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The current state of Nursing Informatics – An international cross-sectional survey

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Abstract

An international survey to explore current and future trends in Nursing Informatics (NI) was done in 2015. This article explores responses to questions about: what should be done to further develop NI as an independent discipline; existing policies and standards influencing NI; perceived support towards NI as a discipline; and advice from NI specialists to students and emerging professionals.

Nurse and allied health professionals in academia and practice were reached with snowball sampling. Open-ended questions were analysed with thematic content analysis and the mean and standard deviation is reported for the perceived support towards NI (scale ranging from 1 (not at all supportive) to 10 (very supportive)).

A total of 507 respondents from 46 countries responded to the survey. Respondents reported mediocre support towards NI from the environment (M 5.79, SD 2.60). Results showed that NI education needs development to better meet practice demands, that current NI resources seem insufficient, that NI expertise is not used to its full potential in health institutions and the community, and that NI needs to show its value through research and increase visibility to be recognised among stakeholders worldwide.

In conclusion, there is a need to clarify NI as a discipline and a need for strong leadership to impact policy making. An increase in NI teaching at undergraduate level in nursing as well as an increase in postgraduate NI programmes worldwide would better support practice demands. National policies and international white papers in NI are needed to guide resource distribution to better support practice.

Keywords: nursing informatics, surveys and questionnaires, nursing education, informatics competencies

Introduction

Nurses are the largest workforce in health care and they directly contribute to the health and well-being of patients, families, communities, and populations. As the use of information technologies in health care continues to evolve and change, so too does the practice of nursing. It is essential that the nursing profession's epistemological and ontological perspectives are strongly embedded throughout the biomedical and health informatics area [see e.g. 1-2] so that the development, application, and use of technology are fit for the purpose of nursing practice, and ultimately, serves the populations we care for. Nursing has an important role in ensuring that nursing perspectives and interests are represented in biomedical and health informatics. There are numerous avenues that such representation can take place, although arguably, much of this focused effort and discourse is largely taking place in the subfield of Nursing Informatics (NI).

The idea of NI as a discipline was first described by Graves and Corcoran in 1989 [3] and followed by others [see e.g. 4]. Initial discussions of NI first explored the suitability and contributions of NI for nursing practice and outlined ways of moving forward in designing nursing information systems [3,5]. Graves and Corcoran [3] contextualized the role of NI as related to the broader nursing discipline in making the case for the relevance and needed development of NI as a field. As NI has and continues to evolve and mature over later decades [e.g. see 6], various definitions and conceptualizations of NI have developed. These can be broadly categorised into information technology-oriented, conceptually-oriented, and role-oriented definitions [7].

Today, a common understanding of NI is as a specialty within the discipline of nursing science or as a part of a multidisciplinary field integrating "nursing science with multiple information management and analytical sciences to identify, define, manage and communicate data, information, knowledge and wisdom in nursing practice" [7-10] often belonging under the broad umbrella of medical and health informatics [2,10]. Those nurses who work and study in this field are often referred to as nurse informaticians.

There is ongoing discussion regarding whether NI is its own discipline [11,12]. There are general arguments against role, task and domain-oriented definitions of NI, as they for example suggest that informatics projects only apply to one group of people, such as nurses [12]. One definition of an academic discipline states that it needs to have a wide-ranging body of knowledge with a taxonomy and knowledge areas, clearly defined outer limits, an agreed methodology for inquiry, a specialised vocabulary, an agreed literature base, and its own theoretical base [13]. Reflecting on this definition, several publications on NI deal with the scope of practice, body of knowledge, taxonomy, knowledge areas, methodologies for enquiry, and theoretical underpinnings [see e.g. 4,8,14-19] as well as core competencies [see e.g. 20-23].

Notwithstanding what will likely be an ongoing lack of consensus on whether or not NI is its own discipline, NI has a long tradition of disseminating its knowledge and NI research has been represented on international scientific conferences since 1974. NI was formally recognised by the International Medical Informatics Association (IMIA) when the NI working group was established in 1982. This group organised their first international NI conference in the same year and have continued organising these events ever since [6]. Dissemination of NI knowledge was supported in 1983 by the creation of the journal "Computers in Nursing", which was renamed into Computers, Informatics, Nursing in 2002 [24].

The state of NI varies across the world. It appears to be more established in some countries while just emerging in others. To date, NI societies, organizations and associations are centered in Australia, Canada, England, Ireland, Korea, New Zealand, Singapore, Taiwan and the United States (US) [25]. Formal NI education ranges from post-baccalaureate certificates to Master and Doctorate degrees; however, education in NI-related competencies are often inadequate for the newly graduated nurse [26] and evidence by postgraduate students show a need for improved training in NI skills [27,28]. Formal NI certification only appears to be available in the US [25] while nurses receive degrees and certifications in related fields across the globe (e.g.

biomedical informatics, health informatics and health information management).

The recognition of NI continues to be a challenge. One of these challenges appears to be related to the general lack of understanding regarding the potential of NI to change and improve health care [29]. To gain insight into the role of informatics and how NI is understood either as an independent discipline or a discipline within nursing, the International Medical Informatics Association Nursing Informatics (IMIA NI) Student and Emerging Professionals (SEP) group developed and distributed an international survey to explore current and future trends in NI, in 2015.

Material and methods

This observational study had a prospective, cross-sectional, exploratory design. Data were collected with an online survey in the autumn of 2015. The questionnaire content was developed based on literature [16,30] and expert opinions, focusing on exploring current and future trends in NI. The questionnaire was initially developed in English and then translated into five additional languages (Arabic, Korean, Portuguese, Spanish, Swedish). Translations were checked by two individuals with appropriate skills in both NI and English to ensure the correctness of the translation. There were eight demographical questions (professional background, highest degree received, clinical position, academic position, years of NI experience, NI education, country, city) and sixteen questions regarding the current state of and future trends in NI. The survey was pilot tested. Results of other survey questions are published elsewhere [31-35]. This article explores the responses to the following survey questions:

> Q1. What should be done to further develop NI as an independent discipline (open-ended question)?
>
> Q2. What national policies, standards or strategy papers regarding NI exist in your country or your institution (open-ended question)?
>
> Q3. Do you feel that your environment is supportive of NI as a discipline (on a scale ranging from 1 (not at all supportive) to 10 (very supportive)?
>
> Q4. Any further comments or advice for current students in NI (open-ended question)?

Snowball sampling was used to reach NI specialists in academia and practice. Nurse and allied health professionals with experience in NI were eligible to participate. The IMIA NI SEP group distributed the survey through their networks. Data were collected anonymously. The study followed ethical standards and the Declaration of Helsinki. The ethics committee of the University of Turku in Finland approved this study (38/2015).

The open-ended questions (Q1, Q2, Q4) were analysed with thematic content analysis [36]. Each of the analyses were done by two individuals and validated by a third individual (LMP, RN, AL, HD, ELP, MT) to increase the trustworthiness of the results. The mean and standard deviation is reported for Q3. Associations between respondents' characteristics and responses to Q3 were explored with ANOVA. Pairwise comparisons were done with Tukey's test when the global effects were significant at level 0.05. Bonferroni was used for multiple comparisons. Adjusted means and standard errors are reported for these. Quantitative data were analysed with SPSS version 24 for Windows (IBM Corp.,156 Armonk, N.Y., USA).

Results

Respondents characteristics

A total of 507 respondents from 46 countries responded to the survey. The respondents' countries of origin were grouped according to World Health Organization (WHO) regions. Respondents were from the African Region (1 %, n = 3), the Region of the Americas (45 %, n = 213), the South-East Asia Region (1 %, n = 6), the European Region (13 %, n = 61), the Eastern Mediterranean Region (4 %, n = 17), and the Western Pacific Region (37 %, n = 174). A further 7 % (n = 33) did not state their

country of origin. In total, 90 % (n = 456) of the respondents had a nursing background and 10 % (n = 51) reported their background as other, such as public health, nursing teacher and health informatics. Most respondents had a master's degree 42 % (n = 212); however, 29 % (n = 149) had a bachelor's degree and 24 % (n = 122) had a PhD. The remaining 5 % (n = 24) reported their educational degree as other, such as post graduate certificate, associate degree and licentiate. Those with clinical position reported having staff member positions (28 %, n = 140), middle management positions (27 %, n = 135), and upper management positions (12 %, n = 59). In addition, 16 % (n = 79) reported another clinical position such as being a consultant, an information system nurse, and a clinical nurse specialist. Those with academic positions reported being students (16 %, n = 79), teachers (16 %, n = 82), professors (21 %, n = 104), and other (11 %, n = 55) such as a researcher, adjunct faculty or a project coordinator. One-third (34 %, n = 173) reported having a formal degree in NI while two-thirds (58 %, n = 294) did not. The remaining 7 % (n = 33) reported having some other NI educational background such as having obtained graduate NI courses, currently pursuing NI degree, or having a PhD with a NI topic. The respondents' mean work experience in NI was 10.53 (SD 9.00) years.

Issues reported to further develop NI as an independent discipline

A total of 298 out of the 507 participants responded to Q1. What should be done to further develop NI as an independent discipline? The analysis resulted in five categories. These were the following: 1) Ensure NI competencies meet demands from practice through education; 2) Develop health organisations to better take advantage of NI expertise; 3) Acknowledge NI needs and resources on national level planning; 4) Develop the NI discipline and increase evidence to support practice; and 5) Increase visibility and participation of NI expertise in society (Table 1).

Table 1. Development notions for NI to be an independent discipline.

Condensed meaning unit	Sub category	Category
Increase NI teaching in undergraduate programmes Establish formal programmes in NI Increase graduate NI education Increase post graduate NI education Educate nursing teachers in NI Develop continuous education / vocational training Increase the education of research skills in NI	Ensure NI education on all levels from undergraduate to doctoral level education and in vocational training as well as educate nurse educators in NI.	Ensure NI competencies meet demands from practice through education
Offer specific NI education Increase NI education quality, means and amount National requirements on NI education Establish competency requirements for nurses Establish competency requirements for nurse leaders on all levels Ensure educational content meets practice demands An understanding of clinical nursing needed for NI specialists Take advantage and learn from international NI education Implement NI certification	Standardise NI education nationally, develop NI competence requirements and develop education content, amount, means and quality to better meet with practice demands	
Develop clinical practice from NI perspective Clinical needs-based orientation Increased support for NI from leadership on different levels	Develop supportive clinical NI structures for clinical needs-based functions in health organisations.	Develop health organisations to better take advantage of NI expertise
Increase number of NI specialist roles in health organisations Develop organisation to better take advantage of NI expertise improve service provision. Clarification of NI roles	Develop organisations to better utilise NI expertise through NI roles and organisational structures.	
National coordination, strategies and policies in NI needed Nation-wide projects NI related legislation Development of NI roles	Development of NI on national level	Acknowledge NI needs and resources on national level planning
More funding for research Funding for education and scholarships Increase in resources	Increase resources for to enable research and education	
Clarification and development of NI as a field Ongoing discussion of NI as an independent discipline or as part of something bigger	Develop NI as discipline	Develop the NI discipline and increase evidence to support practice
Increase faculty in NI Increase number of doctorates in NI	Increase number of NI academics	
Increase amount and quality of research Show the value of NI	More high-quality research to demonstrate the value of NI	
NI in evidence-based practice Increase the dissemination of knowledge	Improve transfer of evidence into practice	
Increase the input of national and international associations Increase the NI Influence in the community Engage staff nurses to be active participants in developing NI Increase the appeal for nurses to apply to NI studies Increase the amount and width of collaboration	Nurses as active participants to guide development in the community	Increase visibility and participation of NI expertise in society
Work towards formal recognition of NI Increase awareness of NI in general Increase awareness of NI to key stakeholders Increase awareness of NI to nurses	Increase recognition and awareness of NI to the multiprofessional community and in society	

Reported national policies, standards and strategy papers in NI

A total of 167 (33 %) out of the 507 participants responded to the Q2. What national policies, standards or strategy papers regarding NI exist in your country or your institution? Out of these 167 respondents who responded to Q2, 28 respondents reported that there was none, or that they were not aware of any policies or strategies regarding NI on national or organisational levels. Responses of the 139 (27 %) respondents who reported being aware of strategies, standards and policies regarding NI were grouped into four categories: 1) National strategies and legislation; 2) Institutional strategies; 3) Recommendations and standards; and 4) Competency requirements and certifications. The results of the analysis are presented in Table 2.

Perceived supportive environment for NI as a discipline

A total of 477 out of the 507 respondents answered Q3. Do you feel that your environment is supportive of NI as a discipline? Respondents experienced only mediocre support towards NI from their environment (M 5.79, SD 2.60). As shown in Table 3, we found no association between educational level ($p > 0.05$) or years of experience in NI ($p > 0.05$) and how respondents perceived their environment supported NI. However, a difference was seen between WHO regions ($p < 0.05$) and those respondents with formal NI degree when compared to those without ($p < 0.05$). Even after Bonferroni adjustments, the Turkey's pairwise test did not show statistically significant differences between the groups of responses with different NI degree background and groups of responses from different WHO regions.

Respondents' further comments and advice for NI students

A total of 202 out of the 507 respondents added comments to the Q4. Any further comments or advice for current students in NI? The analysis resulted in three categories: 1) What NI is about?; 2) Being a NI specialist; and 3) Visibility and collaboration to increase the impact of NI. The results are presented in Table 4.

Table 2. Reported national policies, standards and strategy papers in NI.

Condensed meaning unit	Category
National eHealth / telehealth strategies	National strategies and legislation
National health informatics strategies	
National bodies involved in NI	
National strategies that influence informatics	
Nursing specific national strategies	
Legislation to guide informatics	
Educational institution strategies	Institutional strategies
Health care organisational strategies	
Recommendations and guides for practice	Recommendations and standards
Associations involved in NI	
Standards	
Standardisation of competencies	Competency requirements and certifications
Competency requirement initiatives	
Certification	

Table 3. Associations between respondents' characteristics and perceived supportive environment for NI as a discipline.

Characteristic	Adjusted mean*	SE	*p*
WHO region			< 0.05**
African Region	6.31	1.51	
Region of the Americas	5.68	0.27	
South-East Asia Region	3.35	1.06	
European Region	5.28	0.40	
Eastern Mediterranean Region	3.88	0.74	
Western Pacific Region	5.97	0.33	
Educational level			> 0.05
Bachelor	5.37	0.43	
Master	5.09	0.40	
PhD	5.61	0.42	
Other	4.24	0.69	
NI experience			> 0.05
0-5 years	4.73	0.41	
6-10 years	4.88	0.44	
11-15 years	5.18	0.47	
16-20 years	4.86	0.51	
20-25 years	6.15	0.65	
>26 years	4.67	0.62	
Formal NI degree			< 0.05**
Yes	4.87	0.42	
No	5.67	0.38	
Other	4.70	0.55	

* Adjusted for all variables in the model.
** significant level at $p < 0.05$.
SE = standard error

Table 4. Advice for students in NI.

Condensed meaning unit	Sub category	Category
Apply knowledge and change practice Develop simple and functioning tools Use technology to supports nursing	Application of knowledge and utilisation of technology to support nursing in practice	What NI is about?
Research & development is needed to improve work and patient outcomes Take advantage of previous research	Building on existing knowledge and develop practice to improve care	
Clinical needs are the start point for NI Acknowledge the influence of the environment on NI Involve professionals	Technology supports care when the user and environment is acknowl-edged	
Develop and ensure competencies Value clinical experience Clinical understanding is needed Develop NI education Increase NI education Look for other fields in education as well Master NI NI education needed on undergraduate and graduate level More NI specialists are needed	Building competent NI workforce	Being a NI specialist
Nursing is the start point for NI Endurance in career is needed Seek clearly defined NI roles An open mind is a driver of NI	Elements of a NI specialist career	
Collaboration is important Internationalisation supports NI A transdisciplinary science	International and transdisciplinary collaboration in NI	Visibility and collabo-ration to increase the impact of NI
Active participation necessary Increased activity of NI associations is needed Dissemination of knowledge Engage in NI Promote the discipline Increase the recognition of NI	Engagement to increase NI impact	

Discussion

In this article, we explored responses to four questions of an international survey of NI professionals. These questions relate to: what should be done to further develop NI as an independent discipline; existing policies and standards influencing NI; perceived supportive environment for NI as a discipline; and advice and commentary from NI specialists to students. The overall results showed that NI education needs development to better meet practice demands, NI expertise is currently not used to its full potential in health organisations and the community, NI needs to show its value through high-quality research, and NI needs to increase its visibility to be recognised among stakeholders worldwide.

Based on our findings, there seems to be a clear need to increase postgraduate programmes in NI worldwide. This aligns with previous research [37]. Currently, postgraduate programmes in NI are most commonly found in North America; however, in other parts of the world many programs at the postgraduate level focus on health informatics with rare opportunities to study NI

[38]. International initiatives may be used to increase awareness of NI potentials and foster formal and hands-on education to meet current practice needs.

The survey responses suggest that current resources directed to NI are insufficient. National policies are needed to guide resource distribution to better support NI in practice. More researchers on NI topics are needed to show the impact of NI and guide practice. Increasing the number of PhD prepared nurses in NI aligns well with recommendations to double nurses with doctoral degrees by 2020 [39]. More resources dedicated to NI would benefit the work of the largest professional group in the health care setting.

Our results support the need to further clarify NI and determine if NI stands as a separate discipline or merits inclusion in a broader transdisciplinary field, such as biomedical informatics or health informatics. NI initiatives should focus on the needs of clinical practice. Concurrently, nursing theory in general needs to be further developed and a more focused approach to NI should be articulated. Prior research has indicated a need for more middle range theories in NI [40], however there are theories that may be transferred and used according to different NI perspectives and application. Furthermore, a research agenda for NI has identified the need for more transdisciplinary research [40] and collaboration [10,29]. More focused efforts could be directed to emphasize NI needs and strengthen global initiatives once NI is more clearly defined.

NI is not utilised to its full potential due to a lack of visibility and recognition from the healthcare community, professionals, and other stakeholders. The challenge of increasing visibility and recognition is reduced by distinguishing NI's contributions to health care with high-quality research. The health care setting is rapidly evolving due to an increasing amount of research and innovative technological developments. Grasping the full potential of NI is key for nurses, educators, and leaders to understand to support the future of NI practice [29,41]. Strong nursing leadership can impact policy making and ensure that nurses gain sufficient informatics skills [42]. The lack of recognition regarding the potential impact of NI on health care and patient outcomes has been a challenge for the last decades [29], and this issue continues to grow according to our survey.

A new perspective brought by this study is the scarce number of strategies and guidelines known to survey respondents, as only 27 % (139 of all 507 survey participants) reported being aware of any national policies, standards and strategy papers in NI. The low number of responses to this question (33 %) also brings to question whether the challenge relates to respondents' lack of awareness, visibility, or recognition of strategies and guidelines, or whether the issue is that strategies or guidelines have not been developed or implemented. Many of the reported policies and initiatives surrounding NI were from North America, and only sparse NI specific national regulation existed. In addition, few international recommendations on NI competencies, certification, role definitions, job titles and descriptions, organisation, ethical aspects or research seem to exist apart from a few initiatives such as the TIGER [43]. International guidance on these topics would standardise the field and support environments where NI is now emerging as well as those environments where it is more established to learn from each other and support the development of NI. Based on the survey findings, it may be that organisations could develop their own NI strategies to better support service provision and improve patient outcomes until national policies are developed to guide practice.

In general, findings show that respondents perceived mediocre environmental support for NI as a discipline. The perception of environmental support for NI sends a significant message regarding the value of NI in organisations and gives insight into the future development and resourcing of NI. An important step towards building a more supportive environment for NI is shifting how it is viewed by decision-makers and stakeholders. Specifically, it is important to increase the visibility and understanding of NI, the recognition of the impact of NI on organisational processes and patient outcomes as well as demonstrate the value of NI.

Another new angle brought by this study is the perspective of career stage. Acknowledging challenges faced by

emerging professionals is important to increase high engagement in organisational goals and lower the intention to leave the organisation and the profession [44]. The respondents' advice to NI students raised the question of what NI is about, what is needed to be a NI specialist and what is needed to increase the impact of NI. Overlap between findings related to the question regarding what should be done to further develop NI as an independent discipline was seen, but also new issues emerged, such as unstandardised education, roles and job descriptions, and the need to show the importance of NI and change practice.

The following recommendations are based on the survey findings:

- A comprehensive review of what NI is and how it is related to biomedical, medical and health informatics can clarify discussions related to NI education, practice and research.

- International guidelines on NI education, competencies, certification, role definitions, job titles and descriptions, organisation and ethical aspects would support the development of NI.

- Active international and national NI actors are more visible and influential to ensure resources for NI education, practice and research and the better use of NI expertise in health organisations and the community.

- International initiatives in the development of NI education on postgraduate levels supports curricula to better meet practice demands across settings.

- Acknowledging different career stages in NI has the potential to increase engagement of the specialists in desired goals.

- Steering resources towards high-quality NI research will contribute to showing the impact of NI in the health care setting and beyond and can contribute to an increase in support towards NI.

The findings in this study are unique as they build on responses from academics and clinicians from a variety of settings in 46 countries, although limited by the small representation of participants from the African, the South-East Asian and the Eastern Mediterranean WHO regions. The non-random sampling is another limitation, as snowball sampling was used, we may not have been able to include professionals outside our network.

Conflict of interest statement

Authors state no conflict of interest.

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