningful comparisons

Partnerships with agencies for research

omahasystempartnership.org

• Omaha System Partnership for Knowledge Discovery and Healthcare Quality
  – Scientific Teams
  – Affiliate Members
  – Data

Exemplars of research that is possible with consistent documentation using data standards

• Numerous studies available on-line
  – http://omahasystempartnership.org/completed-research/
• Recent work by Dr. Chi and team on the cutting edge

Problem: A small percentage of clients consume a high percentage of service resources (80-20 rule)

Research Question 1: Predict Intervention Usage
- Regardless of outcome, who will need more interventions?
  - For 50% threshold
    - Maximal accuracy ~ 60%
    - Maximal AUC ~ 75%
  - For 75% threshold
    - Maximal accuracy ~ 74%
    - Maximal AUC ~ 77%

Research Question 2: Predict Responsiveness to Interventions
- Within the population, which individuals will be responsive to more interventions for this problem, compared to those who are less
Research Question 3: Predict Personalized Nursing Intervention

- How to personalize care planning based on an individual's characteristics and what intervention patterns can be used to help personalization?
- Intervention patterns typically used in Oral health

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<th>Pattern C</th>
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</table>

Relative Improvement of Predicted Personalized Nursing Intervention

- Relative improvement is 51% (compared to maximum possible improvement for all clients)
- Choosing the right pattern can improve care (efficiency and effectiveness)

Next steps

- Nursing Big Data has been shown to enable the identification of personalized algorithms to improve nursing care quality and efficiency
- Practice-based dissemination and implementation research proposals in development and review
What are the implications of what you just heard for your practice/setting/job?

- How is nursing represented and documented?

What actions can you take now to implement or optimize a similar project?

- What are the options for coding existing documentation and accessing data?

What barriers would you anticipate or have you experienced?

- Who are your champions?
What would you recommend to overcome barriers?

- How can we collaborate?

Thank you

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