Abstract

This study utilized the ISO RTM for Nursing Action as a model to decompose nursing actions and as a framework for analyzing the practice patterns of nurses working in a medical intensive care unit (MICU). Observations were made in a 25-bed MICU and nursing actions recorded in terms of model attributes. 1013 actions were observed; decomposed into the ISO RTM categories, they represented 68 distinct actions, 166 targets, 6 recipients of care, 81 means, 16 routes and 115 sites. The most frequent actions were ‘assessing’ (19.1%) and ‘documenting’ (10.5%). The most frequent target was ‘medication’ (8.5%) and the most frequent recipient of care was ‘patient’ (94.1%). Data revealed nurses perform, yet do not document all actions. Thus in this setting, the existing documentation system does not adequately represent all aspects of nursing practice. The ISO RTM permits evaluation of the depth and breadth of nursing care by identifying all nursing actions.

Introduction

The purpose of nursing documentation is to represent clinical practice in the patient record. Recording nursing care in an unstructured fashion, however, does not allow us to examine this documentation across patients or across institutions. Accurate documentation in a standardized format enables the collection and organization of nursing data for the analysis of nursing outcomes. The need to identify, name and classify nursing phenomena, in particular diagnoses, interventions and outcomes of patient care has demonstrated the importance of developing nursing terminologies.

A terminology may be described as a set of terms adopted by experts within a subject field to represent a system of concepts specific to that field. The relationship among these concepts provides the basis for standardized systems that enables the organization of knowledge within a discipline. As nursing classification systems have been developed and computer technology has advanced, it has become possible to measure and evaluate nursing-sensitive outcomes.

In recent years, research has focused on the development of reference terminology models that may be used to bridge the gap between terms used in nursing documentation and computer database systems. A reference terminology model (RTM) may be described as a “framework of categories or attributes of terms and the relationships among these attributes that provide a structure for the organization of terms to represent concepts.” Thus a RTM includes not only the sets of terms to describe relevant concepts, but also specifies the way in which individual concepts may be linked to create compositional expressions.

To date, research has primarily focused on the ability of RTMs to map terminologies from various nursing classification systems or has evaluated the ability of a RTM to represent existing nursing documentation. Moss et al., (2003) evaluated the International Standards Organization (ISO) RTM by determining the percentage of pain interventions, as documented by nurses, which could be mapped to the ISO RTM for Nursing Action. The authors reported favorably on the use of RTMs for exploring nursing practice through documentation, and suggested that the ISO RTM for Nursing Action warranted consideration by information system developers.

Hardiker (2004) evaluated the utility of the International Standard (ISO FDIS 18104) with respect to both the model for nursing diagnosis and nursing action. Hardiker supports the value of the standard in evaluating existing terminologies. However given that the standard only provides a sample of diagnosis and action decompositions, he identifies that validation work is necessary to ensure that the models are representative of all suitable nursing diagnoses and nursing actions. This supports the need to test the practical application of these models in nursing practice.

To design documentation systems that accurately represent nursing actions, it is first necessary to describe the characteristics of nursing actions in practice. The purpose of this study was to use the ISO RTM for Nursing Action as a framework for analyzing the practice patterns of nurses working in a medical intensive care unit. What makes this study unique is the direct application of the ISO RTM for Nursing Action to dissect nursing actions in practice, rather than attempting to map existing nursing classification terms for nursing action to the RTM. Four research questions were addressed in this study:

1) Are the existing ISO RTM model attributes sufficient for describing the complexity of nursing actions in MICU practice?
2) What are the types of actions performed by nurses in the MICU?
3) What are the characteristics of actions utilized by MICU nurses during the course of their nursing practice?
4) What effect do education level, years working as a RN, or time working on the unit have on the types of actions performed?

Methods
Setting
This study was conducted in the 25-bed Medical Intensive Care Unit (MICU) of a large metropolitan hospital in the Southeastern United States. Patients admitted to the MICU frequently require advanced care including invasive hemodynamic monitoring, ventilator support and continuous hemofiltration dialysis.

Sample
Study participants included only RNs working in the MICU at the time of data collection. Seven of the nurses held Bachelor’s degrees, two held Master’s degrees and one held an Associate’s degree. Experience working as a nurse varied from four months to 22 years and time working on the unit varied from one month to 12 years.

Data collection
This was an observational study of nursing actions. Observations of RNs were conducted in two-hour intervals during regular, 12-hour morning or evening shifts. The researcher followed individual nurses during the course of their work, observing and recording each nursing action, in terms of the ISO model attributes described below. Data from a total of ten non-consecutive, two-hour observation periods were collected; no nurse was observed twice. Every effort was made to remain as unobtrusive as possible so as to not interfere with the activities of the nurse being observed.

The unit of analysis for this study was nursing action. Nursing action is defined by the ISO as actions that have the attributes of target, recipient of care, means, route and site as outlined in the ISO Reference Terminology Model for Nursing Action, 2002. This definition was operationalized for this study as an intentional act initiated by the nurse applied to a <<target>> through an <action> for one intended purpose.

Semantic descriptors were assigned for all applicable action attributes. Prior to any data collection, a study of action descriptors from other nursing classification systems was made in order to provide the researcher with a broader vocabulary from which to draw upon when selecting descriptors for the present study. Actions that were observed simultaneously, such as drawing arterial blood gases (ABGs) and consoling the patient or changing a dressing and educating the patient were recorded as separate actions to capture the complexity of actions nurses perform in caring for patients.

Observations of nursing actions were recorded on a preprinted data collection sheet with attributes derived from the ISO Reference Terminology Model for Nursing Action, 2002. These attributes include target, recipient of care, means, route and site and are described below. The descriptors recorded for this study were generated by the researcher at the time an action was observed. For each nursing action, a descriptor term was entered under each attribute that applied to that action on the data collection form, thus enabling decomposition of each action into its corresponding attributes. Definitions of the model attributes guided the decomposition and labeling of action components. In these definitions single angle brackets < > are used to enclose semantic categories and double angle brackets << >>, semantic domains.

The following example illustrates how actions were decomposed. Given the action, ‘suctioning secretions in airway through trachea’

<Action>: suctioning
Acts on <<target>>: secretions
Has <<site>>: airway
Has <route>: through trachea
Has <<recipient of care>>: patient

As necessary, clarification of an action was made by consulting with the nurse being observed, thereby validating the use of a given descriptor term when a question arose.

Following each observation period, five randomly selected actions and their descriptors were chosen and the nurse was asked to verify whether or not she/he agreed with the decomposition of the selected actions. Any discrepancies were recorded. The nurse was also asked the following questions:
1) Do these examples accurately reflect your actions?
2) If not, what do you feel was missed or omitted?
3) What do you see as the strengths and/or weaknesses of this tool?
4) Do you have any other comments or suggestions?

Data analysis
Data were analyzed using SPSS 14.0 (Chicago, IL). The frequency of actions that contained words or phrases that mapped to model attributes was measured to evaluate the model’s ability to represent the actions of nurses in a MICU. This analysis determined the types of actions used in MICU nursing practice, their semantic descriptors, semantic descriptor frequency, and how these actions would be represented in an information system by the ISO model. The effect of education level, years of experience as an RN and years working in the MICU on the types of actions performed was examined across participants.

Protection of Human Participants
Informed consent was obtained prior to observations. No personally-identifying data regarding nurses or patients was recorded. Data were secured during and after the study conclusion. Permission to conduct this study was obtained from the hospital in which the unit resides and Institutional Review Board.

Findings
Description of the dataset
Data consisted of descriptor terms to designate each action and each attribute that applied to that action, target, recipient of care, means, route and site. The final data set consisted of
1,013 actions performed by the 10 nurses over 20 hours. The maximum number of actions performed by any nurse was 138 and the minimum number was 75.

**Research questions and answers**

1) *Are the existing model attributes sufficient for describing the complexity of nursing actions in MICU practice?*

All attributes were utilized in recording descriptors during data collection. True to the ISO definition of <action>, every action had a <target>. In addition, descriptors were entered in the attributes <recipient of care> and <means> for 100% of actions performed. Descriptors for <route> were entered for 11.6% of actions and <<site>> was utilized in 74.3% of actions performed. These values are depicted in Figure 1, below.

The total number of 1,013 actions was uniquely represented by 68 descriptors for <action>, 166 for <target>, 6 for <recipient of care>, 81 for <means>, 16 for <route> and 115 for <<site>>. The five attributes for nursing <action> were not sufficient to describe the characteristics of interventions in 24% of nursing interventions observed. Descriptors were assigned to an ‘other’ attribute as described below. The action ‘exchanging’ was most frequently associated with the use of the ‘other’ attribute (31 of 244 or 12.7%), and ‘information’ was its corresponding target (31 of 31 or 100%). Additional actions utilizing the ‘other’ attribute were ‘providing’, ‘receiving’ and ‘requesting’, the majority of which corresponded with the target ‘information’. Notably, ‘verifying’, ‘consulting’ and ‘informing’, also related to information exchanged in most cases. For example, given the <action> ‘exchanging’, <target> ‘information’ and <recipient of care> ‘family’, details specified in ‘other’ were ‘rescheduled for tracheostomy in a.m.’

2) *What are the types of actions performed by nurses in the MICU?*

A total of 68 descriptors were used to identify the actions performed by nurses in the MICU. The most frequently used descriptor for <action> was ‘assessing’ (19.1%) followed by ‘documenting’ (10.5%). ‘Adjusting’ (4.8%), ‘cleaning’ (4.3%), ‘flushing’ (4.1%) and ‘preparing’ (3.8%) were the next most frequently used descriptors. In order to conceptualize the types of actions performed by nurses, the descriptors used to specify <action> were grouped into broader categories of assessment, documentation, medication preparation and administration, equipment and supply management, communication, and physical and emotional care. These categories are not meant to be definitive, but only serve as a more accessible way to view these data. These groups and the descriptors for <action> that fall under these broader categories are illustrated in Table 1, below.

<table>
<thead>
<tr>
<th>Assessment</th>
<th>Documentation</th>
<th>Medication preparation &amp; administration</th>
<th>Equipment &amp; supply management</th>
<th>Communication</th>
<th>Physical &amp; emotional care</th>
</tr>
</thead>
<tbody>
<tr>
<td>20%</td>
<td>11%</td>
<td>26%</td>
<td>18%</td>
<td>13%</td>
<td>17%</td>
</tr>
</tbody>
</table>

| Assessing   | Monitoring    | Observing    | Entering    | Documenting | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" |
|-------------|---------------|--------------|-------------|-------------|----------|------------|----------|------------|----------|------------|----------|------------|----------|
| Assessing   | Access人人    | Access人人   | Access人人   | Access人人   | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" |
| Assessing   | Access人人    | Access人人   | Access人人   | Access人人   | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" | Access人人 | "documents" |

By grouping the <action> descriptors in this way, it is evident that of the 68 unique actions that nurses perform, the greatest number (17) fall under medication preparation and administration.

3) *What are the characteristics of actions utilized by MICU nurses during the course of their nursing practice?*

**Target**

The most frequently used <target> descriptor was ‘medication’ (8.5%). In fact, 10.9% of all <target> descriptors represented medication management and documentation. ‘Information’ (6.4%) was the next most frequently occurring descriptor of target. The <action> descriptors that corresponded with ‘information’ were ‘exchanging’, ‘providing’, ‘receiving’, ‘reporting’ and ‘requesting’. Table 2, below, provides the most frequently used descriptors of target in the five most frequently occurring actions.

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*Figure 1. Percentages of model attribute utilization for data collection.*

*Table 1. Grouping of <Action> descriptors into broader categories and percentage of total observations.*

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Table 2. Representation of <<target>> in nursing actions

<table>
<thead>
<tr>
<th>Action</th>
<th>Target</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessing</td>
<td>Capillary refill</td>
<td>26</td>
</tr>
<tr>
<td></td>
<td>Urinary output</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>Patient status</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Pulse</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Neuro status</td>
<td>12</td>
</tr>
<tr>
<td>Documenting</td>
<td>Vital signs</td>
<td>39</td>
</tr>
<tr>
<td></td>
<td>Lab values</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Position</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Assessment</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Medication admin-</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>-istration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>IV flow rate</td>
<td>3</td>
</tr>
<tr>
<td>Adjusting</td>
<td>Head of bed</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Medication dose</td>
<td>9</td>
</tr>
<tr>
<td></td>
<td>Linens</td>
<td>3</td>
</tr>
<tr>
<td>Cleansing</td>
<td>Hands</td>
<td>37</td>
</tr>
<tr>
<td></td>
<td>Wound</td>
<td>3</td>
</tr>
<tr>
<td>Flushing</td>
<td>Normal saline</td>
<td>38</td>
</tr>
</tbody>
</table>

**Recipient**

Six descriptors were used to designate <<recipient of care>>. ‘Patient’ was most frequently used (94.1%), followed by ‘other nurse’s patient’ (3.6%), ‘family’ (0.9%), ‘spouse’ (0.5%), ‘nurse’ (0.5%) and ‘MD’ (0.5%). In instances when ‘family’ or ‘spouse’ was the recipient of care, the nurse was providing information, orienting them to the unit etc. All instances of a nurse or MD as <<recipient of care>> were related to exchanging, reporting or providing information only.

**Means**

The most frequently used descriptors of <<means>> were ‘verbal’ (14.6%), ‘visual’ (12.9%) and ‘flowsheet’ (9.7%). In all instances where ‘flowsheet’ was the means, the action was ‘documenting’. Some actions, such as ‘assessing’, ‘verifying’ and ‘documenting’ were accomplished by more than one means. In such actions as ‘comforting’, ‘assessing’ and ‘waking’ nurses also used ‘touch’ as a means, often simultaneously with ‘verbal’ or ‘visual’ means.

**Route**

Sixteen unique descriptors specified <<route>> in 117 (11.6%) of the total number of actions (1,013). The most frequently used descriptors were ‘central line’ (48.7%), ‘OG tube’ (11.1%) and ‘ET tube’ (9.4%). The descriptors used to specify <<route>> could be grouped into either artificial or natural routes. Artificial routes included the equipment listed above, in addition to ‘PEG tube’, ‘PICC’, ‘NG tube’ and ‘peripheral IV’. Natural routes included ‘oral’, ‘cutaneous’ and ‘subcutaneous’.

**Site**

Descriptors specified <<site>> in 753 (74.3%) of the total number of actions. The 114 unique <<site>> descriptors could essentially be grouped into anatomical location, physical location and equipment. The most frequently used descriptors specified physical locations. These were ‘bedside’ (20%), ‘nurse’s station’ (4.8%) and ‘sink in patient’s room’ (4.6%).

The most frequently used descriptors of equipment were ‘monitor’ (3.5%) and ‘foley bag’ (3.1%). ‘Hand’ (3.2%) and ‘feet’ (2.9%) were the most frequently specified anatomical location.

All of the nurses validated the selection of descriptors made by the researcher. In only one case, the nurse suggested ‘accuracy; to monitor patient’ versus ‘level’ for <<means>> in the action, ‘calibrating transducer’ which followed the action ‘assessing phlebostatic axis’.

4) What effect do education level, years working as a RN, or time working on the unit have on the types of actions performed?

There was no significant difference (ANOVA) between the number of interventions performed by nurses on the basis of years of experience, time on the unit, or educational level in the categories of assessing, documenting, or comforting.

**Discussion**

**Adequacy of the ISO RTM Model**

The ISO RTM for Nursing Action has the potential to not only evaluate the depth and breadth of nursing care by identifying essential nursing actions that might not be documented, but also to provide a means of capturing those actions into a more suitable documentation system. The attributes <<target>>, <<recipient of care>> and <<means>> were used in 100% of nursing actions recorded. <<Route>> was specified in 11.6% of actions and <<site>> was specified in 74.3% of all actions recorded.

In designing the data collection form, an additional ‘other’ attribute was included to permit the inclusion of more information about a given action as needed. In 24% of the total number of actions recorded, the ‘other’ attribute was used. The majority of these actions pertained to information exchange-type actions and in most cases the ‘other’ category was used to clarify details about the <<target>>. For example, in the action-target pair, ‘exchanging information’, ‘information’ was often further clarified with statements that included ‘febrile status’. The use of only one <<target>> term was did not adequately describe the target.

Others have reported difficulty in fully describing an action by assigning only one term per model category. Moss et al. (2003) reported that it was necessary to utilize whole phrases in some instances to fully capture the content of the nursing action. Hwang et al. (2003) report that hierarchical structures for descriptors are needed to instantiate semantic categories for the ISO RTM for Nursing Diagnosis to fully capture nursing diagnostic concepts. In this study, we could have more fully described actions by combining two or three target terms. This approach would maintain the combinatorial nature of the model while increasing the richness of nursing documentation.

**Documentation as a Reflection of Practice**

A review of this study data revealed that not all actions performed by nurses are documented, showing that the existing methods of documentation in this unit are inadequate to cap-
ture all actions performed by nurses. The nursing documentation in this unit is almost entirely related to reporting patient physiological information with little documentation related to interventions provided by the nurse. These findings are consistent with those of studies of information tasks in intensive care units\textsuperscript{13,14}. Observations of nursing information tasks in a coronary intensive care unit revealed only 50% of nursing information tasks were related to patient information\textsuperscript{14}. However, 98% of the nursing documentation in the same unit was shown to be related to patient monitoring or assessment data\textsuperscript{13}. One of the problems associated with this discrepancy is that it casts doubt on our ability to use nursing documentation as an accurate representation of reality. Therefore, at least in this case, we are unable to rely on documentation data to analyze patients’ responses to nursing care.

**Limitations**

Although the decomposition of nursing actions was validated by the nurses being observed, the validity and reliability of these results could have been strengthened through other review methods. For example, videotaping of a randomly selected set of observation sessions would allow others to independently code each nursing action. This review would serve two purposes: categorical codes could be validated and the reliable use of these codes could be established. However, videotaping would impose a much higher level of intrusion both for nurses and patients. In the present study the anonymity of nurses, patients, and families was maintained.

**Summary**

This study represented a unique application of the ISO RTM for Nursing Action in examining nursing actions in practice. The findings provide support for the use of the ISO RTM to analyze nursing practice patterns and for representing the types of actions performed by nurses in a MICU. The addition of another attribute would be beneficial to fully support the representation of all actions. This study has demonstrated the potential value of using reference terminology models to examine nursing actions in practice and documentation. In the future, information system developers may be able to incorporate this model, or aspects of this model, into computerized documentation systems to improve their ability to represent nursing actions and permit the reuse of these data to support nursing practice.

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