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Use of electronic health records and standardized terminologies: A nationwide survey of nursing staff experiences

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A b s t r a c t

Background: Nursing documentation could improve the quality of nursing care by being an important source of information about patients' needs and nursing interventions. Standardized terminologies (e.g. NANDA International and the Omaha System) are expected to enhance the accuracy of nursing documen- tation. However, it remains unclear whether nursing staffactually feel supported in providing nursing care by the use of electronic health records that include standardized terminologies.

Objectives: a. To explore which standardized terminologies are being used by nursing staffin electronic health records. b. To explore to what extent they feel supported by the use of electronic health records. c. To examine whether the extent to which nursing stafffeel supported is associated with the standardized terminologies that they use in electronic health records.

Design: Cross-sectional survey design. Setting and participants: A representative sample of 667 Dutch registered nurses and certified nursing assistants working with electronic health records. The respondents were working in hospitals, mental health care, home care or nursing homes.

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Methods: A web-based questionnaire was used. Descriptive statistics were performed to explore which standardized terminologies were used by nursing staff, and to explore the extent to which nursing stafffelt supported by the use of electronic health records. Multiple linear regression analyses examined the association between the extent of the perceived support provided by electronic health records and the use of specific standardized terminologies.
Results: Only half of the respondents used standardized terminologies in their electronic health records. In general, nursing stafffelt most supported by the use of electronic health records in their nursing ac- tivities during the provision of care. Nursing staffwere often not positive about whether the nursing information in the electronic health records was complete, relevant and accurate, and whether the elec- tronic health records were user-friendly. No association was found between the extent to which nursing stafffelt supported by the electronic health records and the use of specific standardized terminologies.
Conclusions: More user-friendly designs for electronic health records should be developed. The poor user- friendliness of electronic health records and the variety of ways in which software developers have inte- grated standardized terminologies might explain why these terminologies had less of an impact on the extent to which nursing stafffelt supported by the use of electronic health records.

What is already known about the topic?

- Nursing documentation could help improve the quality of nursing care by being an important source of information about patients' needs and nursing interventions.
- Standardized terminologies are expected to be helpful in achieving more accurate nursing documentation.
- In the last few years, various software developers have in- tegrated standardized terminologies in the electronic health records, using different methods.

What this paper adds

- Nursing staff feel only moderately supported by the use of electronic health records.
- Nursing staff are often not positive about whether the nursing information in the electronic health records was complete, relevant and accurate, and whether the electronic health records were user-friendly.
- This study demonstrates that the extent to which nursing staff felt supported by the use of electronic health records was not associated with the use of a standardized terminology.

1. Introduction

Accurate nursing documentation is not only important for communication between nursing staff, but also has the potential to improve nursing care and patient outcomes by being an important source of information about patients' needs and nursing interventions (Jefferies et al., 2010; Urquhart et al., 2009; Wang et al., 2011). Various definitions of nursing documentation exist in the professional and research literature. Taking inspiration from Blair and Smith (2012) and Jefferies et al. (2010), we define nursing documentation as the process of documenting nursing information about nursing care in health records. Nursing documentation in health records is internationally understood to reflect the phases of the nursing process (Blair and Smith, 2012; De Groot et al., 2019; Flemming and Hübner, 2013; Paans et al., 2011; Wang et al., 2011). Also in the Netherlands it is a standard practice to document nurses' assessment information, as well as nursing diagnoses, and planning, implementation and evaluation of nursing interventions (VandVN and NU'91, 2011).

Nursing documentation helps nursing staff to continuously reflect on the impact of interventions on their patients, and is therefore vital for the quality and continuity of care (Björvell et al., 2003 ; Needleman and Buerhaus, 2003 ; Paans et al., 2011). Standardized terminologies are expected to be helpful in achieving more accurate nursing documentation (De Groot et al., 2019; Müller-Staub et al., 2007; Tastan et al., 2014; Törnvall and Jansson, 2017). Standardized terminologies can guide nursing staff through the phases of the nursing process, and can improve the accurate formulation of patients' care needs and the planning of concrete interventions (The Office of the National Coordinator for Health Information Technology, 2017; Wang et al., 2011). Furthermore, the use of standardized terminologies could improve communication among nursing staff themselves and communication with other healthcare professionals, because recognizable words and distinguishable terms are used (Rutherford, 2008; Thede and Schwirian, 2011). Another benefit of standardized terminologies is that these terminologies provide a certain structure in electronic health records that could facilitate the reuse of documented data, for instance as information sources for scientific research or for quality assurance (Monsen et al., 2010). Besides, standardized terminologies could facilitate the comparison within and between care organizations of the effect of nursing interventions on patient outcomes (Rutherford, 2008; The Office of the National Coordinator for Health Information Technology, 2017).

Thus standardized terminologies have potential advantages, but they do not automatically lead to one common nursing language. Nowadays, nursing staff use various standardized terminologies. The frequency of use of standardized terminologies can be influenced by several factors, including governmental policies. For example, the Dutch government decided in 2015 that it would be mandatory by 2017 for home care providers to implement standardized terminologies in their health records (Ministry of Health Welfare and Sports, 2015). This obligation only applies to the home care setting; nursing staff working in the other Dutch healthcare settings are not obligated to use standardized terminologies in their nursing documentation (Ministry of Health Welfare and Sports, 2015). Nursing staff use standardized terminologies in particular in electronic health records. Various software developers have incorporated standardized terminologies in the electronic health records. According to an international expert panel, clear linkages between the phases of the nursing process are mostly lacking in the current electronic health records (Müller-Staub et al., 2016). This results in differences even between electronic health records using the same standardized terminology. Moreover, these experts estimate that the frequency of use of standardized terminologies would increase if improvements were to be made to the user interfaces of the electronic health records (Müller-Staub et al., 2016).

Standardized terminologies that include a theoretical framework or concept specific to nursing care are often referred to as standardized nursing terminologies or classification systems. The American Nursing Association (ANA) has recognized twelve standardized nursing terminologies, see Table 1 (The Office of the National Coordinator for Health Information Technology, 2017). Although the ANA is based in the USA, it is also referred to across Europe and can be seen as a worldwide reference. Within the twelve standardized nursing terminologies, the ANA distinguishes between interface terminologies, reference terminologies and minimum data sets. Interface terminologies include actual words and terms used by nursing staff in their documentation (The Office of the National Coordinator for Health Information Technology, 2017). Reference terminologies can facilitate the electronic exchange of information from various electronic health records (The Office of the National Coordinator for Health Information Technology, 2017). Even though the reference terminologies are not based on concepts specific to nursing care, they are still recognized as standardized nursing terminologies. Minimum data sets are sets of data elements intended for the collection of essential nursing care data (Westra et al., 2008). The theoretical frameworks of these twelve standardized nursing terminologies differ. For instance, the Omaha System contains components for all steps of the nursing process, whereas NANDA-I is used only for the first steps of the nursing process (Topaz et al., 2014; Warren and Hoskins, 1990).

In addition to the twelve standardized nursing terminologies, nursing staff also use standardized terminologies which are not recognized by the ANA, see Table 1. These terminologies are not recognized by the ANA because either they are not based on a theoretical framework or they are not specific to nursing care.

In spite of the available research on the benefits of standardized terminologies (e.g. Törnvall and Jansson, 2017), there have been fewer studies of how nursing staff experience the use of electronic health records that include standardized terminologies and their perceptions of the accuracy of nursing documentation in such electronic health records (Park and Cho, 2009). Therefore, it remains unclear whether nursing staff actually feel supported in providing good-quality nursing care by the different aspects of the electronic health records. For instance, it is unknown whether the nursing information within electronic health records is sufficient for nursing staff to evaluate their interventions and to contribute to care decision-making. Given the wide diversity in standardized terminologies it can also be questioned whether the support that nursing staff feel they get from electronic health records is associated with the standardized terminologies used in these records. However, to our knowledge no research is available that compares the experiences of nursing staff with electronic health records that include different standardized terminologies. For this reasons, this study explored the experiences of Dutch nursing staff working with different electronic health records that include standardized terminologies. The following research questions were addressed:

1. Which standardized terminologies do nursing staff use in the electronic health records?
2. To what extent do nursing staff feel supported in their documentation by the use of electronic health records, and in which aspects?
3. Is there an association between the extent to which nursing staff feel supported by the use of electronic health records and the specific standardized terminologies that they use in these records?

[Table 1]

2. Method

2.1. Design

A cross-sectional survey design was used.

2.2. Setting and participants

An online survey was conducted with data collection in December 2016 and January 2017 among nursing staff who were members of a pre-existing research panel known as the Nursing Staff Panel. The Nursing Staff Panel is a nationwide, representative group of nursing staff who deliver direct nursing care to patients in various healthcare settings. Certified nursing assistants as well as registered nurses participate in the Nursing Staff Panel.

In the Netherlands, certified nursing assistants receive three years of vocational education and training. Dutch registered nurses are educated to two different levels, namely to the secondary vocational level (a nursing qualification after completing senior secondary vocational education) and to the bachelor's level (a degree in nursing after education at a university of applied sciences).

Members of the Nursing Staff Panel are recruited through a random sample of Dutch healthcare employees, provided by two pension funds. Together, these pension funds register all employees in the Dutch healthcare sector. The employees in the random sample were asked to participate in healthcare research for various purposes. Nursing staff who agreed to this request and who de- liver direct nursing care to patients were asked to join the Nursing Staff Panel. This recruitment method

ensures the representativeness of the panel for the general population of Dutch nursing staff in terms of age, gender, region and healthcare settings (Maurits et al., 2015).

2.3. Data sources

A web-based questionnaire was used. The questionnaire was sent by email to 1609 panel members (all registered nurses or certified nursing assistants) who worked in one of the main health-care settings, i.e. hospitals, mental health care, home care and nursing homes. To increase the response rate, electronic reminders were sent after one week and after three weeks to nursing staff who had not yet responded.

2.3.1. Questionnaire

In the questionnaire it was explained that questions were focused on the process of documenting nursing information about nursing care in health records. Moreover, we explained that nursing documentation is related to the nursing process, and we explained the phases of the nursing process. Documentation by and relating to other professionals or lab results was not covered by the questionnaire. Besides questions relevant to this paper, the questionnaire also included questions related to other aspects of nursing documentation (e.g. patients' involvement in nursing documentation). In total, the questionnaire contained 35 self- developed questions, of which seven questions were relevant for this paper. Most questions had pre-structured response options. After establishing a first draft, the questionnaire was tested for comprehensibility and completeness by nine registered nurses and three certified nursing assistants. Based on their comments, the questionnaire was modified where necessary to produce the final version. The part of the questionnaire with questions rele- vant for this paper can be found at: https://nivel.nl/nl/pdf/nursing- documentation- questionnaire.pdf.

2.3.2. Variables

Data were collected on the following characteristics of nursing staff: age (continuous), gender (male or female), level of education (certified nursing assistant, registered nurse at secondary vocational level or registered nurse with bachelor's degree) and healthcare setting (hospital, mental health care, home care or nursing home).

We asked for the standardized terminologies that nursing staffused in their electronic health records. The fixed response op- tions were the Omaha System, Gordon, ICF, RAI, the combination of NANDA-I, NIC and NOC, and a Dutch terminology called 'Four Domains'. Besides these predefined options, respondents could also fill in their own answer.

The extent to which nursing staff felt supported by different aspects of the electronic health records was measured by their agreement with a set of eight statements on a five-point scale (1 = completely disagree to 5 = completely agree). The statements were based on relevant international and Dutch literature about nursing documentation (e.g. research on aligning documentation with the nursing process (Blair and Smith, 2012 ; Flemming and Hübner, 2013 ; Paans et al., 2011 ; Wang et al., 2011), and research on handovers (De Blok et al., 2012) and consultation with six experts on nursing documentation and/or nursing care. The internal consistency of the eight statements was high (Cronbach's alpha 0.92), indicating that these statements reflected one concept, namely the extent to which nursing staff felt supported by the use of electronic health records. A mean score over the eight statements was calculated, ranging from 1 (completely disagree) to 5 (completely agree), whereby higher scores indicated that nursing staff felt more supported bythe use of electronic health records.

2.4. Statistical methods

Descriptive statistics were performed to describe the characteristics of the respondents and to answer the first and second research questions. Furthermore, the potential relationships between the use of standardized terminologies and the respondent's healthcare setting were examined using Pearson's chi-square test. A one-way ANOVA test was also used to examine the potential differences between the respondents' healthcare settings in the extent to which respondents felt supported by the use of electronic health records.

To answer the third research question, first a multiple linear regression analysis was conducted in which the experienced support provided by electronic health records was the dependent variable, and the use of a standardized terminology (0 = no, 1 = yes) and the socio-demographic characteristics (gender, age, educational level, healthcare setting) were the independent variables. Next, a multiple linear regression analysis was conducted to determine whether there was a difference between different standardized terminologies. In this analysis, we included the experienced support provided by electronic health records as the dependent variable, and the specific standardized terminologies and socio-demographic characteristics as independent variables. The level for determining statistical significance was 0.05. All analyses were conducted using STATA, version 15.0.

[Table 2]

2.5. Ethical considerations

The study was conducted in accordance with the Dutch Personal Data Protection Act, by strictly safeguarding the anonymity of the participants (Sauerwein and Linnemann, 2001). All participants were competent individuals, were not subjected to procedures and were not required to follow rules of behavior. For these reasons, further ethical approval of this study was not required under the applicable Dutch legislation.

3. Results

3.1. Participants

A total of 745 nursing staff working in one of the main health- care settings completed the questionnaire (response 46.3%). This study focussed on the use of various standardized terminologies in electronic health records. Therefore, we excluded from the analysis nursing staff working exclusively with paper-based health records (n = 78), leaving 667 respondents who worked with electronic health records.

As seen in Table 2, the mean age of these respondents was 49 years. This mean age was higher than the mean age of employees working in hospitals, mental health care, home care or nursing homes in the Netherlands, which varied per sector from 41 to 45 years (AZW, 2017). In our sample 88.8% was female, which is similar to the Dutch nursing staff population (AZW, 2017).

In our study, the three groups of nursing staff with different educational levels were approximately equal in size. The largest group in the sample in terms of the healthcare setting was the group of respondents working in home care (45.7%). This means there was an overrepresentation of home care nursing staff, since only 13.5% of the overall Dutch nursing staff population work in the home care setting (AZW, 2017). Nursing staff working in nursing homes are underrepresented in our study, with a share of 18.4% compared to 46.3% in the overall population.

Given that the content and structure of electronic health records might vary across the four healthcare settings, we present further findings for each of the healthcare settings separately.

[Table 3]

3.2. Standardized terminologies

Only half of the respondents (56.4%) used a standardized terminology in the electronic health records. The most frequently used terminologies were the Omaha System (31.5%) and Gordon (15.1%), see Table 3. The Omaha System was mostly used by respondents working in home care, and Gordon mostly within hospitals and mental health care. In addition, nursing staff also used ICF, RAI, and the combination of NANDA-I, NIC and NOC. Respondents did not mention other standardized terminologies that are recognized by the ANA. How often a specific kind of standardized terminology was used was associated with the healthcare setting in which respondents were working; see Table 3. Other respondents did not recognize the use of a standardized terminology. They either answered that they did not know whether they used a standardized terminology (18.4%), or they answered that they used a structure in the electronic health records that was not a standardized terminology (12.0%). It is notable that most respondents in nursing homes answered that they did not know if they used standardized terminologies. Furthermore, one group of nursing staff (13.2%) gave open-ended answers that pointed to the name or software developer of the electronic health records. Some of these electronic health records might also include standardized terminologies. However, it was not possible to work out which specific standardized terminology was used from the answers given by this group of respondents.

3.3. Experienced support from electronic health records

The extent to which nursing staff felt supported in their documentation by the use of electronic health records varied across healthcare settings. Mental health care nurses felt significantly less supported compared to home care nursing staff (mean score 3.54, SD 0.61 vs mean score 3.87, SD 0.65; $p < 0.00$). Nursing staff working in hospitals and nursing homes felt moderately supported, with a mean score of 3.73 (SD 0.58) for hospitals and 3.73 (SD 0.61) for nursing homes. The scores of respondents working in hospitals or nursing homes did not differ significantly from those of nursing staff working in the other two healthcare settings.

Overall nursing staff gave the most positive scores for the statement that the information from the health records supported their activities during the provision of care (mean 3.98). Respondents gave the lowest scores for the statement that the information in the health records was complete, relevant and accurate (mean 3.47), and the statement about the user-friendliness of the health records (mean 3.63), see Table 4.

3.4. Association between perceived support and use of standardized terminologies

To estimate differences in the perceived support from electronic health records between nursing staff who did use a standardized terminology and nursing staff who did not, respondents were divided into two groups. First, all respondents who used one of the standardized terminologies were merged to form one group ($n = 376$, 64.9%). Next, respondents who did not recognize the use of a standardized terminology ($n = 123$) and respondents who did not use a standardized terminology ($n = 80$) were merged, resulting in a group of 203 respondents (35.1%). The use of standardized terminologies was unclear when respondents only mentioned the name or software developer of the electronic health records, so these respondents ($n = 88$) were excluded from this analysis.

The first multiple linear regression analysis showed no significant differences in the perceived support provided by electronic health records between respondents who did use a standardized terminology and respondents who did not ($p = 0.48$). Also gender, age and educational level had no significant effect on the support that respondents experienced. However, we did find that nursing staff working in home care felt significantly more supported by their electronic health records than nursing staff working in hospitals (mean 3.87 (SD 0.65) vs mean 3.73 (SD 0.59); $p < 0.05$).

To examine whether there was an association between the extent to which nursing staff felt supported by the use of electronic health records and the use of specific standardized terminologies,

a second multiple linear regression analysis was conducted. Respondents using ICF and RAI were excluded due to their small numbers, resulting in a further analysis of the data of 574 respondents.

No statistically significant differences were found in the ex- tent to which nursing staff felt supported by the use of electronic health records, see Table 5. Only weak differences were found at the 10% significance level. Nursing staff using the Omaha System tended to feel somewhat more supported by the electronic health records than nursing staff using Gordon (p = 0.067) and nursing staff not using a standardized terminology (p = 0.074). The variables 'healthcare setting' and 'level of education' were not associated with the extent to which nursing staff felt supported by the use of electronic health records. The explained variance was low as well, namely 2.5%.

4. Discussion

This study sought to gain insight into the frequency of use of standardized terminologies in the electronic health records, the extent to which nursing staff feel supported by the use of electronic health records, and whether this perceived support is associated with the use of specific standardized terminologies.

[Table 4] [Table 5]

The first main finding from this study was that only half of nursing staff (56%) were actually using a standardized terminology in their electronic health records. The most frequently used terminologies were the Omaha System and Gordon. These findings differ from other research, which showed that nurses in the USA were most familiar with NANDA-I (Thede and Schwirian, 2011). However, it should be noted that most nurses in the USA reported using NANDA-I during nursing school, but not since.

The use of a specific kind of standardized terminology was related to the healthcare setting in which nursing staff were working. This association is understandable given the variation in nursing care itself between healthcare settings. Furthermore, governmental policies may also influence the frequency of use of standardized terminologies within specific healthcare settings. For instance, the relatively high frequency of the use of a standardized terminology (mostly Omaha System) in the home care setting might partly be explained by the obligation imposed by the Dutch government specifically on home care providers to implement a standardized terminology in their health records (Ministry of Health Welfare and Sports, 2015).

Besides, in our study there was a large group of nursing staff (30%) who did not recognize the use of standardized terminologies. This finding is in line with results from a survey in the USA, in which a large proportion of respondents also had no knowledge of or experience with standardized terminologies (Thede and Schwirian, 2011). Literature research also showed gaps in both the knowledge of standardized terminologies and their use (Park and Cho, 2009).

A second main finding of this study was that nursing staff felt moderately supported by the use of electronic health records. They experienced most support from the use of electronic health records in their nursing activities during the provision of care. However, our study also showed points for concern.

First, nursing staff were often not positive about the user-friendliness of the electronic health records. This finding is in line with other research, which indicated that the poor user-friendliness of electronic health records seemed to be a prominent source of time pressure and psychological distress among registered nurses (Vehko et al., 2019). Likewise, other studies reported that nursing staff commented that the electronic health records were too long, lacked links between the different phases of the nursing process and increased their workload (De Groot et al., 2017; Drummond and Simpson, 2017; Müller-Staub et al., 2016). The current structure of the electronic health records may not always match the routines of nurses in their daily practice (Wisner et al., 2019). A review of

systematic reviews also showed that user-friendly health records are an important precondition for high-quality electronic nursing documentation (De Groot et al., 2019). Therefore, user-friendly electronic health records are much needed in healthcare. To improve this user-friendliness, nursing staff should be more involved in the further development of electronic health records (De Groot et al., 2019; Urquhart et al., 2009).

Second, nursing staff were least positive about the complete- ness, relevance and accuracy of the nursing information in the electronic health records. This is a notable finding. Evidence for the effect of using standardized terminologies on the quality of nursing documentation is limited to date, but several recent studies do show a positive association between the accuracy of documentation and the use of standardized terminologies (Adubi et al., 2017 ; Aling et al., 2018 ; Gencbas et al., 2018 ; Goncalves et al., 2019 ; Kerr et al., 2019). Even though using standardized terminologies is just one criteria for accurate nursing documentation, it can be assumed as an important criteria (De Groot et al., 2019; Tastan et al., 2014; Törnvall and Jansson, 2017). In consequence, the misuse of a standardized terminology could result in inaccurate nursing documentation. Research did show that nursing staff need to understand a standardized terminology for it to be used correctly (Park and Cho, 2009). For instance, nursing staff should know how to apply standardized terminologies within the nursing process and how to fit the standardized words and terms to a specific patient situation. Our study showed a large group of nursing staff who did not recognize the use of standardized terminologies. Given that nursing care is mostly performed by teams, if one person within a team is using the standardized terminology incorrectly, this could result in the experience for other team members that nursing information in electronic health records is incomplete, irrelevant and inaccurate.

The third main finding from our study was that there was no association between the extent to which nursing staff felt supported by the use of electronic health records and the use of specific standardized terminologies. This is a remarkable finding since standardized terminologies are expected to help nursing staff achieve accurate documentation (De Groot et al., 2019; Tastan et al., 2014; Törnvall and Jansson, 2017). However, it should be noted that the explained variance in the regression model was low, namely 2.5%. This low percentage suggests that factors other than the variables included in our study explain the extent to which nursing staff feel supported by the use of electronic health records.

A factor that could be related to the perceived support from electronic health records is that nursing staff in the Netherlands are currently in a transition from paper-based records to electronic health records (Wouters et al., 2018). Therefore, nursing staff are still adjusting their own routines so that they can work with electronic health records. For instance, a previous survey among Dutch nursing staff indicated some negative attitudes among nursing staff to working with electronic health records (De Veer and Francke, 2010).

Another factor that could be associated with the extent to which nursing staff felt supported by the use of electronic health records is the variety in health records that have been developed by software developers. For instance, the health records lack links between the different phases of the nursing process (Müller-Staub et al., 2016). In addition, research showed that nursing diagnoses are not documented in a standardized manner in the present Dutch electronic health records (Paans et al., 2016). This suggests that current generation of electronic health records might not provide a structure that meets the expectations and needs of nursing staff (Wisner et al., 2019).

What is more, in our study some respondents answered with the name of an electronic health record or software developer in- stead of the standardized terminology they used. These answers suggest that nursing staff find it difficult to distinguish between standardized terminologies (e.g. words and terms) and applications from software developers.

Furthermore, it should be noted that the standardized terminologies used by nursing staff within our study were difficult to compare with one another, given that their theoretical frameworks differ. For instance, Gordon is used only for the first step of the nursing process, namely the assessment of

patients' needs. In contrast, the Omaha System and the combination of NANDA-I, NIC and NOC contain components for all steps of the nursing process. This difference in theoretical frameworks could be a possible ex- planation for the slightly greater support that nursing staff using the Omaha System experienced from the use of electronic health records compared with nursing staff using Gordon.

4.1. Limitations and strengths

Some limitations to this study need to be acknowledged. First, a non-validated questionnaire was used since no validated questionnaire exists for the support nursing staff experience from the use of electronic health records. However, questions were developed based on the relevant literature and in consultation with experts on this topic. Moreover, nursing staff pilot-tested the questionnaire for comprehensibility. For this reason, the questionnaire is expected to have content validity.

Second, the average age of our respondents (49 years) was somewhat higher than the national mean age of Dutch nursing staff working in hospitals, mental health care, home care and nursing homes, which varied from 41 to 45 years (AZW, 2017). Nevertheless, the variable 'age' was included in the multiple linear regression analysis and was found not to be associated with the extent to which nursing staff felt supported by the use of electronic health records.

Third, there was an overrepresentation of home care nursing staff in the sample (45.7%), since only 13.5% of the overall Dutch nursing staff population work in the home care setting (AZW, 2017). This overrepresentation might be explained by the present composition of the Nursing Staff Panel, in which home care nursing staff are also slightly overrepresented. However, we presented the findings for each of the sub-samples working in different healthcare settings separately. Moreover, in the multiple linear regression analysis the variable 'healthcare setting' was included, but was found not to be associated with the extent to which nursing staff felt supported by the use of electronic health records.

Notwithstanding these limitations, our research adds some interesting knowledge to an area of research and nursing practice that is relatively new and unfamiliar. A strength of this study is that it was the first study to compare the experiences of nursing staff who were all working directly with patients, and who worked in the four main healthcare settings. Another strength is that our study compared the use of various standardized terminologies with each other, instead of focusing on the use of one standardized terminology.

4.2. Conclusion

Only half of Dutch nursing staff used a standardized terminology in electronic health records. That standardized terminology was generally either Gordon's Functional Health Patterns, the combination of NANDA-I, NIC and NOC, or the Omaha System. The specific kind of standardized terminology used by nursing staff was associated with the healthcare setting. In general, nursing staff only felt moderately supported by the use of electronic health records. They experienced most support from the use of electronic health records in their nursing activities during the pro- vision of care. However, nursing staff were often not positive about whether the nursing information in the electronic health records was complete, relevant and accurate, and whether the electronic health records were user-friendly. No association was found be- tween the extent to which nursing staff felt supported by the use of electronic health records and the use of particular standardized terminologies. In the Netherlands, standardized terminologies are integrated in electronic health records by various software developers in various ways, resulting in considerable diversity be- tween electronic health records. Clear linkages between phases of the nursing process are mostly lacking in current electronic health records, according to an international expert panel (Müller-Staub et al., 2016). Therefore, the variety of ways in which software developers have integrated standardized terminologies might

explain why these terminologies had less of an impact on the extent to which nursing staff felt supported by the use of electronic health records.

4.3. Implications for research

Further research is needed into whether nursing documentation in general and the use of standardized terminologies in particular are associated with the perceived quality of care for patients. Furthermore, our study showed that nursing staff were often not positive about the user-friendliness of their electronic health records. Comparable findings have been mentioned in a Finnish survey study, which also showed that poor user-friendliness of electronic health records is a prominent source of time pressure among registered nurses (Vehko et al., 2019). However, in-depth knowledge about the relation between the user-friendliness of electronic health records and the time pressure experienced in relation to nursing documentation is lacking. Further research is recommended on this topic. In addition, our study shows that half of nursing staff used standardized terminologies in the electronic health records. There could be tension between documenting information in standardized terminologies, which include words and terms familiar to nursing staff, and documenting information in a way that is understandable for patients. For instance, it is known that information at hospital discharge is often not comprehensible for patients (Newnham et al., 2017). Patients' involvement in nursing documentation therefore requires further investigation.

4.4. Implications for practice

The results of our study show that nursing staff were often not positive about the user-friendliness of their electronic health records. To increase the extent to which nursing staff feel supported by their electronic health records, user-friendly designs for these health records should be developed. Therefore, nursing staff, nursing associations, healthcare organisations, government and software developers need to work together. For instance, they should work towards electronic health records that include links between the different phases of the nursing process.

CRediT authorship contribution statement

Kim De Groot: Conceptualization, Formal analysis, Investigation, Writing - original draft. **Anke J.E. De Veer**: Conceptualization, Formal analysis, Writing - review & editing. **Wolter Paans**: Conceptualization, Funding acquisition, Investigation, Writing - review & editing. **Anneke L. Francke**: Conceptualization, Funding acquisition, Investigation, Supervision, Writing - review & editing.

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Supplementary material

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Conflict of interest

The authors declare that they have no conflict of interest.

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Tables

Table 1 Standardized terminologies used in electronic health records.

Standardized terminology	Description	Recognized by the ANA
NANDA International (NANDA-I)[a]	A classification of nursing diagnoses, used to form a clinical judgment about the actual or potential reactions of an individual, (family) system or society to health problems or life processes (Warren and Hoskins, 1990).	Yes
Nursing Interventions Classification (NIC)[a]	A classification of nursing interventions, used to formulate any intervention performed by nurses based on their expert judgment and clinical knowledge (McCloskey and Bulechek, 2000).	Yes
Nursing Outcomes Classification (NOC)[a]	A classification of nursing care outcomes, used to assess the situation and monitor the progress of patients, informal caregivers, families or communities (Johnson et al., 2000).	Yes
Omaha System[a]	A standardized healthcare terminology that consists of a patients' needs component, an intervention component, and an evaluation component. This terminology is used by nursing staff and other professionals such as physical therapists (Topaz et al., 2014).	Yes
Clinical Care Classification (CCC) System[a]	A nursing terminology that provides a standard framework for assessing, documenting and evaluating nursing care (Saba, 2012).	Yes
International Classification for Nursing Practice (ICNP)[a]	A nursing terminology that includes nursing diagnoses, nursing-sensitive patient outcomes and nursing interventions (International Council of Nurses, 2001).	Yes
Perioperative Nursing Data Set (PNDS)[a]	A standardized language for documenting perioperative patient care that describes the nursing diagnoses, interventions and patient outcomes (Taulman and Latz, 2011).	Yes
Alternative Billing Concepts (ABC) Codes[a]	Codes that were designed for documentation and measurement of non-physician and alternative medicine health services (The Office of the National Coordinator for Health Information Technology, 2017).	Yes
Nursing Minimum Data Set (NMDS)[b]	A set of items with uniform definitions for nursing care, patient demographics and service elements (The Office of the National Coordinator for Health Information Technology, 2017).	Yes
Nursing Management Minimum Data Set (NMMDS)[b]	A set of items that identify variables relevant to nursing administrators for decision-making about nursing care effectiveness (Gardner-Huber et al., 1992).	Yes
International Classification of Functioning, Disability and Health (ICF)	A classification of the health components of functioning and disability. This terminology is of interdisciplinary origin (World Health Organization, 2001).	No
Gordon's Functional Health Patterns (Gordon)	A method used by nursing staff to provide a comprehensive nursing assessment of the patient (Gordon, 1987)	No
Resident Assessment Instrument (RAI)	An instrument for needs assessment and care screening for nursing-home residents. This terminology is of interdisciplinary origin (Hawes et al., 1997).	No
SNOMED Clinical Terms (SNOMED CT)[c]	A comprehensive, multilingual clinical healthcare terminology that enables exchange of data. This terminology is of interdisciplinary origin (SNOMED International, 2019).	Yes
Logical Observation Identifiers Names and Codes (LOINC)[c]	A comprehensive clinical terminology that includes terms for laboratory tests, clinical measurements and patient observations. This terminology is of interdisciplinary origin (Forrey et al., 1996).	Yes

[a] Interface terminology = actual words and terms used by nursing staff in their documentation.
[b] Minimum data set = a set of data elements with standardized definitions and codes.
[c] Reference terminology = a terminology that can be linked to multiple interface terminologies.

Table 2 Respondents' characteristics.

Characteristics	Total (n = 667)	
Age (mean (standard deviation), [range])	49 (10.6)	[22–67]
Gender (n, %)		
Female	592	88.8
Male	75	11.2
Level of education (n, %)		
Certified nursing assistant	187	28.0
Registered nurse secondary vocational qualification	233	34.9
Registered nurse bachelor's degree	247	37.0
Healthcare setting (n, %)		
Hospitals	156	23.4
Mental health care	83	12.4
Home care	305	45.7
Nursing homes	123	18.4

Table 3 Use of standardized terminologies in electronic health records as reported by nursing staff (n = 667).

Standardized terminologies (in %)	Hospitals (*n* = 156)	Mental health care (*n* = 83)	Home care (*n* = 305)	Nursing homes (*n* = 123)	Total (*n* = 667)
Gordon (%)	39.1	26.5	3.0	7.3	15.1
NANDA-I, NIC and NOC (%)	10.3	10.8	9.8	4.9	9.2
Omaha System (%)	0.6	0	65.3	8.1	31.5
ICF (%)	1.3	0	0	0.8	0.5
RAI (%)	0	1.2	0	0	0.2
I do not know (%)	22.4	21.7	8.5	35.8	18.4
No standardized terminology (%)	17.3	24.1	2.0	22.0	12.0
No standardized terminology mentioned by respondent[a] (%)	9.0	15.7	11.5	21.1	13.2
Total (%)	100	100	100	100	100

[a] = we were not able to determine from the open-ended answers of these respondents whether they used a standardized terminology.

Table 4 Statements about the extent to which nursing stafffelt supported by the use of electronic health records (n = 666, range 1–5).

Statements	Mean	SD	95% CI
The health record that I am working with is user-friendly	3.62	0.95	3.54 to 3.69
The information in the health records gives me sufficient insight into the actual and potential problems/diagnoses/needs of the patient	3.86	0.78	3.80 to 3.92
The information in the health records supports my activities during the provision of care	3.98	0.68	3.93 to 4.04
The information in the health records gives me sufficient information for the evaluation of care	3.87	0.73	3.81 to 3.92
I can easily use the information in the health records to make an adequate handover	3.89	0.73	3.83 to 3.94
The information in the health records is complete, relevant and accurate	3.47	0.84	3.40 to 3.53
The health record that I am working with supports me in adequate documentation of the choices I make during the provision of care	3.73	0.78	3.67 to 3.79
The health record that I am working with supports me in adequate documentation of the nursing process	3.74	0.80	3.68 to 3.80
Mean score (Cronbach's alpha = 0.92)	3.76[a]	0.63	3.72 to 3.82

[a] = mean scores varied across respondents working in different healthcare settings.

Table 5 Regression model to examine the association between perceived support from electronichealth records and use of standardized terminologies (n = 574).

Self-reported experienced support (range 1–5, higher scores indicate more support was experienced)	Coef.	Std. err.	*P*-value
Gender (0=male; 1=female)	0.081	0.091	0.378
Age (continuous)	−0.001	0.003	0.819
Level of education			
Certified nursing assistant	Ref	Ref	Ref
Registered nurse secondary vocational level	0.011	0.078	0.891
Registered nurse bachelor's degree	0.041	0.080	0.604
Healthcare setting			
Hospitals	Ref	Ref	Ref
Mental health care	−0.161	0.097	0.097
Home care	0.032	0.100	0.748
Nursing homes	−0.000	0.100	0.999
Standardized terminology			
Omaha System	Ref	Ref	Ref
Gordon	−0.197	0.107	0.067
NANDA-I, NIC and NOC	−0.137	0.100	0.169
No standardized terminology	−0.162	0.090	0.074
Constant	3.826	0.205	0.000
Adjusted *R*-square		0.025	