Competencies for nursing in a digital world

Methodology, results and use of the DACH-Recommendations for Nursing Informatics core competency areas in Austria, Germany and Switzerland

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Keywords

Abstract

While Nursing Informatics competencies seem essential for the daily work of nurses, they are not formally integrated into nursing education in Austria, Germany and Switzerland, nor are there any national educational recommendations. The aim of this paper is to show how such recommendations can be developed, what competency areas are most relevant in the three countries and how the recommendations can be implemented in practice. To this end, a triple iterative procedure was proposed and applied starting with national health informatics recommendations for other professionals, matching and enriching these findings with topics from the international literature and finally validating them in an expert survey with 87 experts and in focus group sessions. Out of the 24 compiled competency areas, the relevance ratings of the following four recommended areas achieved values above 90%: nursing documentation (including terminologies), principles of nursing informatics, data protection and security, and quality assurance and quality management. As there were no significant differences between the three countries, these findings laid the foundation of the DACH Recommendations of Nursing Informatics as joint German (D), Austrian (A), and Swiss (CH) recommendations in Nursing Informatics. The methodology proposed has been utilised internationally, which demonstrates the added value of this study also outside the confines of Austria, Germany, Switzerland.

1   Introduction

The advancing digitalisation in our society and in healthcare is increasingly affecting the daily routine work of nurses in different roles. Health IT applications designed to support nurses in these roles embrace amongst others electronic rostering, scheduling and workload measurements, nursing documentation including the entire nursing process and decision making [1, 2]. Despite these developments, there are still many gaps between what seems desirable and what is actually existing and used in the various places where nurses work [3]. A major example is the missing seamless electronic connectivity between healthcare providers to support the care of patients with chronic conditions. These conditions require inter-disciplinary and inter-professional cooperation and coordination to be treated effectively [4, 5]. Another good example is the lack of data analytics of existing data: The large amount of patient information documented by nurses is only rarely used for secondary analyses to improve patient outcomes and the quality and efficiency of care processes [6]. One reason for this could be poor quality of nursing documentation, caused by lack of knowledge and skills in the nursing process [7] or technical and organizational barriers using nursing information systems or computer assisted documentation of care [8]. Another example covers electronic knowledge dissemination, access via social media [9] and use for practical patient care also at the point of care [6, 10]. All these high-level areas of deficiencies are often associated with more basic skills and their motivation to develop and use them. Sometimes this pattern may be part of a negative feedback loop. For example, if nurses are not familiar with the option of analysing electronic and structured data for quality assurance they might not be interested in advancing their documentation skills. This argumentation could work also the other way around: Having no proper skills in electronic documentation and nursing terminologies, nurses may not realise the opportunities of transmitting patient information across settings, may not envision using the wealth of patient data for research and quality assurance. Another example is lack of in-depth knowledge about data protection and unjustified fear to violate the rules becoming a barrier for the adoption of connected health IT systems. Although great achievements have been made and outstanding applications actually exist today, these results and their impact have not penetrated the mind-set of the majority of nurses and other healthcare professionals.

There are many reasons that could explain this situation, one of them is the lack of proper and comprehensive health informatics education of nurses [11] that goes beyond vendor trainings. This deficiency has been recognised by supra national bodies, such as by the International Council of Nurses, who started an eHealth programme "to transform nursing through the application of information and communication technology" [12], or the European Union in the context of patient safety and evidence based practice, who adapted article 31 (training of nurses responsible for general care) when changing the EU Directive on Mutual Recognition of Professional Qualification in 2013 [13], or by the European Federation of Nurses Associations (EFN), who translated the EU Directive into a guideline for nursing education [12]. This guideline explicitly mentions health IT in the key competence CA.4 Communication and Teamwork. One of the sub-competencies is described as "to independently use electronic health records to document nursing assessment, diagnosis, interventions and outcomes based on comparable nursing classification systems and nursing taxonomy" [14]. The corresponding curriculum should therefore integrate Standardized Nursing Languages (SNL), eHealth and IT systems for healthcare in general and for nursing in particular. Potential learning objectives should be accordingly:

- ▪ "To use the IT systems available in their healthcare system.

- To apply healthcare technologies and information and communication systems." [15]

In Germany, regulations about the content of curricula and examinations as well as the directives of the different German Federal States are kept very general and provide much room for interpretation [6]. Information and communication technology is not explicitly mentioned in the relevant regulations for the nursing professions [6, 15]. There are only a few examples, where knowledge and skills in health and nursing informatics are formally included into undergraduate and postgraduate education. In the best case, there are some computer courses integrated in nursing education in non-academic nursing schools [16], which still form the majority of all educational institutions for nursing in Austria, Germany and Switzerland. This circumstance entails a large heterogeneity of informatics competencies of nurses - from very high to very low - also depending on the educational level [17] and on the short periods of training by IT vendors [18]. The skills required may also depend on the area in which the nurse is working. Various roles were described in the literature particularly patient care (nursing with direct patient contact), education and training (nursing education), management (nursing management) and research in nursing informatics [19], in addition quality management [20], care coordination [21], and IT management in nursing as informatics nurse specialist [22] or as chief nursing information officer [23].

A study commissioned by the German Federal Ministry of Education and Research identified a great potential for improving the use of technology in nursing in Germany as compared to other European countries [6]. The same study came to the conclusion that German nursing students have deficits in communication, particularly in inter-professional communication, and in systematically employing methods to achieve their goals.

Very similar to Germany, health and nursing informatics has not been widely adopted in Austrian nursing curricula. The Austrian competence model for nursing professions describes informatics and technology as activities areas to be developed [24].

Likewise, the importance of health IT in nursing curricula is generally recognised in Switzerland [25], however, practically rather less integrated into curricula. In Switzerland a 10-day continuing education program in nursing informatics course was offered for several years, but is not carried on due to missing student subscriptions. Instead, Swiss curricula focus on medical informatics while nursing informatics courses and programmes at bachelor or masters level are missing.

In order to improve the inclusion of health and nursing informatics into the relevant curricula, clear, concrete and comprehensive statements must be made about what competencies are desirable and needed. Usually the term "competencies" embraces knowledge and skills, however, there is no finally conclusive definition [26]. In the following, we will refer to the widely recognised definition of Weinert (2001) according to which competencies are „*the combination of those cognitive, motivational, moral, and social skills available to (or potentially learnable by) a person or a social group that underlie the successful mastery through appropriate understanding and actions of a range of demands, tasks, problems, and goals.*" [27]. A similar understanding of competencies is found in the various qualification frameworks. For example, "competence" is defined by the German Qualification Framework for Lifelong Learning as the capability and readiness of an individual person to utilise knowledge and skills as well as personal, social and methodological capabilities and to behave in a reasoned and individually and socially accountable manner. Competence is hereby understood in

the sense of a comprehensive procedural competence [28]. At the European level, the European Qualifications Framework for Lifelong Learning (EQF) serves as a meta framework to link the various national frameworks and focusses on the learning outcomes [29]. These various, still very similar interpretations of competencies demonstrate the deep rootedness of the related skills and knowledge in the personality and behaviour of an individual person or a group of persons. Competencies in health and nursing informatics are therefore not identical to mechanic procedures, such as knowing how to operate a certain IT application, but reflect a well-defined universe of skills and knowledge to translate technology into meaning.

Summarising, while nursing informatics competencies seem essential for the nursing profession, they are not formally integrated into nursing education in Austria, Germany and Switzerland. Moreover, specific national recommendations do not exist, on which such competencies should be taught and which could help to better prepare nurses for their work.

2   Objectives

It is the aim of this paper to demonstrate how national recommendations for nursing informatics competencies can be developed and how they can be utilised practically in developing nursing informatics curricula and courses. These goals resulted in the following research questions:

- How can national recommendations for nursing informatics competencies be developed and which core competency areas in nursing informatics are regarded as relevant in Austria, Germany and Switzerland?
- Are there any differences between the three countries regarding the relevance of the different core competency areas?
- How can recommendations that are derived from these findings be implemented in practice, i.e. in educational programmes?

3   Methods
3.1   Procedural model for developing national recommendations

As we could not rely on existing recommendations for nursing informatics in the three countries, we conceptualised and conducted a triple iterative approach starting with national health informatics recommendations for other healthcare professionals and expert opinions (STEP 1), matching and enriching these findings with topics in the international literature (STEP 2) and finally validating them (STEP 3) in an expert survey (STEP 3a) and in focus group sessions (STEP 3b).
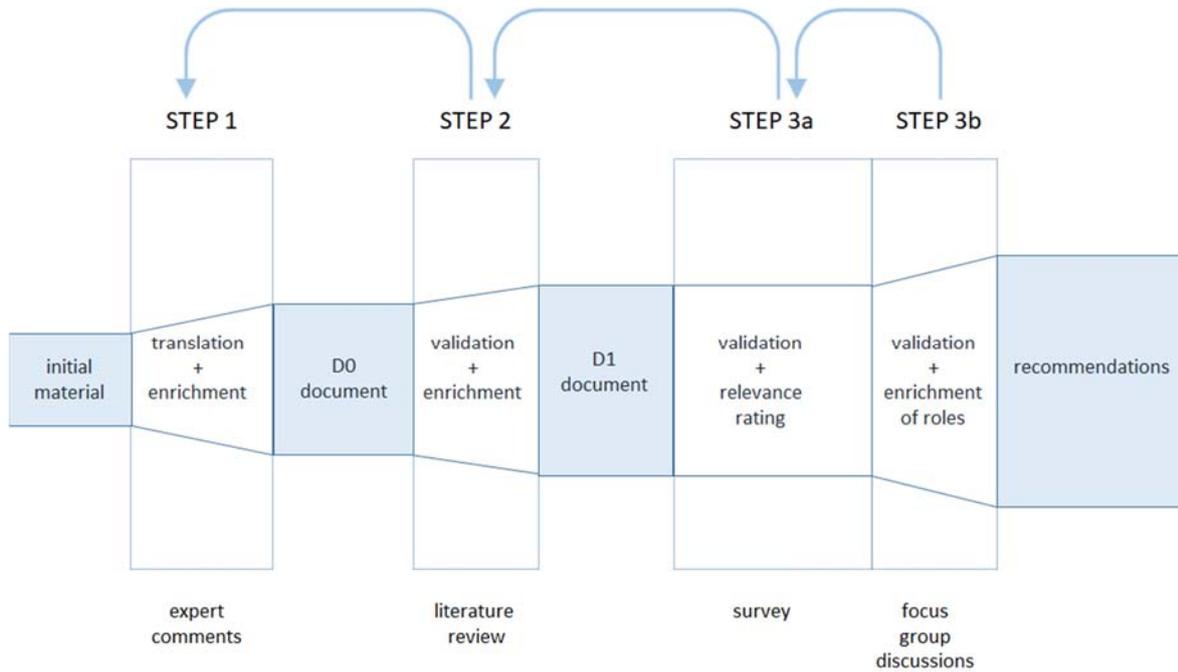
Figure 1: Procedural iterative model of recommendation development (Legend: blue areas: documents; white areas: activities. D0 and D1 refer to documents that summarised interim results.)

The first step (STEP 1) comprised an analysis of recommendations for continuing education of physicians to become a specialist in medical informatics [30], which was based on recommendations of medical informatics competencies for the German national competency based catalogue for learning objectives in medicine (NKLM) [31]. This initial document described 12 competency areas, which should be transferred, modified and supplemented for nursing. To this end, 14 experts of the Nursing Informatics Working Group of the German Society for Medical Informatics, Biometry and Epidemiology (GMDS) were asked to comment on the recommendations for physicians. Comments could be made in the period of November 2014 to February 2015. The changes proposed were consolidated by the authors of this paper and included changes in the wording, in particular "nursing" instead of "medical" or "medicine", a few changes to the content, i.e. "biostatistics" instead of "biometry and epidemiology" and "general content" became "principles of nursing informatics", and finally the inclusion of three new competency areas, i.e. project and process management, resource management and logistics, and information and knowledge management in patient care (Table 1). The resulting document (D0) consisted of 15 competency areas.

Table 1: Enhancement of informatics core competency areas for physicians

Informatics core competencies for physicians	D0: Informatics core competencies for nurses
	(enriched by the nursing informatics working group of the GMDS)
1. General contents	1. Principles of nursing informatics
2. Applied computer science	2. Applied computer science
3. Data protection and security	3. Data protection and security
4. Medical documentation	4. Nursing documentation
5. Information and communication systems	5. Information and communication systems for nursing
6. Telematics	6. Telematics and eHealth

7. Information management in research	7. Information management in research
8. Information management in teaching	8. Information management in teaching
9. Decision support	9. Decision support
10. Image and biosignal processing	10. Image and biosignal processing
11. Quality assurance and management	11. Quality assurance and management
12. Biometrics and epidemiology	12. Biostatistics
	13. Project- and process management
	14. Resource planning and logistics
	15. Information and knowledge management in patient care

In order to validate and enrich D0, international educational recommendations in the field of medical, clinical, health and nursing informatics that were published by national or international bodies or initiatives and that synthesised other existing recommendations were identified and analysed (STEP 2). This second step included the following recommendations in alphabetical order:

- AMIA Board White Paper: definition of biomedical informatics and specification of core competencies for graduate education in the discipline [32],
- German NKLM [31] and
- Global Academic Curricula Competencies for Health Information Professionals Draft for Public Comment [33],
- Health Informatics Scope, Careers and Competencies Version 1.9 from Australia [34],
- Informatics Professional Core Competencies v3.0 from Canada [35],
- Informatics Competencies for Every Practicing Nurse: Recommendations from the TIGER Collaborative [36],
- Recommendations of the International Medical Informatics Association (IMIA) on Education in Biomedical and Health Informatics First Revision [37].

A total of 38 broad competency areas could be extracted from these recommendations, which were then matched with the competency areas in D0. This matching showed that 11 competency areas were identical and further two ones were very similar. The joint competency area project and process management in D0 corresponded with two areas, which were kept separate in the international recommendations. Thus this competency area was split. A set of eight more competency areas from the international recommendations were newly incorporated, which mainly covered adjunct areas such as change and stakeholder management, ethics, IT risk management. There was one competency area in D0, i.e. information management in research, with no immediate counterpart on the top level in the international literature. However, there were several corresponding competencies at a lower level that covered information management in research. Thus it was retained and no competency area from D0 was removed. In conclusion, all 15 initial competency areas proposed by the German speaking experts could be validated by the international literature. As viewed from the perspective of the international literature, eight new competency areas could be contributed to D0 and all except of two were either completely identical, very similar or could be subsumed under one of the competency areas of D0 (see Appendix A). Two areas of the 38 competency areas from the international recommendations were not considered because they covered very basic computer skills. These comparisons resulted in 24 final competency areas denoted as D1, which are shown in

Table 2. All management topics covered their particular application in nursing and nursing informatics. In accordance with the Global Academic Curricula Competencies for Health Information Professionals (Draft for Public Comment) published by the Global Health Workforce Council [33] these competency areas were not grouped but listed alphabetically.

Table 2: List of 24 core competency areas (Document D1) – Result of the comparison of the national and international model

D1: Informatics core competency areas for nurses		
Applied computer science	Financial management	Nursing documentation (incl. terminologies)
Assistive technologies	Human resource management	Principles of management
Biostatistics/statistics	Image and biosignal processing	Principles of nursing informatics
Change and stakeholder management	Information and communication systems for nursing (incl. interoperability)	Process management
Data protection and security	Information and knowledge management in patient care	Project management
Decision support	Information management in research	Quality assurance and quality management
eHealth, telematics, telehealth (incl. interoperability)	Information management in teaching, training and education	Resource planning and logistics
Ethics and IT	IT risk management	Strategic management and leadership

Step three (STEP 3a) covered the primary validation procedure that should result in a relevance voting of the 24 core competency areas and formally involved experts from all three countries. An online questionnaire was therefore developed that allowed the participants to rate the relevance of all 24 core competency areas on a scale from 0 to 100 in steps of 10. The relevance of each individual core competence area was measured in percent with a maximum percentage of 100 per area. In order to obtain an in-depth picture of what types of nurses need what competencies, three professional roles of nurses were initially defined for which the relevance of the competency areas had to be expressed. These three roles were nursing management, quality management, and IT management in nursing. The roles and the competency areas were explained by examples in the questionnaire, which could be seen on mouse-over. Appendix B lists examples for the roles and core competency areas. The online questionnaire was pre-tested by five experts and the link of the final version was mailed to 120 experts from healthcare organisations, academic and research institutions, and finally from IT vendors. This group of persons consisted of 64 experts from Germany, 36 from Austria and 20 from Switzerland that were recruited by nomination from the three Nursing Informatics (NI) groups, i.e. NI working group of GMDS, ÖGPI and the Swiss NI Interest Group (IGPI), and in a snow ball system. The survey was open from end of April 2015 to end of May 2015. Appendix C shows an example of the survey that was sent out to the panel.

Furthermore, validation of the 24 core competency areas and the five roles took place additionally in two focus group discussions (STEP 3b), one at the GMDS Annual Conference 2015 in Krefeld Germany (GMDS 2015) and the other at the European Nursing Informatics Conference 2015 in Hall/Tyrol Austria (ENI 2015). Twenty-three German experts (21 scientists, one user and one person from an IT vendor) attended a workshop organised for this purpose at GMDS 2015 under the motto "Continuing Education in Medical and Health Informatics", where the results of the survey (STEP 2) were presented and discussed. The discussion was recorded to be analysed later. The second workshop, which took place at ENI 2015 under

the title "Continuing Education in Nursing Informatics" attracted 25 participants from all three countries consisting of 17 users, seven scientists and one person from an IT vendor. In contrast to the GMDS workshop, this workshop was intended to conduct in-depth discussions about the core competency areas. Therefore, a set of the top 6 most highly rated competency areas and the related sub-competencies as extracted from the international literature [31-37] were presented and discussed in groups of three persons. The sub-competencies were phrased as explicit as possible using Bloom's taxonomy [38]. The discussions revealed deficiencies in number of nursing roles, which led to the inclusion of two new roles: clinical nursing (direct patient care) and coordination of inter-professional care. The online survey was therefore repeated with the same 120 experts (repetition of STEP 3a), to cover these two new roles. It was open for participation from end of November 2015 to end of December 2015.

According to the ethics commission of the University of Applied Sciences Osnabrück, ethical approval was not required for the study.

3.2 Differences between the three countries

In order to find out whether there are differences between Austria, Germany and Switzerland the mean relevance ratings across all 24 competences was calculated for each nursing role and per country. These means were tested for significance by one-way analyses of variance (ANOVA). We set $\alpha = 0.05$ for all analyses and corrected for multiple testing.

3.3 Implementation of the recommendations in educational programs

The recommendations resulting from research question 1 should provide an overview of role independent and role specific high priority competency areas. Thus, the method for developing and adopting these recommendations was mainly defined by the procedure of research question 1, which already involved the three issuing organisations. They are the major representatives in Nursing Informatics in the three countries. In order to show how these recommendations can be implemented, two case studies are presented that describe what competencies are integrated in what type of educational programme and for which group of nursing students. The two case should illustrate the implementation in Austria and Germany.

4   Results
4.1   How can national recommendations for nursing informatics competencies be developed and which competence areas in nursing informatics are regarded as relevant in Austria, Germany and Switzerland?

The iterative procedure proposed in Figure 1 proved to be feasible and attracted a series of experts involved in the various steps. In STEP 1 fourteen external experts from all three countries could be motivated to comment. STEP 2 was performed individually by the authors and discussed in group meetings. In STEP 3a, the online survey, we invited 120 experts of which 87 responded (72.5% response rate) in both survey rounds. Figure 2 shows the distribution of experts from the three countries for the online survey (STEP 3a).
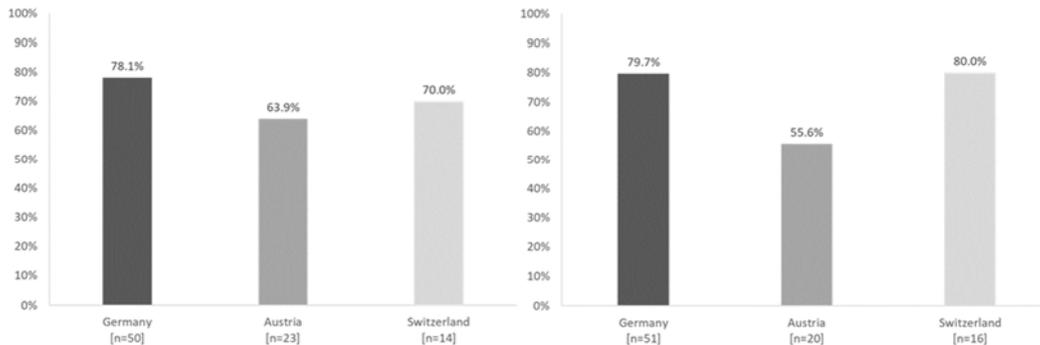
Figure 2: Distribution of expert participants in the first online survey on the relevance for nursing management, quality management, IT management in nursing (left) and in the second survey on the relevance for clinical nursing (direct patient care) and coordination of inter-professional care (right) (STEP 3a). In both surveys, there were 87 respondents. 78% of all participating persons were identical. The percentage values reflect the corresponding response rates.

Broken down by professional activity, there were 41/46 persons from academia (teaching and research), 36/28 from the group of users and finally 10/13 persons representing IT vendors. The numbers refer to the first and second round of the survey.

Table 3 provides an overview of the five most relevant rated core competency areas for each of the five roles as average values across the entire group of experts (STEP 3a). Relevance ratings for all 24 competency areas are described in Appendix D. All competency areas found in the top five received relevance ratings above 66.6%, most of them above 75.0%. There were four competency areas whose relevance ratings achieved values above 90.0%. These were:

- ➢ nursing documentation (including terminologies),
- ➢ principle of nursing informatics,
- ➢ data protection and security, and finally
- ➢ quality assurance and quality management.

Each role was defined by a lead core competency area, such as nursing documentation (including terminologies) for the roles "nursing management", "clinical nursing" and "coordination of inter-professional care". The role "IT management" in nursing was characterised by "principles of nursing informatics" and the role "quality management" by the core competency area "quality assurance and quality management" in nursing informatics.

Each role had a distinctive set of core competency areas, such as "nursing management" was dominated by management related competencies and "IT management" in nursing by technology related areas. "Clinical nursing" and "coordination of inter-professional care" also shared four of the five core competency areas. Across all roles, "nursing documentation (incl. terminologies)" and "data protection and security" occurred four times and "process management" three times.

Table 3: Top 5 core competency areas sorted by average relevance (in % {0%…100%} / ± SD) in all three countries

Role	Top 1	Top 2	Top 3	Top 4	Top 5
Nursing management [n=87]	Nursing documentation (incl. terminologies) (90.5% / ±14.8)	Process management (85.6% / ±17.7)	Human resource management (83.9% / ±22.4)	Principles of management (83.3% / ±21.8)	Project management (83.2% / ±19.9)
IT management [n=87]	Principles of nursing informatics (93.3% / ±14.2)	Data protection and security (93.2% / ±12.5)	Information and communication systems for nursing (incl. interoperability) (89.1% / ±13.5)	Project management (88.2% / ±14.2)	Applied computer science (86.1% / ±18.3)
Quality management [n=87]	Quality assurance and quality management (95.1% / ±14.1)	Process management (85.4% / ±20.4)	Project management (84.8% / ±20.0)	Data protection and security (81.3% / ±22.7)	Nursing documentation (incl. terminologies) (80.0% / ±22.4)
Clinical nursing [n=87]	Nursing documentation (incl. terminologies) (94.1% / ±12.3)	Data protection and security (74.4% / ±25.7)	Information and knowledge management in patient care (69.9% / ±24.1)	Ethics and IT (67.4% / ±24.8)	Quality assurance and quality management (66.6% / ±24.1)
Coordination of inter-professional care [n=81]	Nursing documentation (incl. terminologies) (88.9% / ±14.9)	Data protection and security (83.5% / ±21.6)	Process management (76.8% / ±21.9)	Information and knowledge management in patient care (76.7% / ±23.4)	Quality assurance and quality management (74.4% / ±22.7)

4.2 Are there any differences between the three countries regarding the relevance of the different core competency areas?

As Table 4 shows there were no overall significant differences regarding the mean relevance ratings for any of the five roles between the three countries.

Table 4: Results of one-way ANOVA with means of relevance ratings across all 24 competencies and SD for the five roles and per country.

Nursing management						
country	mean	SD	n	F	df	p
Austria	67.17	13.41	23			
Germany	67.69	12.79	50	0.021	2;84	0.98
Switzerland	66.99	16.32	14			
IT management in nursing						
country	mean	SD	n	F	df	p
Austria	73.95	14.13	23			
Germany	72.02	12.76	50	0.167	2;84	0.85
Switzerland	72.53	13.80	14			
Quality management						
country	mean	SD	n	F	df	p

Austria	68.03	16.28	23	0.89	2;84	0.41
Germany	63.58	15.34	50			
Switzerland	67.92	12.81	14			
Clinical nursing						
country	mean	SD	n	F	df	p
Austria	48.02	21.37	20	2.76	2;84	0.07
Germany	48.94	12.69	51			
Switzerland	58.54	13.62	16			
Coordination of inter-professional care						
country	mean	SD	n	F	df	p
Austria	55.61	21.21	19	1.43	2;78	0.25
Germany	59.49	14.76	47			
Switzerland	65.19	14.49	15			

Experts in all three countries agreed to a large extent with regard to the lead core competency area for all roles (Table 5). Only for the role IT management in nursing, the Swiss experts differed from the other countries. Similar to the overall relevance ratings across all countries, the role nursing management was dominated by management related core competency areas and the role IT management in nursing was characterised by technology related ones across the three countries. The prominent position of nursing documentation among the top 5 core competency areas was evident for all three countries likewise, which only did not hold true for the role IT management in nursing (Table 5). Similarly, data protection and security was represented in all countries for the roles IT management in nursing, quality management, clinical nursing and coordination of inter-professional care (except of Switzerland).

Table 5: Top 5 core competency areas sorted by average relevance (in % {0%…100%}) in all five roles

Country	Top 1	Top 2	Top 3	Top 4	Top 5
Role: nursing management					
Germany [n=51]	Nursing documentation (90.8%)	Project management (86.6%)	Process management (84.8%)	Principles of management (83.4%)	Human resource management (81.6%)
Austria [n=20]	Nursing documentation AND process management AND human resource management (88.7%)	Strategic management and leadership (88.3%)	Quality assurance and quality management (83.9%)	Principles of management AND project management (83.0%)	Information and knowledge management (81.4%)
Switzerland [n=16]	Nursing documentation (92.1%)	Human resource management (84.3%)	Principles of management AND process management (83.6%)	Information and knowledge management AND strategic management and leadership (79.3%)	Ethics and IT (79.3%)
Role: IT management					

Germany [n=50]	Principles of nursing informatics (93.0%)	Data protection and security (92.4%)	Information and communication systems for nursing (89.8%)	Project management (88.2%)	eHealth, telematics, telehealth (85.8%)
Austria [n=23]	Principles of nursing informatics AND data protection and security (96.5%)	Applied computer science (90.0%)	Project management AND Information and communication systems for nursing (89.1%)	Ethics and IT (84.8%)	eHealth, telematics, telehealth (82.6%)
Switzerland [n=14]	Data protection and security (90.7%)	Principles of nursing informatics (89.3%)	Information and communication systems for nursing AND project management AND IT risk management (86.4%)	Applied computer science (85.0%)	Decision support (82.1%)
Role: quality management					
Germany [n=50]	Quality assurance and quality management (94.4%)	Project management (87.0%)	Process management (82.6%)	Nursing documentation (80.4%)	Data protection and security (80.0%)
Austria [n=23]	Quality assurance and quality management (96.5%)	Process management (91.3%)	Project management (86.5%)	Data protection and security (85.7%)	Information and knowledge management (81.7%)
Switzerland [n=14]	Quality assurance and quality management (95.0%)	Process management (85.7%)	Nursing documentation (82.1%)	Data protection and security (78.6%)	Information and knowledge management (77.9%)
Role: clinical nursing					
Germany [n=51]	Nursing documentation (94.7%)	Data protection and security (77.5%)	Information and knowledge management (66.9%)	Ethics and IT (66.5%)	Information and communication systems for nursing (65.7%)
Austria [n=20]	Nursing documentation (95.0%)	Information and knowledge management (76.0%)	Data protection and security (72.0%)	Quality assurance and management (67.5%)	Ethics and IT (63.0%)
Switzerland [n=16]	Nursing documentation (91.3%)	Information and knowledge management AND ethics and IT (75.6%)	Quality assurance and quality management (71.9%)	Process management (68.8%)	Data protection and security (67.5%)
Role: coordination of inter-professional care					
Germany [n=47]	Nursing (86.6%)	Data protection and security (86.6%)	Process management (78.7%)	Project Management (73.8%)	Information and knowledge

	documentation (88.1%)				management AND information and communication systems (73.6%)
Austria [n=19]	Nursing documentation (90.5%)	Data protection and security (82.6%)	Information and knowledge management (81.6%)	Quality assurance and quality management (79.5%)	Process management (69.0%)
Switzerland [n=15]	Nursing documentation (89.3%)	Process management (80.7%)	Information and knowledge management AND Information and communication systems for nursing (80.0%)	Project management (78.7%)	Ethics and IT AND Quality assurance and quality management (76.0%)

4.3 How can recommendations that are derived from these findings be implemented in practice, i.e. in educational programmes?

The findings of STEP 1 – STEP 3 were presented to the German Nursing Informatics Working Group within GMDS, the Austrian Society for Nursing Informatics (ÖGPI) and the Swiss Nursing Informatics Interest Group (IGPI) and formed the foundation for developing Nursing Informatics recommendations. Due to the fact that there were no major differences between the countries, the three organisations decided to jointly issue recommendations based on the combined results of all three countries.

These recommendations are published in [39] and comprise two parts:

➢ an overall list of core competency areas, notably those areas with relevance values of 50 % and higher
➢ a list of core competency areas for each of the five roles, including those areas with a relevance minimum of 66 % to denote significance.

The recommendations were used to design new Nursing Informatics curricula and to validate existing ones. The following section describes two case studies of universities that made use of the recommendations to design and re-design Nursing Informatics courses.

Case study 1:

Nursing Informatics as integral part of all nursing study programmes at the University of Applied Sciences Osnabrück, Germany

With the advent of gradually moving nursing education into universities in Germany, the University of Applied Sciences Osnabrück was among the first to offer academic programmes in Nursing since the early 1980s and was the first to offer compulsory academic courses in Nursing Informatics. Today, the Nursing study programmes at the University of Applied Sciences Osnabrück embrace two part-time bachelor programmes, one in Nursing Science, the other in Nursing Management, and a full-time bachelor programme in Clinical Nursing, designed as a so called dual study programme in cooperation with hospitals. This set of bachelor programmes is supplemented by an inter-professional masters programme for all healthcare professionals. Due to the regular re-accreditation of these programmes, all curricula including the one for Nursing Informatics had to be updated in summer 2016. Although the content of the courses had evolved over the past 20 years, it was decided to abandon the previous approaches and to use the survey findings as the major orientation when re-designing the Nursing Informatics curriculum. As all three different study programmes should have had a uniform Nursing Informatics curriculum, the overall relevance ratings were used. In addition to the survey findings from Austria, Germany and Switzerland, international TIGER recommendations [40] should be integrated as there are several countries with a longer history and experience in Nursing Informatics than these three countries. These deliberations led to the following areas of competencies to define the new curriculum:

- Principles of nursing informatics

- Nursing documentation (including terminologies)

- Process management

- Information and communication systems for nursing (including interoperability)

- eHealth, telematics, telehealth and assistive systems (including interoperability)

- Data protection and security and ethics and IT

- Information and knowledge management in patient care

- Quality management and decision support

- Project management and change management

The newly developed curriculum significantly differs in several parts from the previous one. Information and knowledge management in patient care, quality management and decision support are new competency areas. Likewise, the combination of project management with change management, the merging of eHealth, telematics, telehealth with assistive technology and the integration of data protection and security with ethics in IT are new. This new approach should intertwine competency areas of Nursing Informatics with competency areas in Nursing Research, Quality Assurance and Healthcare Management in a stronger fashion. The new curriculum takes effect from winter semester 2017/2018 for all bachelor programmes. The inter-professional masters programme for all healthcare professionals also starts with the onset of winter semester 2017/2018 and covers eHealth, telematics, telehealth and assistive technologies, information systems for (health service) research, planning and evaluation of IT

systems and data protection, security and ethics in IT. Thus this curriculum, focusses on selected areas in the context of integrated care and health service research. Furthermore, it deepens other competency areas such as planning and evaluation of IT systems, which is part of the competency area information and communication systems, and data protection, security and ethics in IT.

Case study 2:

Nursing Informatics educational strategy of the University for Health Sciences, Medical Informatics and Technology (UMIT) Hall in Tirol, Austria

The University for Health Sciences, Medical Informatics and Technology (UMIT) in Hall in Tirol was one of the first in Austria to offer academic programs in nursing science. Currently, UMIT offers a full-time and a part-time bachelor programme and a part-time masters programme for nursing science.

Within the bachelor programme, one module is dedicated to nursing informatics. This module covers the core competency area of nursing documentation (including terminologies). This corresponds with the recommendations that list this area as top one priority for the role nursing management, clinical nursing and coordination of inter-professional care.

Within the master programme, another module covers nursing informatics. This module embraces the core competency area of process management, project management and change management and stakeholder management. These areas are among the top 10 recommended areas.

UMIT also offers a three-day certificate course for "information management in nursing" that takes place every year. Participants mostly have a background in nursing (clinical nursing, nursing management). This course also covers the competency areas nursing documentation (including terminologies), process management, project management and change management and stakeholder management" but also integrates eHealth, telematics and telehealth and information and communication systems for nursing. The content of this three-day course is revised regularly. The curriculum will be re-designed with regard to the Austrian, German and Swiss recommendations [39] in the next turn of revisions in 2018.

In 2018, UMIT will start a new programme in health information management (www.umit.at/him). This new online-based study programme has a duration of five semesters and will cover several core competency areas to some depth, including:

- principles of nursing informatics,
- applied computer science/informatics,
- information and communication systems for nursing,
- eHealth, telematics and telehealth,
- information management and knowledge management in patient care,
- nursing documentation (including terminologies),
- data protection and security,
- ethics and IT,

- process management,
- project management and finally
- change management and stakeholder management.

This programme was inspired to a great extent by the DACH recommendations of Germany (D), Austria (A) and Switzerland (CH) as can be seen when comparing these competency areas with the ones in the overall list of recommendations [39].

5   Discussion

Methodology for developing recommendations

The findings of this study demonstrate the feasibility and merits of employing an iterative methodology for identifying relevant Nursing Informatics core competency areas that finally led to the publication of Nursing Informatics recommendations for Austria, Germany and Switzerland. These recommendations comprise a general set of desirable core competency areas and describe the top areas for each of the five roles, namely nursing management, IT management in nursing, quality management, clinical nursing and coordination of inter-professional care.

This stepwise methodological approach with selected back loops intertwined national and international sources and included the voice of experts from Austria, Germany and Switzerland to comment on the various draft versions and rate the relevance with regard to the five roles. A total of approximately 150 experts contributed to these findings either via the survey, the workshops and/or the initial comments. Even if we assume some overlap of experts to exist in the various steps, there is still a considerable number of knowledgeable and skilled persons from the field who added to these findings. This fact demonstrates the validity of the methodology and thus supports the validity of the results. The validity of results is also confirmed by the high agreement among the experts of Austria, Germany and Switzerland. The 72.5% survey response rate reveals a great interest in this topic and obviously points to the need for changes in the existing nursing curricula. As the case studies also shows, these findings had already practical implications for designing nursing informatics curricula in two countries. These implications indicate the practical usefulness of this approach in education.

The methodology for developing the national recommendations was utilised to expand the scope of national recommendations and to develop a recommendation framework in the context of the Technology Informatics Guiding Education Reform (TIGER) Initiative [40]. This framework provided the foundation for the survey which included the 24 core competency areas and the procedures to validate the findings in group discussions at workshops.

Thus, all in all the main impact of this study for other countries outside Austria, Germany and Switzerland is its rigorous and unique methodological approach including back loops and various nodes for validation and incorporation of change.

Relevance of Nursing informatics core competency areas in the three countries

The overall survey findings hint at a considerable relevance of nursing informatics core competencies in all five roles. The most meaningful result is the high average relevance of Nursing Informatics competency areas for the role of clinical nursing, a role taken by the very large majority of nurses. This leads to the conclusion that Nursing Informatics comprises a set of competencies for nursing as a profession, not only for a small subgroup of specialists. It therefore has to be considered as an integral part of any curriculum in nursing.

The survey findings - particularly the top 5 most relevant core competency areas - reveal how important classical topics such as nursing documentation including terminologies and data protection and security are. As nursing care is often narratively documented, it lacks important patient information despite high redundancies [41, 42]. Standardised nursing languages are not applied everywhere and therefore, nursing data are not transferable and difficult to evaluate [43]. Standardised nursing languages obviously are required to describe the nursing process and constitute the core of nursing informatics.

There are several management-related core competency areas among the top 5 including project management, process management and change management, which underpin the horizontal role of nursing informatics within other topics and across the entire field of nursing. Information and knowledge management, process management, quality assurance and quality management also received high rankings. The importance of information and knowledge management reflects the role of nurses as an information and knowledge intensive profession that seeks to better include research findings into education and practice [6]. Nurses need to know how and where to search for evidence based information and how to organise the resulting documents and the search process. Information and knowledge are the essence of quality management, which includes data and information quality, and of IT decision support. A newly published, internationally consented standard for nursing process decision support systems supports this finding [44].

Another core competency area that appears when analysing the relevance findings by role and country is ethics and IT. Ethics is concerned with data capture, storage, analysis, sharing and patient access, e.g. via electronic health record systems [45], when touching the right of private sphere and anonymity, questions of responsibility, the role of virtual communities, and the right of information availability. The importance of data protection and security is understandable as the lack of confidentiality when handling personal data and as missing system security belong to the largest barriers when implementing new systems [46]. Although technology related areas, such as information and communication systems, play a role, the goal of Nursing Informatics education seems to be the application of these technologies to achieve care related outcomes and weave these technologies safely into the daily routine. Other competency areas, in contrast, first and foremost assistive technologies are still not yet seen to play a major role in today's working practice and related competencies are ranked lower in the overall perspective. Likewise, the bridge between biostatistics/statistics and nursing informatics has not yet been fully appreciated.

Despite some minor variations, the relevance ratings show a strong agreement in the three countries and no statistically significant differences. This notion formed the basis of issuing joint Nursing Informatics competency recommendations across all three countries that were published separately in [39]. These recommendations are meant to serve as a compass for learners, teachers and employers alike. As these recommendations only touch the highly aggregated level of core competency areas, they need to have a counterpart at a more detailed

level. Thus, the case studies included partly describe model applications of these recommendations and illustrate how these core competency areas can be translated into very practical curricula at the undergraduate level and in continuing education in Germany and Austria. Currently, no Nursing Informatics study programmes and courses are offered in Switzerland and existing Medical Informatics courses do not cover nursing related topics such as evidence-based nursing documentation, nursing process decision support system criteria and advanced knowledge on nursing classifications. In light of this situation, the findings of this study support the need to learn across the three countries and to jointly focus on the combination of nursing informatics and evidence-based nursing.

Limitations

We did not compute psychometric measures of reliability (internal consistency) and criterion validity (correlation with external criterion) for the questionnaire of the expert survey. Reliability was not measured because we did not structure the questionnaire into different subscales that should be internally consistent. Furthermore, this questionnaire as an entirety was designed to be as diverse as possible to cover a maximum of relevant competencies. Validity was not measured separately as the stepwise approach itself, which included the international literature and the two focus group discussions, was meant to ensure content validity via the representation of a broad body of knowledge in this area.

Despite the merits of the iterative approach and its validity and usefulness, this approach cannot entirely warrant the inclusion of all relevant areas. Nursing informatics as a discipline is evolving steadily, thus new competency areas may have to be added to the recommendations in the future. The list of roles proposed in this study may also need to be supplemented as new responsibilities and duties of nurses may arise in the near future. One might criticise why nursing education and nursing research were not listed. We contend that both roles are strongly defined by the subject on which they focus. For example, a nursing teacher, who lectures students in nursing management, would have to possess similar competencies as nursing managers themselves. Recent publications specifically address the competencies of nursing educators, whose influence on the next generation of nurses must not be underestimated. The frameworks and competencies discussed match the findings of this study [47]. In addition, one of the most obvious competency areas important for nursing researchers is information management in research, which belongs the 24 competency areas.

The survey does not refer to competencies at a very detailed level. Therefore, the findings do not allow the reader to draw conclusions about the meaning of certain competencies at different academic levels. We refrained from distinguishing between various levels because these levels strongly depend on the background knowledge of the students, the professional role that is targeted and on the context and focus of the educational institution.

It could be argued that national recommendations are obsolete because technologies are global. Indeed, the global findings of the TIGER study [40] do not hint at landslide differences between the results of an international survey and the results of this study. The rank of a competency area and its absolute relevance rating might vary but the big picture remains the same. Having said that, informatics competencies are contextualised by the national healthcare system, the professional roles, the educational culture and local peculiarities, e.g.

ANA Nursing Informatics: Scope and Standards of Practice, 2nd Edition [22] for the USA. These are all reasons to investigate whether there are differences and to tailor the recommendations accordingly. Case studies are ideal formats to demonstrate real life local applications of these recommendations.

6   Conclusions

This study lays the foundation of the joint DACH (Germany, Austria, Switzerland) Recommendations for Nursing Informatics and illustrates the use of these recommendations. It furthermore and not least, proposes and applies a procedure to develop recommendations using a mixed methods approach. This methodology has been utilised internationally, which demonstrates the added value of this study also outside the confines of Austria, Germany and Switzerland.

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