MEDINFO 2010
C. Safran et al. (Eds.)
IOS Press, 2010

doi:10.3233/978-1-60750-588-4-917

Foundations for a Nursing Services Reference Model

Liza Heslop[a], Keith Toh[b], Evelyn Hovenga[a]

[a] *School of Nursing and Midwifery, Victoria University, Melbourne, Victoria Australia 8001*
[b] *School of Management, RMIT, Melbourne, Victoria Australia 3000*

Abstract

The Nursing Services Reference Model (NSRM) is presented as a theoretical position and discussion paper. The aims are to describe the components of the NSRM concept, to explain why such a model needs to be developed and to explore methodological issues in the development of a NSRM. The concept is important to address as it may illuminate a most pressing problem faced by the Australian health care industry where the content and activity of nursing practice is not embedded as computer processable data in health information system structures. Digital documentation of nursing content and activity is urgently needed to enable reliable electronic processing of nursing services. However, it is necessary, prior to this, to develop a reference model that describes the range of nursing services in an unambiguous manner.

Keywords:

Nursing information systems, Health knowledge management, Reference models, Operations management, Acute health services.

Introduction

The content and activity of nursing practice in the Australian health care industry is not embedded as computer processable data in health information system structures. Two key conceptual matters must be addressed for this to occur. There is a need for standardisation of nursing service description at an abstract business level as well as standardisation of clinical nursing language in terms of computer processing of digital documentation. While these conceptual matters persist and remain unaddressed, the imbalance continues at a business level where nursing services have not made the same pace of development as other fields such as supply chain management which are advanced in terms of the standardisation of service models e.g. Supply Chain Operations Reference Model [1-3].

Reference models are proven methods for communicating business information to stakeholders, strategists, policy makers and business analysts. Two examples of such models include the SAP reference model [4] and Scheer's model for production planning and control systems [5]. The Service Reference Model of the Australian Government Architecture (AGA) contains seven service reference models, including, for example, Customer Services, Business Management, and Back Office Services [6]. It does not include a service reference model for nursing services, which is a critical part of the Australian health and social infrastructure. Nurses represent the largest health workforce in Australia. Conservative estimates suggest the acute services nursing workforce continue to represent greater than 30% of total inpatient costs [7]. In addition, public hospital unit/ward nursing costs alone constituted 24% of the national average case cost identified in round 12 of the National Hospital Cost Data Collection Round 12 (2007-08), and critical care, operating room and emergency services, where nursing costs are very significant, constituted a further 25.6% [8].

The concept we wish to develop is a Nursing Services Reference Model (NSRM) to fill the previously identified gap. The NSRM is separate to diagnostic taxonomies which also lack integration into clinical nursing practice in Australia. For example, the nursing taxonomy with most development is an outcome of two decades of research by the North American Nursing Diagnosis Association (NANDA) where more than 100 nursing diagnoses form a taxonomic structure that reflect patient responses to actual or potential health problems. A NSRM is a different concept and comprises a standard business structure which documents the business activity of nursing practice in a manner that will support management of nursing service delivery and represent nursing activity in business system structures. It forms the basis for knowledge resources, data types and structures.

The proposal for a NSRM is also in line with the IT Infrastructure Library (ITIL) Framework [9-10] in relation to the definition of a service catalogue. Based on ITIL, the service catalogue is used as a starting point for the implementation of the Service Level Management process. Carefully planned and documented IT Service Management (ITSM) processes are becoming an increasingly important component in the delivery of higher customer satisfaction.

At a consultation workshop titled "S*tudying the redesign of patient care*"[1] participants voiced powerful opinions about the current state of health knowledge management and indicated

[1] Hosted at Victoria University (VU), Melbourne, Australia on the 20th of July 2009. Attendees comprised 25 targeted participants including researchers from within VU, key policy advisors, regional health services officials, representatives of the Victorian Government Department of Health (DoH) , the Australian Nursing and Midwifery Council and executive nursing and information communictaoin technology members from Western and Melbourne Health service providers including their health service redesign teams.

that support would be received for several projects (for example, the NSRM project) by peak health professional bodies in nursing, health informatics and health service officials at many levels of industry and government.

This paper is based on a critical reflection upon the workshop results and what is needed to develop a NSRM. The NSRM we propose will be informed by an international standard: The International Standards Organization (ISO) 'Health informatics - integration of a reference terminology model for nursing' (ISO/FDIS 18104). This ISO standard helps researchers to recognize that nursing data cannot stand alone [9]. It requires integration within clinical records. Also, the NSRM model we propose will be developed within the Australian Government Reference Model of the Australian Government Architecture (AGA). If the model can be situated in this context, the language for nursing services has potential for recognition alongside other health agency services in Australia. This work follows related projects, especially, of health informatics standards development, health terminology and electronic health records including knowledge management and ontology documented in the following references [11-18].

No reference model exists for nursing services in Australia and we could only source very limited international literature on reference models to support nursing practice. Destrebecq et al [19] from Italy refer to an 'old reference model' to allow for classification of tasks performed by nurses in three areas-nursing activities without chances of delegation, nursing activities that could be assigned to aids, and activities beyond the competence of nurses. They made a comparison between data collected and the reference model. The study has limitations for international audiences as the detail on the reference model was not provided. An example of the application of reference model for heatlh services more generally is provided by Huber-Bloder et al [20] who report a reference model with comprehensive hierarchical specifications for the domain layer of a hospital information system and its enterprise functions.

The development of a reference model would form the basis for the further development of an ontology (containing links to terminologies and bindings) for the nursing domain of knowledge. The nursing activity domain is wide-ranging and diverse; nurses practice in settings ranging from acute to community care as well as private and public services. For this project, our research team will focus on clinical public hospital nursing. The proof of concept or theoretical work to be achieved is to fit the NSRM with the many information /workflow processes where each process is associated with a specific aspect of nursing care.

The Nursing Services Reference Model

As part of the e-Government Strategy (released in March 2006), the Australian Government Information Office (AGIMO) defined a vision for increasing the effectiveness of service delivery and established the requirement for a 'cross-agency services oriented architecture' [6]. A crucial part of this was the development of a set of high-level reference models that provide a common language and classification scheme for business and technology (see Figure 1).

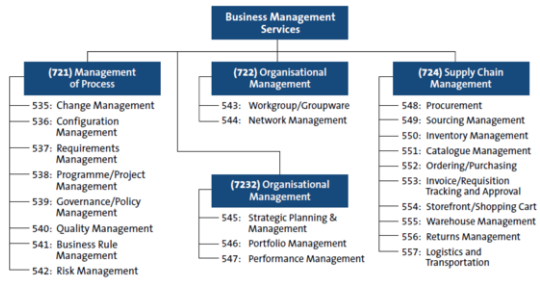

Figure 1 - Business Management Services of the AGA [6]

The development of the NSRM concept was proposed with the recognition that service improvement efforts would be supported through the considered application of ICT. It has been recognised that ICT will play an increasing role in terms of patient care. In proposing the NRSM, we wanted to ensure that technology plays a subservient role to the needs of service provision and therefore, the establishment of the NRSM was proposed as a means to push the "nursing business architecture" in front of technology architecture.

The development of the NRSM concept was influenced by the Service Reference Models of the AGA, in terms of granularity and abstraction of the service types. Development of the model will be informed by the AGA to enable the eventual acceptance of the NRSM as part of the Service Reference Models of the AGA. National adoption would be a longer process and would depend upon funding to support further development and application of the NSRM. The proof of concept NSRM model will be developed and tested as a valid model that fits with international standards (through the ISO) and Australian Government standards (through the AGRM and AGA). Methodologies will be developed during the development for testing validity. Generally, the model of validation will be based on consultaion and feedback incorporating elements developed by others who have adopted this approach. See, for example, Mohpatrea et al [21]; Colton and Hatcher [22]; and Tracey et al [23].

In parallel to this, the study of service management practice in the industry brought forward the ITIL Framework. The official definition of an ITIL Service Catalogue is: "A database or structured Document with information about all Live IT Services, including those available for Deployment. The Service Catalogue is the only part of the ITIL Service Portfolio published to Customers, and is used to support the sale and delivery of IT Services. The Service Catalogue includes information about deliverables, prices, contact points, ordering and request Processes" [24].

The initial NRSM concept was developed on this basis as the foundation for service management in the nursing sector in Australia. As an applied discipline, nursing uses knowledge in the service of solving problems of human health and caring. Nursing care also has complex management dimensions.

Integration within the AGRM and AGA will establish a national consistent approach with reference models of other clinical domains such as medicine and allied health. Hence, relevant entities of the Australian Commonwealth Government will benefit through improved understanding of ICT investment via access to repositories of standards, principles and templates derived from reference models. Improved design and delivery of nursing infrastructure ICT capability will improve business services to Australian citizens.

A high level start point for the clinical component of the NSRM is shown in Figure 2. The basis for this is that effective nursing is always organized and systematic, that prioritizes patient assessment and management.

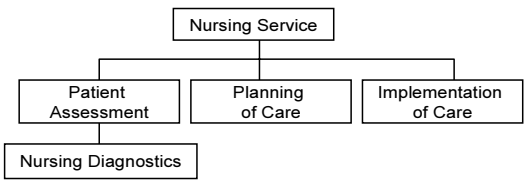

Figure 2 - High level classification of nursing services

The fundamental elements of the model are as follows:

- ***Assessment.*** An integral and ongoing aspect of the nursing service.
- ***Planning and Implementation.*** The formulation and implemention the care.
- ***Evaluation***. Determining whether the action taken has met the identified needs.

A challenge immediately emerged, where the nursing service includes more entities beyond procedures/techniques necessary for care and actually includes day to day personnel management and training/mentoring activities. Furthermore, delivery of the nursing services also includes significant multidisciplinary interactions with doctors, consultants and other specialists, going beyond the administrative domain (see Kelley et al [25].

It emerged from the workshop that there are other categories, for example in "Implementation of Care", the category of "Respite services" was put forward, which tends to be provided on a short-term basis because of the emergency absence or need for routine or periodic relief of the primary caregiver. They are provided in an individual's home, other community residence or in other community sites. Examples include assistance with activities of daily living such as: bathing or showering, toileting, and routine personal hygiene skills.

Further, in developing the NSRM, consideration must be given to other relevant areas of work to reflect the interdependency with behavioral sciences to allow room for the inevitable expansion of nursing practice.

It was clear to the participants of the initial consultations that the NSRM would have to capture monitoring health status and physical condition, assistance with medication and other medical needs. This also included assistance with preparation and eating of meals.

The NRSM must also include the holistic and effective nursing care, including health promotion and health screening. It must also include service descriptors relating to "housebound" care, where for reason of their diagnosis patients are best supported in their own environment by the skills and expertise of the nurses.

Another issue that emerged was the level of abstraction in describing aspects of services that were generic across the entities described in Figure 2. This is shown in Figure 3.

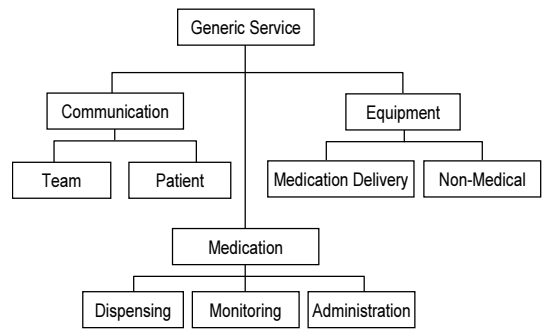

Figure 3 - Generic service descriptions

Communication

Communication (team) is generic, related to the exchange of information among the patient care team about a patient and patient care issues. Communication (patient) relates to the exchange of information from the patient care team or the health care facility to patients. This aspect will be common across assessment, planning and implantation of care.

Equipment

This relates to the physical infrastructure and may be categorized into medication or non-medical. Examples of non-medical include hospital lighting, privacy, physical safety and noise abatement. Medication delivery equipment identifies the services provided in terms of ensuring availability, reporting of malfunctions, maintenance, design, training and operations.

Medication

This category is related to a patient medication that originates in the dispensing process. Administration is related to patient medication that originates with administration of medication to a patient. Monitoring is related to a patient medication that originates after a drug is administered to a patient.

Future application of a NSRM with a common nursing data structure will enable formal recognition of nursing services from which an evidence base can be built to inform understandings of the nursing infrastructure including funding and provision of nursing services, and for the connection and integration of nursing care services across the health system.

Discussions

Given the importance of the nursing domain of care provision, the lack of a reference model at a national level in Australia has a major impact on research and development of health service systems including using source data to monitor, measure and evaluate nursing performance. Also nursing data cannot be shared within and between healthcare agencies.

Nursing work is complex and has many interconnections with medicine, allied health and community services. Nurses must increasingly deal with information and share their information with multi-disciplinary teams. Nursing services are largely documented upon paper-based records. Nurses have multiple files and documents to deal with for specific nursing aspects of patient care. For example, these files might be paper-based documents related to assessments of neurological observations, input of figures related to fluid balance management which forms part of managing an intravenous infusion, and pain management records.

Systemic change is necessary to accommodate the content of nursing records within information systems to fulfill interdisciplinary needs. Interdisciplinary professionals must access nursing files and records daily to make decisions about patient care. Design of digital systems will be enhanced by a sound description of nursing services in the form of a NSRM. Effective digital nursing data flow within and between healthcare agencies enables the use of these data both as contributions to electronic patient records and for the purpose of managing nursing workflow efficiency, nursing workload allocation, costing, and effective nursing service and performance management.

These different areas of work should be underpinned by a standardized and widely accepted structure or framework for describing nursing services. The Australian Government has recently announced its intention to fund hospitals federally based on activity (casemix) data. This means there must be a mechanism to consistently identify the nursing service contribution to ensure that these services are adequately funded to achieve desired outcomes. The NRSM should be sufficiently mature and embody the goals and descriptions of nursing services and can then be looked at as a reference for the various purposes discussed above.

Conclusions

The development of the NSRM is in the infancy stage, but it is in the opinion of the authors that this forms the first critical step to achieving the same degree of maturity in definition which will be comparable, eventually, to SCOR or the Service Reference Models of the AGA.

A Nursing Services Reference Model (NSRM) concept will be developed within the context of Australian government ICT architecture frameworks and international standards development organization (ISO TC125) as a research endeavour towards achieving a sustainable health care system.

This paper arises from dialogue between senior health care officials, health care managers and academics interested in the complex health knowledge management needs of contemporary health care organization. These discussions have continually underscored the importance of dialogue between the service and academic sectors. Such collaboration is necessary if the evidence from studies on reference models are to be effectively linked to initiatives in practice that to enhance the quality and safety of patient care. Development of a NSRM will involve key nursing stakeholders to build consensus on requirement analysis. The methodology when formally developed will include critical inputs from stakeholders and a project reference group. We will work with peak groups in nursing, health informatics and relevant government entities supporting the AGA to achieve levels of rigor acceptable to these groups.

Acknowledgments

The authors extend their thanks to Victoria University for the support for the project. We also acknowledge the participants from VU, regional health services officials (Western and Melbourne Health), representatives of the Department of Health Services (DoH), the Australian Nursing and Midwifery Council (ANMC) and colleagues from the University of Melbourne. Particular mention is made of Karen Parent from the Vancouver Health Care Authority, BC, Canada, who attended and persevered during a period of bereavement.

References

[1] Supply Chain Council. Supply Chain Operations Reference-model (SCOR), V9.0, available through the Supply Chain Council; 2009.

[2] Poluha RG. Application of the SCOR Model in Supply Chain Management. New York: Youngstown; 2007.

[3] Bolstorff P, and Rosenbaum R. Supply Chain Excellence: A Handbook for Dramatic Improvement Using the SCOR Model. AMACOM Div American Mgmt Assn; 2003.

[4] Keller G, and Meinhardt S. SAP R/3 Analyzer Business process reengineering based on the R/3 reference model. SAP AG; 1994.

[5] Scheer AW. Business Process Engineering – Reference Models for Industrial Enterprises. Springer-Verlag, New York; 1994.

[6] AGIMO, Australian Government Architecture Reference Models, Version 1.0, Australian Government Information Management Office, Department of Finance and Administration; 2007.

[7] National Hospital Cost Data Collection Round 12 (2007-08). Retrieved Tuesday, 23 February 2010 http://www.health.gov.au/internet/main/publishing.nsf/Content/Round_12-cost-reports

[8] Tas Gov't audit 1993-94 Retrieved Tuesday, 23 February 2010

http://www.audit.tas.gov.au/publications/reports/specialreport/specialrep13/part9full.html

[9] Office of Government Commerce (OGC). ICT Infrastructure Management Book. The Stationery Office; 2002.

[10] AGIMO. The Australian Government Business Process Interoperability Framework: Enabling Seamless Service Delivery: Australian Government Information Management Office, Department of Finance and Administration; 2007.

[11] International Standards Organisation. Health informatics — Integration of a reference terminology model for nursing. 2003. Available from: http://www.tc215wg3.nhs.uk/pages/pdf/wg3_148.pdf

[12] Hovenga EJS. Importance of Achieving Semantic Interoperability for National Health Information Systems Text & Context Nursing Journal: 2008;17(1):158-167.

[13]Garde S, Hovenga E, Buck J, and Knaup P. Expressing Clinical Data Sets with openEHR Archetypes: A Solid Basis for Ubiquitous Computing. International Journal of Medical Informatics 2007; 76 (S3): S334-S341.

[14] Garde S, Hovenga E, Gränz J, Foozonkhah S, and Heard S. Managing archetypes for sustainable and semantically interoperable electronic health records. Electronic Journal of Health Informatics 2007;2(2): e9.

[15] Coiera E, and Hovenga EJS. Building a Sustainable Health System Methods Inf Med 2007; (46 Supp):11-18.

[16] Garde S, Knaup P, Hovenga EJS, and Heard S. Towards Semantic Interoperability for Electronic Health Records: Domain Knowledge Governance for openEHR Archetypes. Methods of Information in Medicine 2007;46(3): 332-343.

[17] Hovenga EJS, Garde S, Carr T, and Hullin CM. Innovative Approaches and Processes for Capturing Expert Aged Care Knowledge for Multiple Purposes. eJHI - electronic Journal of Health Informatics 2007; 2(1): e5.

[18] Hovenga EJS, Garde S, and Heard S. Nursing Constraint Models for Electronic Health Records: a vision for domain knowledge governance. International Journal of Medical Informatics, Special Issue, Nursing Informatics 2005;74(11-12):886-898.

[19] Destrebecq A, Lusignani M, Terzoni S (2009) A national survey on the activities performed by nurses and aids in Italian outpatients' services Cah Sociol Demogr Med. 49(2):137-66.

[20] Hübner-Bloder G Ammenwerth E Brigl B Winter A Specification of a reference model for the domain layer of a hospital information system Studies In Health Technology And Informatics (2005) 116:497-502

[21] Mohapatra P, Bora M Sahu K. Incorporating Delphi results in system dynamics models: A case of Indian tea industry. Technological Forecasting and Social Change (1984) 25(2), 159-177

[22] Colton S Hatcher T (2004) The Web-Based Delphi Research Technique as a Method for Content Validation in HRD and Adult Education Research. Academy of Human Resource Development International Conference, 183-189

[23] Tracey M, Richey R. (2007) ID model construction and validation: a multiple intelligences case. Educational Technology Research and Development 55(4), 369-390

[24] Hendriks L, Carr, M, ITIL: Best Practice in IT Service Management. In: van Bon, J.: The Guide to IT Service Management. Vol. 1. London, Addison-Wesley; 2002, pp. 131-150.

[25] Kelley JH, Weber J, and Sprengel A. Viewpoint: Taxonomy of nursing practice: Adding an administrative domain. International Journal of Nursing Terminologies and Classifications: 2005;16(3-4): 74-80.

Address for correspondence

Associate Professor Liza Heslop
School of Nursing and Midwifery
Victoria University
PO Box 14428
Melbourne
Australia 8001
Email: Liza.Heslop@vu.edu.