

Informing Standard Development and Understanding User Needs with Omaha System Signs and Symptoms Text Entries in Community-Based Care Settings

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Abstract

The Omaha System is one of the most widely used standards for documentation in community-based settings. While researchers have focused upon this extensible classification scheme to understand and summarize structured data, few studies have analyzed the use of associated text. Two years of client records were accessed from two diverse sites utilizing the Omaha System 2005 revision: a skilled homecare, hospice, and palliative care program and a maternal child health home visiting program. Each problem allows users to enter text data for “other” signs and symptoms (S&S). Problems with the most frequent use of Other S&S were analyzed by a group of content experts to categorize associated text and inform future standard refinements. Text entries for Other S&S frequently contained duplicate entries, multiple concepts, medical diagnoses, interventions, or comments. A number of potential new and modified S&S were identified. Text entries for Other S&S appear valuable for informing future standard development.

Introduction

The use of electronic health record (EHR) systems is increasingly important for documentation, delivery, and analysis of healthcare, including within community-based settings. One of the most widely used clinical taxonomic classifications in community-based care is the Omaha System, which is designed to comprehensively describe health and produce meaningful information through three interrelated components: Problem Classification Scheme, Intervention Scheme, and Problem Rating Scale for Outcomes. Approximately 11,000 clinical practitioners from 400 organizations in 14 countries⁽¹⁾ are using the Omaha System to describe client knowledge, behavior, and status with multiple health indicators⁽²⁾. Signs and symptoms (S&S) are objective and subjective evidence respectively indicating the presence of a problem. Each of the 42 Omaha System Problems have structured S&S that are unique to each problem and non-repetitive across problems. The user can add textual data for “other”

S&S when no logical choices are available. Refinements were made with the Omaha System’s 2005 update (Revised 2005) ⁽²⁾. Details of its terms and structure are online (omahasystem.org).

A large amount of research has focused on the Omaha System and analysis of data derived from structured documentation. In addition to structured Omaha System terms, clinicians frequently enter text during the course of documenting an encounter to provide clinical reasoning and fill information gaps. Text is used throughout healthcare documentation as it allows clinicians to express sophisticated concepts such as timing, clinical interpretation, and complex reasoning⁽³⁾ which potentially adds crucial information for care and research.

As point-of-care standardized documentation becomes more widespread and adopted into community-based EHR systems, a fuller understanding of issues encountered with the use of both electronic systems and documentation standards can help to inform user needs, identify “work-arounds” as well as gaps in standardized languages. Use of standardized languages in EHRs facilitate accurate and functional healthcare documentation, improved patient safety, and quality oversight⁽⁴⁾.

We hypothesized that the text entries associated with Other S&S would contain valuable empiric information relevant to both the use of electronic documentation systems that are standards-based and for ongoing development of the Omaha System terminology.

Methods

A multi-disciplinary team in the University of Minnesota School of Nursing and Institute for Health Informatics, along with two community partners, collaborated in this research. Community partner sites spanned two diverse clinical settings: a maternal child health home visiting program at Washington County Public Health and a skilled homecare, hospice, and palliative care program at Fairview HomeCaring & Hospice. Both community partners

use CareFacts™ [St. Paul, Minnesota], a software system that implements the Omaha System for documentation. After University of Minnesota Institutional Review Board approval was obtained, CareFacts™ provided a de-identified limited dataset over the study period (October 2006-8).

General

Data from both sites were analyzed for the use of S&S. The frequency of problems overall (including Actual, Potential, and Health Promotion) were tabulated, along with S&S at each of the two sites. The system did not require entry of an associated S&S, and actual problems more frequently were observed to have associated S&S. We included the 12 problems in our analysis where Other S&S were used most often and also added one additional problem (Residence) to increase the amount of data from the public health site. The frequency of S&S for each problem excluding blank entries was expressed as an absolute number, as a percentage of overall S&S entries, and as a percentage of S&S entries for the problem.

Analysis of Other Signs and Symptoms

Each Omaha System Problem has Recommended S&S(2), and users can enter text for Other S&S when the Recommended S&S do not fit the patient's exhibited or stated S&S. The Other S&S entries were reviewed over a series of group sessions with between 4 to 6 research members experienced in

nursing, public health, homecare, health informatics, and medicine to characterize Other S&S entries. A small subset of entries was initially analyzed to formulate and inform the types of content that these entries could represent.

We categorized text into several overlapping categories: duplicate entry, wrong problem, intervention, cause, medical diagnosis, comment, or multiple concepts. In the CareFacts™ software which generated data in this study, when a visit is created, the care plan is carried forward from one visit to the next, resulting in duplicate information. Wrong problem entries were S&S that referred to another problem focus and were not relevant to the particular problem. Some entries represented an intervention, a problem cause/etiology, or included a medical diagnosis and were classified as such. Entries that contained conceptually multiple concepts or statements were classified as "multiple concepts". As a final step, entries were compared to the Recommended S&S for each problem to help identify possible gaps including new S&S or modification of Recommended S&S for future enhancement of the Omaha System. All differences of opinion were settled by group consensus.

Results

Over the two year period of the study, there were 6,680 visits (1,079 clients, median age 16, 77% female) in public health and 55,021 visits (2,309

Problem	Problems Overall	Actual Problems	S&S Entries* (Actual Problems)	Recommended S&S Entries			Other S&S Entries		
				N	% All Recommended S&S entries	% of S&S Entries for Problem	N	% of All Other S&S entries	% of S&S Entries for Problem
Medication regimen	1889	1346	1279	412	6	32	867	30	68
Skin	2330	1269	1271	759	11	60	512	18	40
Respiration	2033	448	422	214	3	51	208	7	49
Urinary function	1914	319	303	177	3	58	126	4	42
Nutrition	1704	482	417	292	4	70	125	4	30
Circulation	1465	323	300	189	3	63	111	4	37
Bowel function	1969	232	226	125	2	55	101	4	45
Mental health	2205	267	275	188	3	68	87	3	32
NMS function	1898	1245	1155	1072	15	93	83	3	7
Health care supervision	1592	199	175	100	1	57	75	3	43
Pain	2187	1461	1364	1303	18	96	61	2	4
Caretaking/parenting	2395	181	179	126	2	71	53	2	29
Residence	2044	145	134	106	2	79	28	1	21
Other (29 problems)	45835	2587	2569	2154	30	84	415	14	16
Total	71460	10504	10029	7217	100	72	2852	100	28

Table 1. Frequency of suggested and other signs and symptoms by problem. S&S=Signs and Symptoms. NMS= Neuro-musculo-skeletal. *Blank entries excluded, along with visits where no changes were noted for a given problem with a S&S.

clients, median age 70, 62% female) in the homecare, hospice, and palliative setting.

Table 1 summarizes our findings with respect to frequency of Problems, recommended S&S, and Other S&S. For most problems, Other S&S were entered in infrequently, but some problems (e.g. Medication regimen, Health care supervision) had a significant proportion of Other S&S entries. Overall, 13 problems contained over 85% of Other S&S.

Other S&S entries and their categorizations are summarized in Table 2. Duplicate entries ranged from 9% to 65%. The remaining statistics were generated based off of the total unique entries for Other S&S. Most entries for Other S&S were related to the correct problem, although the problems Health care supervision, Residence, Neuro-musculo-skeletal function, and Mental health had entries of the wrong focus for 32%, 37%, 19%, and 15% of unique entries respectively. Some problems also contained a large proportion of interventions, including Medication regimen (58%), Caretaking and parenting (58%), Health care supervision (32%), Nutrition (38%), and Bowel function (32%). Medical diagnoses were entered commonly with the problems Circulation (71%), Respiration (60%), Mental health (52%), and Urinary function (45%). Some Other S&S text also contained additional comments, causes for the problem, and multiple concepts.

When Other S&S text was compared to the Recommended S&S for each problem, a number of possible new S&S were discovered as well as possible areas for modifying existing Recommended

S&S (Table 3, <http://omahasystemmn.org/>).

Discussion

The use of EHR systems and standardized terminology for community-based care is increasingly important as healthcare continues to shift from acute inpatient settings to increased ambulatory and public health settings. In our study we analyzed the use of text entry for Other S&S and demonstrated several areas of challenges with text including: improper use Other S&S text fields to describe interventions, medical diagnoses, or to refer to the incorrect problem focus. We also found several areas where the Omaha System could potentially be informed for future refinement.

We observed a significant number of user problems, including wrong problem focus and intervention for Other S&S. For instance, entries for Mental health were often more appropriately Cognition entries due to the close relationship and potential overlap of these problems. Similarly, some entries for Residence belonged in Sanitation or Neighborhood/workplace safety. Other S&S text field also was used incorrectly to describe interventions. It is likely that novice users document incorrectly to save time and decrease documentation effort. We support additional training and modifying this software for improved ease of documenting multiple S&S for a problem.

We identified several potential gaps to add new S&S or modify existing ones. For example, Medication regimen text entries suggested the need to include S&S for “New/modified medication regimen”,

Problem	Total S&S Other N	Duplicate Entries N (%)*	Unique S&S Other N (%)*	Wrong Problem Reference N (%)†‡	Intervention N (%)†‡	Comments N (%)†‡	Problem Cause N (%)†‡	Medical diagnosis N (%)†‡	Multiple Concepts N (%)†‡
Medication regimen	867	511 (59)	356 (41)	38 (11)	207 (58)	46(13)	30 (8)	6 (2)	126 (35)
Skin	512	334 (65)	178 (35)	13 (7)	3 (2)	33 (19)	55 (31)	22 (12)	22 (12)
Respiration	208	92 (44)	116 (56)	0 (0)	1 (1)	12 (10)	70 (60)	69 (60)	23 (20)
Urinary function	126	41 (33)	85 (67)	2 (2)	9 (11)	23 (27)	65 (76)	39 (45)	11 (13)
Nutrition	125	21 (17)	104 (83)	0 (0)	39 (38)	9 (9)	35 (34)	17 (16)	4 (4)
Circulation	111	35 (32)	76 (68)	8 (11)	2 (3)	39 (51)	15 (20)	54 (71)	17 (22)
Bowel function	101	57 (56)	44 (44)	0 (0)	14 (32)	7 (16)	6 (14)	5 (11)	6 (14)
Mental health	87	33 (38)	54 (62)	8 (15)	1 (2)	14 (26)	8 (15)	28 (52)	14 (26)
NMS function	83	19 (23)	52 (77)	12 (19)	5 (10)	13 (25)	29 (56)	14 (27)	7 (13)
Health care supervision	75	10 (13)	65 (87)	24 (37)	21 (32)	14 (22)	2 (3)	0 (0)	1 (2)
Pain	61	26 (43)	35 (57)	1 (3)	10 (29)	9 (26)	5 (14)	3 (9)	0 (0)
Caretaking/parenting	53	5 (9)	48 (91)	1 (2)	28 (58)	21 (44)	14 (29)	0 (0)	0 (0)
Residence	28	6 (21)	21 (79)	7 (32)	0 (0)	3 (14)	1 (5)	1 (5)	1 (5)

Table 2. Use of Signs and Symptoms Other Entries. S&S=Signs and Symptoms. NMS=Neuro-musculo-skeletal. *Percentage of Total S&S Other for problem. †Percentage of Unique S&S Other for problem. ‡Some entries with multiple uses.

“Complicated medication regimen”, and “Inadequate understanding of medications”. Similarly, “[Subjective] shortness of breath” for Respiration and “Decreased endurance” for Neuro-musculo-skeletal function were frequently documented by clinicians. One challenge, however, is that “Decreased endurance” is a subjective symptom which can be multi-factorial in origin or etiology and thus difficult to assign to a single Problem. In several cases, text identifying Other S&S suggested the need for modification of Recommended S&S. For instance,

while “Abnormal frequency/consistency of stool” exists as a Recommended S&S in the Omaha System, clinicians reported the type of abnormality (“diarrhea” or “constipation”), each of which is conceptually very different. In the public health setting, concepts for extended types of homelessness including eviction or temporary housing were not well covered by the concept “homeless” for the problem Residence.

The problem Skin had a particularly large number of entries with Other S&S associated with the concepts

Problem	Example Statement	Count*	Existing Signs and Symptoms	Suggested Signs and Symptoms
Medication regimen	"Med changes since hospitalization"	49		New/modified medication regimen
	"Many different medications "	25		Complicated medication regimen
	"Confusion re: medications"	3		Inadequate understanding of medications
	"Unable to afford meds"	1	Fails to obtain refills appropriately	Difficulty obtaining medications
Skin	"Left foot wound"	50	Delayed incisional healing	Open wound
	"Incision right abdomen"	19	Delayed incisional healing	Incision
	"Immobility, heel with pressure ulcer"	50	Lesion/pressure ulcer	Pressure ulcer
Respiration	"Slight SOB with activity"	24		[Subjective] Shortness of breath
	"Decreased [oxygen] sats"	2	Abnormal respiratory laboratory results	Abnormal respiratory diagnostic test
Circulation	"EF 15-20%"	1	Abnormal cardiac laboratory results	Abnormal cardiac diagnostic test
Bowel function	"Chronic constipation"	11	Abnormal frequency/consistency of stool	Constipation
	"Recent diarrhea"	5	Abnormal frequency/consistency of stool	Diarrhea
	"Has 1 year hx of bloating and gassiness. Followed by Pediatric G.I."	1	Cramping/abdominal discomfort	Abdominal discomfort
Caretaking and parenting	"Has additional twin in NICU. This is very stressful for mother."	1		Caregiver stress/burnout
	"Has difficulty dealing with ----'s negative behavior. Requests assistance in how to respond."	1		Difficulty managing behavioral issues
Health care supervision	"Needs assistance with managing health care"	6		Inability to implement treatment plan
	"Needs assistance to manage rapidly changing health care status."	2	Inability to coordinate multiple appointments/ treatment plans	Inability/ difficulty coordinating appointments/treatment plans
	"Client has history of inconsistently managing health care."	1		Fails to follow recommended health care plans
	"Unable to physically go to Doctor"	1		Inability to seek care
Neuro-musculo-skeletal function	"Poor endurance"	10		Decreased endurance
Pain	"Client experiences increased L arm/shoulder pain."	1		Increased Intensity/inadequate control
Residence	"Eviction in one week"	8	Homeless	Homeless/eviction/temporary housing
	"High water temperature"	2		Unsafe water temperature
	"No furniture/household goods"	1		Inadequate furnishing

Table 3. Example statements with suggested new or modified signs and symptoms. *Number of statements in the corpus supporting new or modified signs and symptoms.

of “wound”, “pressure ulcer”, or “incision”. The Omaha System currently has Recommended S&S: “delayed incisional healing” and “lesion/pressure ulcer”; this terminology could be confusing for providers. The term “lesion” in the context of skin refers to any abnormal area of skin (e.g., mole, wound, ulcer, abrasion, etc.). A “wound” is any opening in the skin, including an incision that has opened with “delayed incisional healing”. While an incision is typically closed (i.e. not an open wound), because assessment of a post-operative incision is an important objective physical finding, we support representing “open wound” and “incision” as distinct S&S. Similarly, while “pressure ulcer” can be a type of open wound, the concept of a pressure ulcer is particularly important for clinical care and quality and should be distinct from “open wound”.

We encountered a large number of Other S&S entries associated with technical procedures including entries for central lines, feeding tubes or other tubes (i.e. nephrostomy, drains, T-tubes), or foley catheters. When concepts that included stomas (i.e. urostomy, colostomy, ileostomy) were added, this resulted in over 70 entries, which were found to be associated with multiple, inconsistent problem foci including Urinary Function, Skin, Bowel Function, and Medication Regimen. We would propose that a reliable way to deal with documentation of technical procedures is important for consistency. For example, we encountered similar entries to “Central line for TPN” associated with Skin, Nutrition, and Digestion/hydration.

The work described in this paper is part of a greater group effort aimed at understanding and utilizing text entries with the Omaha System associated with community-based documentation using automated natural language processing (NLP) tools. While still an understudied area of informatics investigation, several groups have recently reported exploratory work using NLP techniques to extract information from nursing text, particularly for nursing outcomes and interventions(5) and also for mappings to the nursing terminologies, as reported by Bakken et al. with the ISO reference terminology models for nursing (6, 7).

This study suggests several important areas for further research. In a broad sense, we believe that the use of text can be helpful for modifying or expanding other biomedical terminologies. For example, one could conduct very similar studies using clinical notes from a specialized clinical domain to improve content coverage for interface terminologies such as the International Classification of Nursing Practice (ICNP). We observed that for some problems, Other

S&S were used frequently, which negatively affects the quality of associated data with respect to understanding a Problem with consistency of S&S. Efforts to better standardize use of the Omaha System may be able to assist in improving the quality of data(8). We plan to examine the use of text associated with interventions, as well as target terms/concepts for NLP processing specific to the public health and nursing domains to improve automated techniques to process text.

Conclusions

This study is one of few studies to capitalize on the rich content of text entries to help empirically inform terminology development. Analysis of text entries associated with Omaha System documentation for Other S&S contains valuable information. These entries frequently contain duplicate “carry forward entries”, multiple concepts, medical diagnoses, interventions, or comments. The analysis of text may help inform future standards development where information gaps or challenges occur.

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