

Meaningful Use of a Standardized Terminology to Support the Electronic Health Record in New Zealand

K. Monsen; M. Honey; S. Wilson

¹School of Nursing, University Of Minnesota, 5-140 Weaver-Densford Hall, 308 Harvard Street SE, Minneapolis, MN 55455, USA;

²School of Nursing, The University of Auckland, Private Bag 92019, Auckland, New Zealand; ³Shona Wilson Consultancy Co. Ltd., Wellington, 6011, New Zealand

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Summary

Meaningful use is a multidimensional concept that incorporates complex processes; workflow; interoperability; decision support; performance evaluation; and quality improvement. Meaningful use is congruent with the overall vision for information management in New Zealand. Health practitioners interface with patient information at many levels, and are pivotal to meaningful use at the interface between service providers, patients, and the electronic health record. Advancing towards meaningful use depends on implementing a meaningful interface terminology within the electronic health record. The Omaha System is an interface terminology that is integrated within Systematized Nomenclature of Medicine – Clinical Terms (SNOMED CT[®]), and has the capacity to disseminate and capture information at the point of care because its codes are simple defined terms. Two community nursing and allied health providers who are considering using the Omaha System in clinical systems for gathering intervention and outcomes data within the personal EHR include Nurse Maude and the Royal New Zealand Plunket Society. Help4U is investigating using the Omaha System as a way to standardise health terminology for consumer use. The Omaha System is also a good fit with the Midwifery and Maternity Providers Organisation (MMPO) existing clinical information system to describe and capture data about interventions currently recorded as free text. As a country that promotes access to affordable primary care and free hospital care, within an environment constrained by resource limitations, maximizing the use of data is key to demonstrating health outcomes for the population.

Correspondence to:
Dr Karen Monsen, RN, PhD
Assistant Professor
University Of Minnesota School of Nursing
5-140 Weaver-Densford Hall
308 Harvard Street SE
Minneapolis, MN 55455
Phone 612-624-0490; Fax 612-625-
E-mail: mons0122@umn.edu

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Introduction

Adoption of electronic health records (EHR) is thought to be a strategy for obtaining the best value for each health care dollar invested. Value comes from meaningful use of the electronic record, and health data within the record. Meaningful use is a multidimensional concept that incorporates complex processes; workflow; interoperability; the exchange and use of health information to best inform clinical decisions; evaluate performance; and improve health care quality [1-2]. The cornerstones of 'meaningful use' have been defined by the National Quality Forum as:

1. Improve quality, safety, efficiency, and reduce health disparities,
2. Engage patients and families,
3. Improve care coordination,
4. Improve population and public health, and
5. Ensure privacy and security protections. [3].

Achieving meaningful use of data is dependent on selecting meaningful interface standards for point of care documentation of health needs assessments and health care services. Nurses have led efforts to develop such standards over the past four decades. The American Nurses Association (ANA) currently recognises twelve terminologies:

- ABC Codes,
- Clinical Care Classification (CCC),
- International Classification of Nursing Practice (ICNP),
- Logical Observation Identifiers Names and Codes (LOINC),
- NANDA International,
- Nursing Interventions Classification (NIC),
- Nursing Minimum Data Set (NMDS),
- Nursing Management Minimum Data Set (NMMDS),
- Nursing Outcomes Classification (NOC),
- Systematic Nomenclature of Medicine Clinical Terms (SNOMED CT),
- Omaha System, and
- Peri-operative Nursing Data Set (PNDS) [4-6].

These terminologies are being implemented in EHRs globally. New clinical data sets that provide essential health assessment and service data are becoming available, and methods for meaningful use of the data are emerging [7-9]. Interface terminologies enable documentation of clinical assessments and services within the electronic health record. The Omaha System is uniquely suited for this purpose because all Omaha System codes are simple defined terms that describe health problems, actions, and outcomes. Thus, administrators, practitioners, and researchers can readily develop shared understanding of care standards, care delivery, and care evaluation using Omaha System terms [10]. Examples of standards, care pathways, and evaluation reports that have been developed by the Omaha System community are available on-line at <http://omahasystemmn.org>. The aim of this paper is to describe how use of the Omaha System in the electronic health record can contribute to meaningful use of electronic health record data in New Zealand.

New Zealand as the context

New Zealand is a small country located in the south Pacific Ocean. The New Zealand population is reported as nearly 4.4 million. Approximately three quarters of the total population live in the North Island as a result of a population drift to northern urban areas [11]. Multi-cultural and multi-ethnicity statistics indicate the diversity of the population [11]. Māori, as the indigenous people of New Zealand, have been specifically targeted for health service because of their over representation in morbidity and mortality data [11-14]. Despite New Zealand's health care spending as a percent of Gross Domestic Product (7% to 10%), matching other developed countries, the demands for healthcare outstrip the provision of services [15]. In addition to the significant pressures to improve the provision of health services New Zealand, the country has an ageing population and

there is a growing incidence of long term conditions such as diabetes, chronic pulmonary and cardiovascular disease [16].

New Zealand's health care is guided by a national strategy, which has the goal of good health and well-being for all New Zealanders throughout their lives [17]. Providing good health care is a challenge; and meaningful use of information management and technology is recognised as essential to support quality, effective care. As the New Zealand Health Strategy [17, p. 29] states: "The ability to exchange high-quality information between partners in health care processes will be vital for a health system focused on achieving better health outcomes". To provide direction to the health information collection and use the New Zealand Health Information Service [18] lists health information guiding principles as:

- the need to protect patient confidentiality and privacy
- the need to collect data once, as close to the source as possible, and use it as many times as required to meet different information requirements
- the need for standard data definitions, classifications and coding systems
- the requirement for national health data to include only that data which is used, valued and validated at the local level
- the need for connectivity between health information systems to promote communication and integrity
- the need to address Māori health disparities.

The overall vision for information management in New Zealand is set out in the Health Information Strategy as this document provides a direction and an impetus for the health and disability sector to improve information management and the sharing of information, to underpin better health and disability outcomes for New Zealanders [20].

National Directives

The New Zealand Health Information Strategy provides context to support a number of separate health and disability strategies, for example, the Primary Health Care Strategy, the Health of Older People Strategy and the Child Health Strategy. [17] It guides health information systems, how they support delivery of health care and investments in information systems to ensure developments are coordinated and targeted. New Zealand is working towards a national systems model. The various health sectors are working together to form patient-centred health systems to enhance the flow of information.

National direction is provided for data collection and the use of standardized coding systems in the electronic health record. READ codes are used by primary care providers and by the Accident Compensation Corporation (comprehensive, no-fault personal injury coverage) [21]. The ICD10 International Statistical Classification of Diseases and Related Health Problems, 10th Revision (ICD 10) are used in secondary care [22]. Logical Observation Identifiers, Names, and Codes (LOINC[®]) is used for laboratory data, and Health Level Seven (HL7[®]) is the favoured messaging standard. More recently the government has introduced the use of the Systematized Nomenclature of Medicine – Clinical Terms (SNOMED CT[®]) as a means to have a single reference coding system in place for the country [19].

The aim in New Zealand is to ensure high quality information is available where and when it is needed and in the right format. It is now widely recognised that there are many stakeholders requiring information; consumers, care providers, provider organisations, funders, policy makers and researchers. Collaboration across the continuum of care requires good information exchange and with this comes the requirement for agreed standards and terminologies. Implementation of standards in EHRs can generate data with potential to advance health outcomes knowledge. Thus, it is essential that all health disciplines are represented in discussions about standards that should be incorporated into EHRs.

Role of Nursing

There are 40,616 nurses currently practising in New Zealand [23]. The nursing workforce in New Zealand is the single largest health professional group, and is recognised as having enormous potential to advance health and disability outcomes [24]. Nurses have a unique perspective because of their roles coordinating care in and across acute, ambulatory, long-term, community, home care, and public health based settings. They are recognised as global leaders in selecting and adopting standards for documenting health assessments and health care services in EHRs [5].

Electronic Health Record

EHRs can contribute to efficiency in health information management by nurses because of the capacity to store, process, retrieve, display, analyze, and report information which aids coordination of care, communication, medication management and the ordering of equipment and other services [25]. Currently nurses in New Zealand are actively engaged in initiating clinical nursing dataset standards for nursing and allied health professions documentation in personal EHRs. An example of the national commitment towards supporting such initiatives has been a Foundation for Research, Science and Technology (FoRST) funding for research to develop a framework for clinical nursing practice dataset development, implementation and ongoing maintenance. The benefits of having standardised clinical terminology are not well understood in New Zealand, and are yet to be realized. One option under consideration to contribute to dataset establishment in the community care setting is the Omaha System which was developed in the United States [10].

The Omaha System

The Omaha System is an interface standard for health care documentation [10]. It consists of three components for documenting client needs (Problem Classification Scheme), interventions (Intervention Scheme), and outcome measures (Problem Rating Scale for Outcomes). The Omaha System codes appear to the user as terms instead of numbers. The simple terms of the Omaha System are easily understood, and are organised logically for use in the electronic health record in a hierarchical, relational structure. These factors make the Omaha System easy to understand and use. Furthermore, Omaha System data have been shown to be useful in evaluating health care quality and client outcomes [10].

During the development of the Omaha System (1975-1993), researchers tested and retested the reliability and validity of these three components. In testing reliability, they gave attention to measures of stability or consistency, homogeneity, and equivalence. In testing validity, they gave attention to content, concurrent, construct, and predictive issues. Testing of the three components as a whole provided the basis for revisions and for establishment of reliability and validity of components [26].

The Problem Classification Scheme is a taxonomy in which health-related information is organised into 42 defined problems (e.g. Abuse, Pregnancy, Nutrition, Pain). The Problem Classification Scheme was field tested by test agencies in Des Moines, Delaware, and Dallas. Comparison of problems identified by test agency staff and research project staff showed 66%-78% in 3 major US cities. A retest showed 73%-90% in the same 3 locations [26].

The Intervention Scheme consists of four levels, problem, category, target, and care description. The first level (problem) consists of all of the problems in the Problem Classification Scheme. The second level (category) consists of four actions:

1. teaching, guidance, and counseling;
2. treatments and procedures,
3. case management, and
4. surveillance.

The third level (target) consists of 75 targets that provide additional information about the focus of the intervention. The fourth level (care description) is not taxonomic, and can be customized to

provide precise descriptions of unique care attributes. The Intervention Scheme was field tested in 4 major US cities. The percentage of agreement between the staff nurse and nurse testers, and between testers was computed for each general intervention. Percentages of agreement ranged from 42.2% to 96.9% with eight of the twelve percentages at or above 80% [26].

The Problem Rating Scale for Outcomes consists of three five-point Likert-type ordinal rating scales; one each for the concepts of knowledge, behavior, and status. Similar to the Intervention Scheme, the Problem Rating Scale for Outcomes is used in conjunction with the Problem Classification Scheme, permitting the assessment of client knowledge, behavior, and status for every Omaha System problem addressed with a client. The scoring of the scales ranges from 1 (most negative) to 5 (most positive). The Problem Rating Scale for Outcomes was tested in 4 major US cities. The percentage of agreement between staff nurse and raters and between raters was computed for exact matches and for differences of one. Exact matches ranged from 11.7% to 64.8%, and differences of one ranged from 82.6% to 96.1% [26]. Reliability of the Problem Rating Scale for Outcomes scales was studied using a research assistant who accompanied nurses on 97 visits and compared independent ratings following the visits. The research assistant and nurse ratings were analyzed for agreement using a coefficient gamma test, and were found to agree significantly ($p < 0.01$). Coefficient gamma for knowledge ratings was 0.53, for behavior ratings was 0.60, and for status ratings was 0.87 [27]. Content validity of the Problem Rating Scale for Outcomes was assessed using a panel-of-experts approach. Ten Omaha System problems were randomly selected for examination. Experts were recruited based on their credentials and expertise in practice related to representative Omaha System content. The experts reviewed problem definition; knowledge, behavior, and status subscales; a copy of the Problem Rating Scale for Outcomes, and prototypical guidelines for each of the selected problems. The experts rated each item from 1 (definitely no) to 4 (definitely yes) using the Content Validity Index. Analysis of the results was accomplished through calculation of the proportion of times the experts chose a rating of 3 or 4 for an item. The composite proportion for knowledge was 0.85, for behavior was 0.81, and for status was 0.77. When Content Validity Index values for specific units were averaged, any prototype statements or sub scale items below 0.80 were revised before they were published [27].

Use of the Omaha System is expanding rapidly. Approximately 12,000 multidisciplinary practitioners, educators, and researchers use Omaha System point-of-care software or paper-and-pen records in the United States and other countries such as New Zealand, the Netherlands, Turkey, the UK, and China. Research teams have used Omaha System data to study health care quality and value in diverse settings. There are over 250 publications related to the Omaha System in the scientific literature [28]. Interdisciplinary research teams and Omaha System Users Groups have established partnerships to advance practice, policy, and research agendas enabled by Omaha System implementation and data [29].

Potential for using the Omaha System in New Zealand

Use of the Omaha System in New Zealand can be traced back to 1999 and a nursing education based study using hand-held technology and point of care data collection. The Nightingale Tracker (previously available through Fitne, Inc.) used custom software based on the Omaha System, and a central server for storing patient records and facilitating online communication. The Omaha System enabled students to collect relevant patient data at the point of care [30-31]. Since that time, several other practitioners and organisations independently investigated the Omaha System for diverse health care contexts, and asserted that is reliable and appropriate for documenting community-based nursing care in New Zealand, and be readily incorporated into electronic documentation systems [32]. In addition, the Omaha System is congruent with reference terminologies and messaging standards already selected by the New Zealand government. For example, the Omaha System is integrated into SNOMED CT and LOINC; and registered by HL7 [28].

Methods

Four New Zealand community-based organisations independently reviewed the scientific literature and identified the Omaha System as a potential interface terminology to describe and evaluate their services. These organisations requested expert analysis on how the Omaha System might fit with their information systems and existing projects. The organisations are Nurse Maude, the Royal New Zealand Plunket Society Inc., the Midwifery and Maternity Provider Organisation, and Help4U. The organisations populated spreadsheets with de-identified service content, which was then mapped to the defined Omaha System terms. Use of the spreadsheet for the mapping process enabled quantification of the mapping results. The results were shared with organisational leaders and clinical experts for validation. This mapping process created the four community-based care use cases for the Omaha System in New Zealand, which are described next.

Results

Nurse Maude is a community based health services provider with a staff of 218 nurse and 631 health care workers who offer extensive nursing and home care services in a southern region of New Zealand. They receive about 1,200 referrals per month into their services from a variety of sources, including hospitals, medical specialists and general practitioners. These services are aimed at supporting people with either short or long term health problems to stay in their homes during episodes of health care need. Nurse Maude also offers specialist nursing services, which include continence, stoma, diabetes, wound management, and palliative care. In addition, Nurse Maude has a research institute, the New Zealand Institute of Community Health Care. The centre has developed collaborative research partnerships with tertiary education providers and with external researchers. These activities are designed to foster a centre of excellence for research and development projects that will lead to tangible improvements in community health care. Nurse Maude is using the Omaha System to inform the development of a community care clinical dataset for nursing and allied health workers. This will be one of many clinical datasets in primary health care in New Zealand. Nurse Maude has received a grant for the completion of the dataset from the information directorate at the Ministry of Health [32]. Clinical data from documentation by home care practitioners will enable program evaluation of the diverse services provided by Nurse Maude. For example, outcomes of wound management care will be captured using Skin problem assessments and ratings. Outcomes of services received in the wound management clinic can be compared with outcomes services received in the home. These wound care outcomes can then be benchmarked through comparison with data from other home care agencies internationally such as Buurtzorg in the Netherlands or Fairview Home Caring and Hospice in Minnesota.

The Royal New Zealand Plunket Society Inc. (Plunket) is a nurse-led well child care provider supported by a large network of volunteers, serving 91% of families with new born babies up to the age of five. Plunket is commencing an ambitious electronic user- and provider-interface project that will enable consistent collection of health information, so that information can be accessed, shared, and analyzed. Mapping Plunket data requirements to the Omaha System demonstrated that the Omaha System could be used for documenting the desired assessment and intervention data. Clinical data from documentation by well child care providers will enable program evaluation of the many services provided by Plunket. For example, the Plunket assessment mapped to 30 of the 42 Omaha System problems, demonstrating the comprehensiveness of the Plunket assessment. Furthermore, comparison between the problems identified in the Plunket assessment and the problems identified by four Minnesota counties providing similar well child services demonstrated congruence in client assessments between the two countries [33].

The Midwifery and Maternity Provider Organisation (MMPO) has developed an information system that captures 450 unique assessments items and outcomes. This is used by 80 percent of midwives throughout New Zealand and the system is being adopted by other obstetrics providers. Preliminary mapping of Omaha System terms to the MMPO Plan of Care successfully described

midwifery's continuity of care focus and holistic approach, and appears to be a good fit with the MMPO information system and goals. There is potential to map the MMPO data fields to the Omaha System within the existing record, and to add structured Omaha System documentation to replace free text clinical notes. Clinical data from documentation will enable linking of interventions to birth outcomes. Such analysis has been successful with elderly patients receiving home care, and families receiving well child visits, but has not yet been attempted for midwifery care. The MMPO information system together with the possible addition of the Omaha System would provide an unparalleled data source for quality improvement research in midwifery care.

Unlike the above health care providers, Help4U is a private consumer support organisation committed to making it easier for customers to find health care answers, find funding options, make decisions and coordinate outcomes. Help4U collaborates closely with health care providers to enhance communication between consumers and the health care system. To improve communication between consumers and practitioners, Help4U envisions a plain language electronic interface where consumers and health care providers can interact, and they are considering the Omaha System as a possible user-friendly architecture for organising health data. Clinical data generated by consumers and practitioners within the electronic health record has potential to demonstrate the role of patient self-care for various health problems, as well as advancing knowledge about patients' views and experiences as recipients of services in the health care system.

Discussion

In New Zealand there seems to be a gap between the reference terminologies currently in use and the collection of standardised data at the point of care. The Omaha System can be considered a viable option to bridge this gap, especially in the area of community-based care. The Omaha System is well suited to the electronic health record because of its hierarchical, relational structure. Likewise, it is uniquely suited to guide and evaluate practice because its codes are simple, defined terms that are easily understood by administrators, practitioners, and researchers alike.

Despite the Omaha System having originated in the United States there is sufficient alignment and congruence with New Zealand health care values and aspirations. For example, there is an adequate language match for the problem classification domains of environmental, psychosocial, physiological and health related behaviours, which are broad enough to apply equally in New Zealand. The problem rating scale for outcomes within the Omaha System of knowledge, behaviour and status are integrally related to the interventions which makes them potentially useful in New Zealand. The data produced is simple enough for any user to make sense of it, which will aid analysis and therefore support meaningful use.

The cornerstones of meaningful use of data seem to mirror many sentiments of the New Zealand health information guiding principles. For example, concern about protecting patient privacy, dealing with disparities and ensuring quality data are similar. Of particular concern for New Zealand is the ability for any terminology to reflect and respect the ethnic and cultural diversity of the population. The Omaha System fosters a holistic perspective that can acknowledge culture and spirituality, and therefore is likely to support partnership between the nurse and patient and their family.

New Zealand has demonstrated commitment to thoughtfully selecting meaningful standards for electronic personal health records. As the Omaha System is integrated within SNOMED CT its national adoption would align with the government direction of the adoption of SNOMED CT, and could build on New Zealand's strong infrastructure of having a NHI (unique identifier). Furthermore the broad terms within the Omaha System, that are further refined when building up the individual record can support the multi-disciplinary health team, and potentially link to the National Provider Index (NPI).

Conclusion

In New Zealand, there is a national precedent and mandate to advance collectively towards the goals of meaningful use. Meaningful use of Omaha System data to advance health care knowledge and improve health care is expanding globally. New Zealand is in a position to capitalize on a sound infrastructure to support a personal EHR. These four projects exemplify some of the diverse work environments, health providers, and populations for which the Omaha System can potentially provide client and service data. As a country that wishes to continue the ideal of universal access to affordable health care, within an environment constrained by resource limitations, maximizing the use of data is key to demonstrating health outcomes for the population. The New Zealand government support of carefully selecting EHR standards provides a strong foundation for consideration of a national clinical terminology standard. New Zealand has to target and prioritize where investments are made in the health and disability sector. A personal EHR that incorporates clinical documentation standards has potential to improve efficiencies in information flow between all healthcare providers in primary, secondary and tertiary sectors, and provide meaningful and measurable data about health outcomes for the population. Implementing a national clinical documentation standard, such as the Omaha System, could be key to the long term sustainability of affordable healthcare service and improving health outcomes in New Zealand [1, 20, 32].

Conflicts of Interest

The authors are informatics specialists with expertise in use of the Omaha System in education and research. All authors declare no conflict of interest in the preparation of this manuscript. The content is solely the responsibility of the authors and does not necessarily represent the official views of the authors' employers.

Human Subjects

No human subjects were involved in the preparation of this manuscript.

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