Institution: The University of Salford
Unit of Assessment: A3 Allied Health Professions, Dentistry, Nursing and Pharmacy
Title of case study: International Standards for Nursing Terminology
1. Summary of the impact *International Standards for Nursing Terminology* is focused on supporting nursing practice internationally, through the application of theoretical informatics research, demonstrating the following impact: • Bringing together practice-level data from a range of sources and utilising the Web Ontology Language (OWL) within a nursing context, leading to the development of a formal foundation for standardised terminologies for nursing; • The only nursing-specific terminology within the World Health Organisation Family, the International Classification for Nursing Practice (ICNP®) has been accepted as a Related Classification within the World Health Organisation Family of International Classifications (WHO-FIC); • Translated into 16 languages ICNP is emerging as an international standard for nursing, facilitating more effective nursing care and improved patient outcomes.
2. Underpinning research **The key researchers and positions they held at the institution at the time of the research are as follows:** Professor Nicholas Hardiker (Senior Research Fellow and Reader 2001-2012), (Professor and Associate Head [Research & Innovation] School of Nursing, Midwifery & Social Work 2012 onwards). The impact of *International Standards for Nursing Terminology* is underpinned by the following research: • **2003:** The International Council of Nurses (ICN) elected to explore the use of computer-based tools in managing their in-house terminology, the International Classification for Nursing Practice (ICNP), commissioning Hardiker to explore applying his foundational research (the application of knowledge representation language, the Galen Representation and Integration Language (GRAIL), within the nursing domain) in revising their product. ICNP is a product of the International Council of Nurses, a terminology that is used to inform health care practice and policy to improve patient care worldwide. The research concluded that technologies such as GRAIL make possible the process of building automatically enumerated classifications while providing a useful means of validating and refining both combinatorial terminologies and enumerated classifications. • **2004-2006:** Funding from ICN allowed a consolidation of the research, utilising the emerging de facto knowledge representation language (and a successor to GRAIL) the Web Ontology Language (OWL), resulting in enhancements such as; the use of annotations for extrinsic information to support maintenance functions; version tracking and the development of multiple output formats to suit the needs of a wider range of users. • **2007:** A feasibility study of clinical templates for nursing in the community for NHS Scotland explored the potential for the development of standards which structure information round discrete clinical concepts, in a way that supports system development and interoperability to engage and support clinical practitioners in developing clinical information standards in an open and accessible way. The project involved modelling and processes for managing content and relating to information standards; and implementation in working systems in a manner that is professionally acceptable. • **2007:** A feasibility study for the creation of a Nursing Care terminology subset of SNOMED® CT, Royal College of Nursing, explored the mutual enhancement of diverse terminologies. The project described a collaborative effort to mutually enhance both ICNP® and SNOMED CT by comparing representations of, or mappings from, a third terminology, the North American Nursing Diagnosis Association Nursing Diagnoses (NANDA). The

research concluded that with appropriate refinement, combinatorial terminologies such as ICNP have the potential to provide a useful foundation for representing enumerated classifications such as NANDA.

- **2008-2010:** The ICN commissioned Hardiker to update, develop version management and the use of ICNP®. A terminology quality improvement (TQI) model was formulated based on a review of the existing international standards developed for healthcare terminologies. The TQI model, encompasses structure, process, and outcome components in relation to a terminology life cycle. Multi-dimensional quality outcome measures were identified in the areas of terminology content, modelling structure, mapping, and process management. A case study was developed to validate the TQI model using ICNP. The TQI model represented the complexity of activities involved in terminology quality management. The research concluded that the TQI model would be useful for various stakeholders to guide terminology selection, to assess the quality of healthcare terminologies and to make improvements according to an agreed standard.

- **2011 onwards:** The ICN commissioned Hardiker to extend the scope and utility of ICNP®, This project involves facilitating the ongoing development and implementation of ICNP® and derived products such as translations, data sets, distribution formats.

3. References to the research

Key outputs
1. Hardiker NR, Rector AL. *Modeling Nursing Terminology using the GRAIL Representation Language,* Journal of the American Medical Informatics Association. 1998; 5:120-128. DOI
2. Hardiker N, Rector AL. *Structural validation of nursing terminologies*, Journal of the American Medical Informatics Association, 2001; 8: 212-221. DOI
3. Hoy D, Hardiker NR , McNicoll IT, Westwell P, Bryans A. *Collaborative development of clinical templates as a national resource,* International Journal of Medical Informatics, 2009; 78: S3-S8, DOI.
4. Kim TY, Coenen AC, Hardiker NR. *A quality improvement model for healthcare terminologies*, Journal of Biomedical Informatics. 2010; 43: 1036-1043. DOI

Key grants
5. **2004-ongoing:** A research programme of 5 interrelated projects around ICNP®, International Council of Nurses, £176, 399, Hardiker Principal Investigator (P.I.)
6. **2007**: A national library of clinical templates for nursing in the community: a feasibility study, NHS Scotland, £70,000 (£9,779 to Salford), Hardiker Partner *(in collaboration with Glasgow Caledonian University)*
7. **2007**: Feasibility study for the creation of a Nursing Care terminology subset of SNOMED® CT, Royal College of Nursing, £2,000, Hardiker P.I.

4. Details of the impact

Terminology work within nursing has been ongoing for several decades. Prior to the application of the research that underpins this case study, the development and maintenance of nursing terminologies was a largely manual process. Hardiker's research in the use of description logics, specifically the application of OWL to explore the utility of statements that describe nursing diagnoses and nursing-sensitive patient outcomes, marked a leap forward. The use of automated reasoning has assured correctness and consistency among a significantly expanded term set, opening up new horizons in terms of scale, demonstrating high efficiency and effectiveness without impacting negatively on resources:

- ICNP classifies patient data and clinical activity in the domain of nursing and is used for decision-making and policy development aimed at improving health status and health care delivery. ICNP improves communication and statistical reporting practices across health services and remains the only international production standardised nursing terminologies to be underpinned with a formal foundation. ICNP has promoted harmonisation with other

widely used standards, made visible nursing's contribution to health and health care globally and improved healthcare and patient outcomes.

- The utility and efficiency of ICNP is demonstrated by the level of uptake, ICNP is available in 16 languages (with Swedish, Icelandic and Slovenian also in progress):
  - Brazilian-Portuguese
  - Chinese (traditional)
  - English
  - Farsi
  - French
  - German
  - Italian
  - Indonesian
  - Japanese
  - Korean
  - Mandarin
  - Norwegian
  - Polish
  - Portuguese
  - Romanian
  - Spanish
- This significant translation effort has been largely voluntary with individuals and national organisation seeing the potential benefits of ICNP and investing resources to facilitate national adoption.
- Emerging as a national standard for nursing in a number of countries, ICNP is recognised by the American Nurses association as an interface terminology that supports nursing practice.
- The Canadian Nurses Association (CNA) endorses ICNP for documenting professional nursing practice in Canada. CNA has developed mapping between ICNP and its own outcomes measurement instrument, the Canadian Health Outcomes for Better Information and Care (C-HOBIC).
- Brazil is establishing national endorsement and adoption.
- The Portuguese version of ICNP (Classificação Internacional para a Prática de Enfermagem – CIPE) is now widely used in software applications within the Portuguese national health system (SNS). ICNP has been promoted as the preferred nursing terminology within Portugal for over 10 years; all Portuguese Government-funded nursing information systems are required to be ICNP-compliant.
- Iceland has recently relinquished its reliance on other nursing terminologies in favour of ICNP.
- A related terminology is the multidisciplinary SNOMED Clinical Terms (CT). SNOMED CT is based on a different foundational technology to ICNP. However, it uses ICNP as its nursing reference. A formal Harmonisation Agreement is now in place and a representative of ICN is formally constituted as Vice-Chair within the Nursing Special Interest Group of the International Health Terminology Standards Development Organisation to ensure consistency between these two international terminologies. This is an important strategic relationship that will ensure that users of ICNP are integrated within the wider multi-disciplinary informatics infrastructure.
- The World Health Organisation accepted ICNP within the Family of International Classifications (WHO-FIC) to extend coverage of the domain of nursing practice as an essential and complementary part of professional health services. ICNP is the only nursing-specific terminology within the Family. ICNP can be used as a classification, in conjunction with other WHO-FIC classifications, wherever such care is provided. A mapping agreement has been developed between ICNP and another member of WHO-FIC, the International Classification of Functioning. ICNP is also strongly influencing the development of the multidisciplinary International Classification of Health Interventions (ICHI). The 11th revision

of the WHO International Classification of Diseases has broken convention in adopting a formal approach that is similar to ICNP to underpin the terminology; other terminologies within WHO-FIC are likely to follow suit in the future.

- The research that underpins ICNP strongly influenced work on international technical health informatics standards. For example, it is cited in the International Standard ISO 18104: 'Integration of a reference terminology model for nursing', published in 2003. ISO 18104 establishes a nursing reference terminology model consistent with the goals and objectives of other specific health terminology models in order to provide a more unified reference health model. This International Standard includes the development of reference terminology models for nursing diagnoses and nursing actions and relevant terminology and definitions for its implementation. ICNP has been consulted throughout the recent revision of the standard.
- Hardiker continues to play an active role in formal standardisation efforts, contributing to terminology-related standards activity within ISO, the European Committee for Standardisation (CEN), the British Standards Institute (BSI) and the International Medical Informatics Association (IMIA).
- Hardiker was invited to join the Nursing Peer Group of the National Advisory Group to the UK NHS Connecting for Health Programme, England's Chief Nursing Officer's Next Stage Review Nursing and Midwifery Advisory Board and its successor, the National Nursing Informatics Strategic Taskforce and is a founder member of the Steering Committee of the Vanderbilt University Nursing Terminology Summit, a US-based 'think tank', providing global strategic direction for research and development around terminologies, and Chair of the Health Information Systems Society (HIMSS) Europe Governing Council.

5. Sources to corroborate the impact

a) The international Classification for Nursing Practice web link *"an integral part of the global information infrastructure informing health care practice and policy to improve patient care worldwide"* http://www.icn.ch/pillarsprograms/international-classification-for-nursing-practice-icnpr/

b) Chief Executive Officer, International Council of Nurses: *"The International Council of Nurses relies on the work of researchers, such as Dr Nicholas Hardiker [Professor from 09/2012], to incorporate and consolidate evidence from research into policy decisions. ICN's partnership with Dr Hardiker has enabled ICN to explore the use of computer-based tools in developing and managing nursing terminologies, and to extend the scope and use of these languages. Dr Hardiker's work has led to the development of the ICN ehealth programme which advances nurses' knowledge of and involvement in eHealth worldwide."*

c) Medical Terminologist, 3M *"Dr. Hardiker's research pertaining to the knowledge structure in terminologies and the development of the International Classification of Nursing Practice (ICNP) has facilitated the integration of multiple nursing terminologies, such as the Clinical Care Classification (CCC) and NANDA International."*