

This is an electronic reprint of the original article. This reprint may differ from the original in pagination and typographic detail.

Please cite the original version: Ahonen, O. ; Kotila, J. ; Melender, H-L. & Saranto, K. (2023) The Biomedical and Health Informatics Recommendation Domains in Relation to the Nurse Competence Scale Categories. *Studies in Health Technology and Informatics*, 216 - 219.

doi: 10.3233/SHTI230466

Available at: <https://ebooks.iospress.nl/doi/10.3233/SHTI230466>

[CC BY-NC 4.0](#)

The Biomedical and Health Informatics Recommendation Domains in Relation to the Nurse Competence Scale Categories

Outi AHONEN^{a,1}, Jaana KOTILA^b, Hanna-Leena MELENDER^b and Kaija SARANTO^c

^a*Laurea University of Applied Sciences, Espoo, Finland*

^b*HUS Group, Helsinki University Hospital and University of Helsinki, Finland*

^c*University of Eastern Finland, Kuopio, Finland*

ORCID ID: Outi Ahonen, <https://orcid.org/0000-0002-5450-4322>,

Jaana Kotila <https://orcid.org/0000-0002-1876-7109>, Hanna-Leena Melender <https://orcid.org/0000-0003-4535-282X>, Kaija Saranto <https://orcid.org/0000-0002-3195-1955>

Abstract. The purpose of this mapping review was to examine the Recommendations of the Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics (BMHI) in relation to the contents of the Nurses' Competency Scale (NCS). The BMHI domains were mapped to the NCS categories to find analogous competence areas. As a conclusion, a consensus is presented on what each of the BMHI domain could mean on a responding NCS category. The number of the relevant BMHI domains were two for the Helping role, the Teaching and coaching, the Diagnostics functions, the Therapeutic interventions, and the Ensuring quality domains. The number of the relevant BMHI domains was four for the Managing situations and the Work role domains, of the NCS. The essence of nursing care has not changed, however, current means and equipment in practice require updated knowledge and digital skills for nurses. Nurses have a special role in narrowing the view gap between the views related to clinical nursing and informatics practice. Documentation, data analyses, and knowledge management are essential parts in nurses' competence today.

Keywords. Competence, Informatics, Health, Nursing

1. Introduction

The term Biomedical and Health Informatics (BMHI) is still used in the Recommendations on Education in BMHI by the International Medical Informatics Association (IMIA) [1]. In some countries the term 'digital health' is commonly used, for example, in Finland [2,3], replacing partly the terms 'health informatics' and 'medical informatics'. One of the key purposes of the BMHI recommendations is to identify competencies and essential skills for healthcare professionals to certify their abilities to support the development and implementation of digital health [1] There are new

¹ Corresponding Author: Outi Ahonen, Laurea University of Applied Sciences, Espoo, Finland email: outi.ahonen@laurea.fi.

competence requirements for nurses in a clinical work environment, which mostly mean hybrid care pathways [2].

In the latest version of the BMHI Recommendations, learning outcomes are described in six knowledge domains of which five are important for healthcare workers in their daily practice [1].

The focus of **BMHI Core Principles** domain is on the understanding of principles for data management from different sources e.g., models, terminologies, standards and system architectures as well as awareness of the ethical and responsible use of sensible health and patient data. **The Health Sciences and Services** domain acknowledges policies and regulatory frameworks for information handling, and knowledge about information systems and digital services. Digitalization impacts not only clinical work processes and delivery of care, but also illness prevention and the patient-clinician relationship. The domain of **Computer, Data and Information Science** focuses on understanding of the principles of new technologies, such as blockchain, Internet of Things, and cloud and edge computing. The domain of **Social and Behavioral Sciences** highlights evaluation and assessment of clinical safety and risk associated with information, ethical perspectives, ensuring staff competency, capability and empowerment, and appraisal of the changed role of the patient in person-centered care. The domain of the **Management Science** highlights project and team management skills, as well as organizational information technology strategy in the context of interdisciplinary environments with the ability to generalize or abstract and apply knowledge to local contexts. The sixth domain, **Specialization**, is important for BMHI specialists to demonstrate knowledge regarding interoperability, standardization, and the ability to apply research theory into practice [1].

Nurse Competence Scale (NCS) is a 73-item scale with response options on a visual analogy scale format (0-100), developed to measure nurses' competence in seven categories which have been derived from the competency framework 'From Novice to Expert', presented by Benner. The NCS categories are 'Helping role' (7 items), 'Teaching—coaching' (16 items), 'Diagnostic functions' (6 items), 'Managing situations' (8 items), 'Therapeutic interventions' (10 items), Ensuring quality' (6 items) and 'Work role' (19 items) [4]. The value of NCS has been confirmed since it has shown relationships between background variables and competence. The instrument has been widely used with experienced and newly graduated nurses and their managers in different countries [5]. Brief description of the categories of NCS is introduced by Lima [6].

The purpose of this review was to examine the BMHI recommendations in relation to the contents of the NCS. The research question was: Which knowledge categories are common between the NCS categories and the BMHI domains? The aim was to produce information to be used in the implementation of the BMHI recommendation in clinical practice.

2. Methods

Mapping is a review that seeks to identify linkages between concepts by searching for relations between the contents presented in different frameworks. [7] The BMHI domains [1] are mapped to the NCS categories to find analogous competence areas [4,6]. As a conclusion, a consensus is presented on what each of the BMHI recommendation domain [1] could mean on responding NCS categories [4,6] in changing working environments.

3. Results

The results are described in Table 1. The number of the relevant BMHI domains were two for the Helping role, the Teaching and coaching, the Diagnostics functions, the Therapeutic interventions, and the Ensuring quality domains. The number of the relevant BMHI domains was four for the Managing situations and the Work role domains, of the NCS.

Table 1. The BMHI domains in relation to the NCS categories and the mapping conclusions

NCS	
Categories [4,6]	The core contents of the Mapping BMHI [2] with examples of Digital means to Implement Competencies included in NCS [4]
Helping role	1. BMHI core Principles; 2. Health sciences and services Core: a) clinical decision support trough data governance; b) use research methods and paradigms to guide patients with change; c) empowering patient by using different digital care delivery models in patient centered care and public health knowledge including ethics of digitalization
Teaching – coaching	2. Health sciences and services; 4. Social and Behavioral Sciences Core: a) mapping out patient's educational needs b) problem solving with different stakeholders including professionals and patients; c) education and engagement with health informatics
Diagnostic functions	1. BMHI core Principles; 2. Health sciences and services Core: a) using wireless technology, sensor-based systems and robotics; b) educating professionals and patients to use new diagnostic tools and to understand the health literacy; c) supporting patients and families emotionally by digital tools; d) supporting patients' self-care by increasing understanding of wellbeing technology data; e) understanding patient's care documentation as a baseline to data governance; f) understanding the use of patient own data in individual care and the secondary use of patients' data in development work
Managing situations	1. BMHI core Principles; 2. Health sciences and services; 3. Computer, data, and information science; 5. Management science Core: a) Guiding clinical teams in clinical decision-making and promoting their skills to use informatics as a tool in patients' safety and wireless technology sensor-based systems; b) Using Artificial Intelligence for analyzing and visualizing data; c) Enabling the professionals to use data for clinical decision making
Therapeutic interventions	2. Health sciences and services; 5. Management Science Core: a) Evaluating systematically patient care outcomes with knowledge; b) Analyzing and evaluating ethics, security and privacy questions in problem solving also in digital care environment; c) as well as professionals' education and engagement; d) Utilizing research findings in nursing interventions; e) Utilizing Artificial Intelligence (AI) for analyzing and visualizing patient data companying various data for development multilinearly clinical paths
Ensuring quality	2. Health sciences and services; 5. Management Science Core: a) Patient safety and evidence informed practice by using AI, data and information analysis and visualization; b) Quality and risk management, use of research methods and paradigms focusing on evidence; c) Critical care philosophy evaluation in connection with information culture; d) Patient satisfaction associated with the user experience on health technology as part of evaluation to care; e) Nurses' user experience of health informatics as basis for initiative for development and research
Work role	1. BMHI core Principles; 3. Computer, data, and information science 5. Management Science; 6. BMHI specialization partly Core: a) Implementation of the BMHI core principles and computer data and information science into one's work; b) Interdisciplinary team management c) The stakeholder (interdisciplinary team) education and engagement; d) Change management and leadership; e) Clinical research informatics, personal health informatics and public health informatics are the parts of BMHI specialization which are required competencies of all nurses

4. Discussion

The mapping [7] was carried out by two researchers individually at first. The proposals were then discussed in the research group and the final decisions were made together. This review revealed that all categories of the NCS were relevant to be examined in the light of the BMHI recommendations. In this review, from two to four BMHI domains were found related to the NCS categories.

The essence of nursing [4,6] has not changed. However, the environment, including e.g., new interventions and observation tools, is in a constant change due to digitalization [2]. This brings new requirements for nurses' digital competence. Nurses have a special role in narrowing the view gap between the views related to clinical nursing and informatics practice. Documentation, data analyses, and knowledge management are essential parts in nurses' competence today.

The domain 'Health sciences and services' could be applied on all other categories of the NCS, except the category 'Work role'. This domain acknowledges that policies and regulatory frameworks for information handling need to be complemented with knowledge about information systems and digital services as medical-technical and healthcare products. [1.] This seems to be crucial in current Finnish health care context [4]. In future, it would be important to analyze more thoroughly relations between the NCS categories and the BMHI recommendations.

Nurses' competencies in therapeutic interventions and ensuring quality categories have shown to be the lowest [5]. To support nurses' learning related to health informatics on these categories, the BMHI domains can be used to highlight the importance of AI for analyzing and visualizing various patient data for development multilinearly clinical paths. To ensure effective learning, it would be of utmost importance to encourage the positive attitude towards digital services among professionals [2].

Currently, nurses are mostly BMHI users and generalists [1]. To ensure high quality care with effective knowledge management, all professionals need to have competencies on BMHI. Moreover, organizations need BMHI specialists. In the future, all organizations should have a chief nursing information officer and nursing informatics specialists who work in co-operation with clinical nurse specialists (CNS).

References

- [1] Bichel-Findlay J, Koch S, Mantas J, Abdul d SS, Al-Shorbaji N, Ammenwerth E, et al. Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics: Second Revision. *International Journal of Medical Informatics* Volume 170, February 2023, 104908. <https://doi.org/10.1016/j.ijmedinf.2022.104908>.
- [2] Ahonen O, Kouri P, Salanterä S, Liljamo P, Kinnunen U-M, Saranto K, et al. Finnish Nurses Association's Digital Social and Health Services Strategy. 2021. https://sairaanhoitajat.fi/wp-content/uploads/2021/06/E-health-2021_.pdf.
- [3] Vehko T, ed. E-Health and e-Welfare of Finland. Check Point 2022. Finnish Institute for Health and Welfare. <https://urn.fi/URN:ISBN:978-952-343-891-0>.
- [4] Meretoja R, Isoaho H, Leino-Kilpi H. Nurse Competence Scale: Development and psychometric testing. *Journal of Advanced Nursing*. 2004;47(2):124-133.
- [5] Flinkman M, Leino-Kilpi H, Numminen O, Jeon Y, Kuokkanen L, Meretoja R. Nurse Competence Scale: a systematic and psychometric review. *Journal of Advanced Nursing*. 2017;73(5):1035–1050.
- [6] Lima S, Newall F, Jordan HL, Hamilton B, Kinney S. Development of competence in the first year of graduate nursing practice: a longitudinal study, *Journal of Advanced Nursing*. 2016;72(4):878-888.
- [7] Cooper ID. What is a "mapping study?" *Med Libr Assoc*. 2016 Jan;104(1):76–78. doi: 10.3163/1536-5050.104.1.013.