Capturing Complexity: Use of TimeCaT & the Omaha System to Study Multi-tasking Activities of Acute Care Nurses

Second International Conference on Research Methods for Standardized Terminologies

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DISCLOSURES

There are no conflicts of interest or relevant financial interests that have been disclosed by these presenters or the rest of the planners and presenters of this activity that apply to this learning session.
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- Kenn Daratha, PhD  Washington State University
Setting Context

25,500+ nurses

10 million patient touches annually
PH&S Mission & Core Values

As people of Providence, we reveal God’s love for all, especially the poor and vulnerable, through our compassionate service.

*Respect - Compassion – Justice – Excellence – Stewardship*
Riding the EHR Bullet Train

36 hospitals, 500 clinics, 3 sub-acute settings in 3.5 years

What is the impact of a comprehensive EHR on hospital nursing care?
Study Aims

• Evaluate applicability of the Omaha System for acute care
• Adapt & use a digital observation tool to measure medical-surgical & ICU nurses’ workflows
• Observe & record nursing interventions using the Omaha System, pre- and post-EHR implementation
Today’s Focus

Digital Observation Tool

MS & ICU Nursing Events

Omaha System
Applicability of Omaha System Terms in Acute Care

Methods: Mapping & Content Validation

- Convenience sample
- Structured interviews
- Content mapping to Omaha System
- Consensus on terms

*Must capture multi-tasking!*
Applicability of Omaha System Terms in Acute Care

Results

- 76% Omaha System terms applicable in acute care MS & ICU settings
  - 40 of 42 Problem terms (95.2%)
  - 4 of 4 Category terms (100%)
  - 48 of 75 Target terms (64%)
- Phrases for approaches to care
- Content validity established
The Quest: Digital T&M Study Tool

- Desired elements
  - Supports data capture for multi-tasking in clinical workflow
  - Configurable for Omaha System terms + location
  - Adaptable user interface – creative use of icons
  - Easy to learn
  - Comprehensive, web-based
  - Mobile/handheld device
  - Integrated tools for training & inter-observer reliability
Data Capture Discovery!

TimeCaT
Time Capture Tool
Data Capture

Real Observation

Training Session

Inter-Observer Reliability Assessment (I.O.R.A.)

Begin new observation.
To start the observation, please specify a site and a subject/tag.

Select the site of the observation.

carepoint east

Indicate a subject or a tag (optional) (What is this?)

Subject 22

Select the type of the observation (?).

Real obs. Training I.O.R.A.

Begin observation
Interface Development

Omaha System in TimeCaT

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

<table>
<thead>
<tr>
<th>Section</th>
<th>Problem</th>
<th>Category</th>
<th>Target</th>
<th>Care description (on interface)</th>
<th>Care descr symbol</th>
<th>Care descr word</th>
<th>Explanation (definition of care description)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Health care supervision</td>
<td>TGC</td>
<td>anatomy/physiology</td>
<td>% p/f - condition</td>
<td>%</td>
<td>condition</td>
<td>nurse explains physiology of patient's illness (p/f = patient/family)</td>
</tr>
<tr>
<td>Communication</td>
<td>Health care supervision</td>
<td>CM</td>
<td>continuity of care</td>
<td>:: report</td>
<td>::</td>
<td>report</td>
<td>nurse gives or participates in report of patient condition and care (e.g. shift report or formal handover)</td>
</tr>
<tr>
<td>Communication</td>
<td>Health care supervision</td>
<td>CM</td>
<td>communication</td>
<td>~ notes</td>
<td>~</td>
<td>notes</td>
<td>nurse documents notes</td>
</tr>
<tr>
<td>Task</td>
<td>Skin</td>
<td>TP</td>
<td>dressing change/wound care</td>
<td>* wound</td>
<td>*</td>
<td>wound</td>
<td>nurse provides wound care</td>
</tr>
<tr>
<td>Task</td>
<td>Health care supervision</td>
<td>S</td>
<td>signs/symptoms physical</td>
<td>✓ assessment ✓</td>
<td></td>
<td>assessment</td>
<td>nurse conducts thorough assessment of patient</td>
</tr>
<tr>
<td>Task</td>
<td>Health care supervision</td>
<td>S</td>
<td>communication</td>
<td>_ chart review _</td>
<td></td>
<td>chart review</td>
<td>nurse reviews patient chart, reads notes, reviews order history to gain comprehensive understanding of the patient health needs, care, and progress</td>
</tr>
<tr>
<td>Location</td>
<td></td>
<td></td>
<td>Med room</td>
<td>x</td>
<td>Med room</td>
<td></td>
<td>nurse is in medication room</td>
</tr>
</tbody>
</table>
Icons:
Terminology Visualized

% Teaching, Guidance & Counseling
* Treatments & Procedures
:: Case Management
✓ Surveillance
~ Writing
_ Reading
Observer Training
Methods for Measuring Workflows

• Observers collected data on nurses in three units, Medical Surgical, Telemetry and Intensive Care

• Approximately **30 hours** of observations on each unit

• Using the TimeCat interface, care descriptions were assigned to one of three groups: task, communication, or location

  – Task and Communication together = “interventions”
  – All data were organized in a structured query analysis
  – Descriptive and comparative analysis done in Excel and SPSS
Findings

• About the three observed Units

• Analysis of interventions

• Analysis of location

• Analysis of multi-tasking

• Comparisons to other studies
About the Units

• Telemetry 4:1 staffing

• Med-Surg 5:1 staffing

• Intensive Care Unit 1 or 2:1 staffing
Time and Interventions

Mean: 1.24 min
Range **0.017-48.9** min
Fratzke (2013) mean 1.1 min
Interventions per Category

<table>
<thead>
<tr>
<th>Category</th>
<th>ICU</th>
<th>MS</th>
<th>Tele</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treat/Proc</td>
<td>196</td>
<td>187</td>
<td>348</td>
<td>931</td>
</tr>
<tr>
<td>Teach/Guide/Coun</td>
<td>366</td>
<td>349</td>
<td>347</td>
<td>1062</td>
</tr>
<tr>
<td>Surv</td>
<td>236</td>
<td>260</td>
<td>383</td>
<td>883</td>
</tr>
<tr>
<td>Case Mgmt</td>
<td>530</td>
<td>569</td>
<td>976</td>
<td>2175</td>
</tr>
</tbody>
</table>

70% of interventions were in the problem: **Health Care Supervision**
## Minutes/Intervention per Episode

These 9 interventions represent the top five on each of the 3 units

<table>
<thead>
<tr>
<th></th>
<th>3N-Tele</th>
<th>7NE-MS</th>
<th>ICU</th>
<th>mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>:: report</td>
<td>5.26</td>
<td>5.47</td>
<td>3.21</td>
<td>4.65</td>
</tr>
<tr>
<td>:: non p/f workflow</td>
<td>0.83</td>
<td>7.25</td>
<td>2.09</td>
<td>3.39</td>
</tr>
<tr>
<td>~ notes</td>
<td>4.67</td>
<td>3.77</td>
<td>1.18</td>
<td>3.21</td>
</tr>
<tr>
<td>_ chart review</td>
<td>3.35</td>
<td>2.2</td>
<td>1.49</td>
<td>2.35</td>
</tr>
<tr>
<td>✓ lab results</td>
<td>2.66</td>
<td>3.31</td>
<td>0.77</td>
<td>2.25</td>
</tr>
<tr>
<td>~ mar</td>
<td>2.52</td>
<td>2.26</td>
<td>0.67</td>
<td>1.82</td>
</tr>
<tr>
<td>% p/f - procedure</td>
<td>0.98</td>
<td>2.45</td>
<td>0.59</td>
<td>1.34</td>
</tr>
<tr>
<td>* specimen</td>
<td>1.33</td>
<td>1.14</td>
<td>1.4</td>
<td>1.29</td>
</tr>
<tr>
<td>% other professional</td>
<td>0.8</td>
<td>0.47</td>
<td>2.01</td>
<td>1.09</td>
</tr>
</tbody>
</table>
About Location

- The observers selected locations from the interface
  - Team area
  - Patient room
  - Hallway
  - Break
  - Off unit
  - Nutrition
  - Supply room

- Location data were analyzed in two ways
  - Frequency of location change
  - Time spent in each location
## Frequency of Location Change

<table>
<thead>
<tr>
<th>Location</th>
<th>Transitions per hour</th>
<th>Average # locations per minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tele</td>
<td>23.93</td>
<td>1.39</td>
</tr>
<tr>
<td>Med-Surg</td>
<td>28.96</td>
<td>1.47</td>
</tr>
<tr>
<td>ICU</td>
<td>34.96</td>
<td>1.57</td>
</tr>
</tbody>
</table>

Range of locations per minute: 1-9
Time Spent in Locations
(% of total time observed)

Team area: 46.5% Tele, 44.4% MS, 39.9% ICU
Patient room: 28.6% Tele, 27.8% MS, 39.4% ICU
Hallway: 9.2% Tele, 14.2% MS, 8.6% ICU

(Other locations not displayed based on low frequency)
Multi-Tasking

Example
Intervention A from 1:02 to 1:15
Intervention B from 1:10 to 1:25
Intervention C from 1:22 to 1:35

MT-Minute: Two or more interventions within same minute
Interventions A, B, and C all occur within minute 1:00-1:59
= 3 Interventions

MT-Overlap: Having at least one second in common
Activity A to B  5 seconds
Activity B to C  3 seconds
=8 seconds of co-occurrence
## MT-Minute

<table>
<thead>
<tr>
<th># interventions done in the same minute</th>
<th>Tele</th>
<th>MS</th>
<th>ICU</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64.9%</td>
<td>62.8%</td>
<td>51.6%</td>
<td>59.8%</td>
</tr>
<tr>
<td>2</td>
<td>14.8%</td>
<td>16.4%</td>
<td>18.5%</td>
<td>16.6%</td>
</tr>
<tr>
<td>3</td>
<td>10.4%</td>
<td>9.1%</td>
<td>13.9%</td>
<td>11.1%</td>
</tr>
<tr>
<td>4</td>
<td>6.7%</td>
<td>7.0%</td>
<td>8.7%</td>
<td>7.5%</td>
</tr>
<tr>
<td>5</td>
<td>2.2%</td>
<td>2.9%</td>
<td>4.0%</td>
<td>3.0%</td>
</tr>
<tr>
<td>&gt;5</td>
<td>0.9%</td>
<td>1.9%</td>
<td>3.4%</td>
<td>2.1%</td>
</tr>
<tr>
<td>Total #</td>
<td>1794</td>
<td>1743</td>
<td>1848</td>
<td></td>
</tr>
</tbody>
</table>
MT- Overlap

- 684 of 4747 observations had at least one overlapping intervention (14.4%)

- How many overlaps occurred with observed interventions?
  Range: 1-15 (average 1.57)

- How long were interventions with overlap?
  Range: 7 seconds to 33.1 minutes
MT- Overlap in 3 Units

12.9% mean across units
Overlapping in Categories

- Teaching, guidance, and counseling with Treatments and procedures
- Case management and Surveillance

<table>
<thead>
<tr>
<th>Category 1/ Category 2</th>
<th>Treatments &amp; Procedures</th>
<th>Surveillance</th>
<th>Case Management</th>
<th>Teaching, Guidance and Counseling</th>
<th>Grand Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teaching, Guidance and Counseling</td>
<td>100</td>
<td>77</td>
<td>42</td>
<td></td>
<td>219</td>
</tr>
<tr>
<td>Case Management</td>
<td>22</td>
<td>75</td>
<td>49</td>
<td></td>
<td>58</td>
</tr>
<tr>
<td>Surveillance</td>
<td>1</td>
<td>85</td>
<td></td>
<td></td>
<td>72</td>
</tr>
<tr>
<td>Treatments &amp; Procedures</td>
<td></td>
<td></td>
<td>18</td>
<td></td>
<td>85</td>
</tr>
<tr>
<td>Grand Total</td>
<td>122</td>
<td>153</td>
<td>194</td>
<td></td>
<td>215</td>
</tr>
</tbody>
</table>


Overlap in Targets

• **All targets overlapped** with at least one other target at least once

• Targets most **frequently** overlapping
  • Communication
  • Sickness/injury care
  • Nursing care

• Most **common** overlapping intervention **pairs**
  • Communication-Communication
  • Medication administration-medication action/side effects
  • Sickness/injury care-signs/symptoms physical
### Overlap in Care Descriptions

<table>
<thead>
<tr>
<th>Care description</th>
<th># of occurrences*</th>
</tr>
</thead>
<tbody>
<tr>
<td>% other professional</td>
<td>104</td>
</tr>
<tr>
<td>% p/f - condition</td>
<td>102</td>
</tr>
<tr>
<td>_ chart review</td>
<td>77</td>
</tr>
<tr>
<td>✓assessment</td>
<td>68</td>
</tr>
<tr>
<td>% p/f - plan of care</td>
<td>66</td>
</tr>
<tr>
<td>* meds</td>
<td>66</td>
</tr>
<tr>
<td>~ notes</td>
<td>60</td>
</tr>
</tbody>
</table>

*out of 1071 multi-tasked occurrences
## Overlap in Care Descriptions

<table>
<thead>
<tr>
<th>Care description</th>
<th>% of total min</th>
</tr>
</thead>
<tbody>
<tr>
<td>% - p/f support</td>
<td>34.36%</td>
</tr>
<tr>
<td>% p/f - procedure</td>
<td>30.76%</td>
</tr>
<tr>
<td>% p/f - condition</td>
<td>27.33%</td>
</tr>
<tr>
<td>_ chart review</td>
<td>26.28%</td>
</tr>
<tr>
<td>✓assessment</td>
<td>25.19%</td>
</tr>
<tr>
<td>% p/f - plan of care</td>
<td>19.81%</td>
</tr>
<tr>
<td>% p/f - meds</td>
<td>19.51%</td>
</tr>
<tr>
<td>All</td>
<td>12.92%</td>
</tr>
</tbody>
</table>
Examples

• Overlap in care descriptions

  – **Explain** medications to patients and family while **administering** medications

  – **Check** vital signs while **writing** notes

  – **Explain** the patient’s condition and plan of care while **assessing** the patient
## Comparing Units

<table>
<thead>
<tr>
<th>TELE</th>
<th>MS</th>
<th>ICU</th>
</tr>
</thead>
<tbody>
<tr>
<td>* iv</td>
<td>37.05%</td>
<td>% p/f - procedure</td>
</tr>
<tr>
<td>✓ assessment</td>
<td>31.95%</td>
<td>% - p/f support</td>
</tr>
<tr>
<td>% p/f - meds</td>
<td>23.53%</td>
<td>% p/f - condition</td>
</tr>
<tr>
<td>* specimen</td>
<td>22.18%</td>
<td>✓ vitals</td>
</tr>
<tr>
<td>_ chart review</td>
<td>19.42%</td>
<td>_ chart review</td>
</tr>
</tbody>
</table>

Top 5 interventions by percentage of time per unit
Interventions which are co-occurring (sharing at least one second)
Comparisons to Other Studies

• Bowles, 2000: Chart review focused on discharge planning

• Zhang, 2011: Creating interface based on observations in med-surg unit

• Fratzke, 2013: Acute care, post-surgical unit observations

• Providence, 2015: Telemetry, med-surg and ICU observations
How Does it Compare?

<table>
<thead>
<tr>
<th></th>
<th>Providence, 2015</th>
<th>Fratzke, 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>TGC</td>
<td>22.4%</td>
<td>6.1%</td>
</tr>
<tr>
<td>T/P</td>
<td>15.4%</td>
<td>18.2%</td>
</tr>
<tr>
<td>S</td>
<td>18.5%</td>
<td>17.9%</td>
</tr>
<tr>
<td>CM</td>
<td>43.7%</td>
<td>45.4%</td>
</tr>
</tbody>
</table>

Fratzke: 96 hours observations on post-op unit
Providence: 90 hours observations on telemetry, med-surg and ICU
Limitations

• Observational studies are limited: Can’t see what nurses are thinking, or subtle interpersonal communication

• 90 hours of observation is substantial, but still small to make between unit comparisons

• Different observers, tendencies may change over length of observation period
Summary

- We have learned
  - Nurses move, quickly changing locations (about every two minutes)
  - Nurses are busy, performing a different activity about every minute
  - Nurses multi-task
    - Perform >1 activity per minute 40% of the time
    - Do more than one thing at once 13% of the time
  - Nurses spend 70% of their time in Health Care supervision and 44% in Case Management
  - TimeCat is an effective tool for observing complex nurse behavior
  - Omaha System classification scheme translates well to acute care
Further Questions

From this data:
• Are there differences through the day?
• More exploration of co-occurrence of communication and task

From new studies:
• Measure effectiveness of teaching when multitasking
• Compare multitasking to error rate or hospital acquired harm
Next Steps

Our Study:
• Post EHR go-live data collection
• Second data collection to validate findings
• Compare pre and post EHR environments

Your Study
• Invitation to replicate! Use TimeCaT
Thank you!

Questions?

Contact
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