Effects on the Quality of the Nursing Care Process Through an Educational Program and the Use of Electronic Nursing Documentation

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PURPOSE: To evaluate the effect of the educational program "Guided Clinical Reasoning" (GCR) and the introduction of an intelligent electronic nursing documentation system (e-doc) on the quality of the nursing process.

METHODS: Evaluation was conducted at three measurement points and rated with the instrument "Quality of Nursing Diagnoses, Interventions and Outcomes" (Q-DIO).

FINDINGS: GCR showed the best Q-DIO-scores. No long-term effect was found after GCR cessation. The e-doc delivered the lowest scores, while showing adequate support in using nursing diagnoses.

CONCLUSIONS: E-docs can support conducting the nursing process, but for meaningful e-doc use, clinical reasoning is essential.

IMPLICATIONS: High-quality nursing documentation requires recognition of factors obstructing or supporting nurses in the use of e-docs while conducting the nursing process.

ZIEL: Ziel der Studie war es den Effekt des Schulungsprogramms "Guided Clinical Reasoning" (GCR) und der Einführung eines intelligenten elektronischen Pflegedokumentationssystems (e-doc) auf die Qualität des Pflegeprozesses hin zu evaluieren.

METHODE: Die Evaluation wurde an drei Zeitpunkten mit dem Instrument "Quality of Nursing Diagnoses, Interventions and Outcomes" (Q-DIO) durchgeführt.

ERGEBNISSE: GCR zeigte die besten Q-DIO Ergebnisse. Unter GCR-Sistierung konnte kein länger anhaltender Effekt gefunden werden. Die e-doc zeigte die tiefsten Ergebnisse, trotz adäquater Unterstützung Pflegender beim Gebrauch von Pflegediagnosen.

SCHLUSSFOLGERUNGEN: Die e-doc kann beim Führen des Pflegeprozesses unterstützend wirken. Für einen sinnvollen Gebrauch der elektronischen Kurve ist jedoch klinische Entscheidungsfindung unerlässlich.

IMPLIKATIONEN FÜR DIE PRAXIS: Für eine qualitativ hochstehende Pflegedokumentation mit e-docs müssen förderliche und hinderliche Faktoren beim Führen des Pflegeprozesses erkannt werden.

In the 1980s, nursing diagnostics were introduced in Swiss nursing documentation (Needham, 1990). This standardized nursing language (SNL) represents an international, theory-based, nursing-specific vocabulary to better achieve quality assurance in nursing care documentation (Gordon & Bartholomeyczik, 2001). Given that the diagnostic process is conducted by the entire nursing team, its systematic evaluation is crucial to ensuring consistent quality (O'Connor, Hameister, & Kershaw, 2000). The quality of the nursing process is based on the NANDA-I Nursing Diagnoses, the Nursing Interventions Classification (NIC), and the Nursing Outcomes Classification (NOC) (NNN). Therefore, the term "quality of the NNN nursing process" is used in this article. The NNN nursing process is

defined by (a) a comprehensive assessment, (b) the use of sufficient and accurate nursing diagnoses (ND) specified by defining characteristics and related factors, (c) consistency with the assessment and nursing report, and (d) the effectiveness of nursing interventions and their impact on (e) evidence-based nursing-sensitive outcomes (Müller-Staub, 2006). Cross-sectional and longitudinal studies show that the introduction of nursing diagnostics enhances the quality of assessment, the quality and quantity of nursing interventions, and patient outcomes (Florin, Ehrenberg, & Ehnfors, 2005; Müller-Staub, Lavin, Needham, & van Achterberg, 2006; Müller-Staub, Needham, Odenbreit, Lavin, & van Achterberg, 2007; Müller-Staub et al., 2008; Thoroddsen & Ehnfors, 2007). Moreover, it was found that nurses need training in order to achieve and maintain accurate nursing documentation (Maust, 2012; Paans, Nieweg, van der Schans, & Sermeus, 2011; Paans, Sermeus, Nieweg, & van der Schans, 2010). However there is a gap in the literature to whether educational programs introducing and promoting the nursing diagnostic process show persistent beneficial influence on the quality of the nursing process over time.

In recent years, electronic nursing documentation (e-doc) has been systematically implemented in Switzerland. In literature, the impact on the quality of documentation, on care provided, on communication, and on use of time remains highly controversial in the literature (Carrington & Effken, 2011; Kelley, Brandon, & Docherty, 2011; Mahler et al., 2003; Stevenson, Nilsson, Petersson, & Johansson, 2010; Urquhart, Currell, Grant, & Hardiker, 2009). It is suggested that the quality of documentation is not necessarily enhanced by simply transferring paper record systems into an electronic program, without developing a practical and functional system (Ball, Hannah,

Newbold, & Douglas, 2000; Kossman & Scheidenhelm, 2008; Paans et al., 2011) that accurately captures the complexities of nursing practice (Ammenwerth et al., 2001) or care (Kohle-Ersher, Chatterjee, Osmanbeyoglu, Hochheiser, & Bartos, 2012; Urquhart et al., 2009). Research concerning the implementation and evaluation of electronic nursing records does exist (Courtney, Alexander, & Demiris, 2008; Maust, 2012), but only one study was found using the frequency of nursing diagnoses (ND), interventions, and outcomes as measures (Thoroddsen, Ehnfors, & Ehrenberg, 2011). No studies that also analyze the quality and content of the steps of the nursing process were found.

Background

In 2004, a midsized Swiss general hospital introduced the nursing process based on the NNN taxonomy. An educational program, later called "Guided Clinical Reasoning" (GCR; Table 1), was used to implement nursing diagnostics. In 2005, a pre-test/post-test evaluation study of the introduction process was conducted. Significant improvements in the quality of documentation (assessment, ND, interventions, and outcomes) were found ($p < .0001$) (Müller-Staub et al., 2007). To achieve an even higher quality of the diagnostic process, GCR was repeated in 2006 in an advanced format. Subsequently, a traditional case study group (control group) and an intervention group with GCR were compared in a randomized intervention study. In the control group, nurses were merely informed about the link between ND, interventions, and outcomes before engaging in discussion. In contrast, the GCR group was trained in critical thinking and clinical reflection by being encouraged to make evidence-based connections between ND, effective

Table 1. Overview of the Content of Guided Clinical Reasoning and Classic Case Discussions

Method	Guided clinical reasoning	Classic case discussions
Aim of method used	To facilitate critical thinking and reflection, in order to state accurate NANDA-I nursing diagnoses, related interventions, and outcomes	To support utilization of NANDA-I nursing diagnoses, related interventions, and outcomes
Pedagogical approach	Interactive method, using iterative hypothesis testing by asking questions.	Knowledge distillation, no iterative hypothesis testing applied.
	To obtain diagnostic data, nurses were asked for signs/symptoms seen in the patient, and asked for possible etiologies, as well as to link them with effective nursing interventions.	Knowledge about interventions and outcomes were presented.
	Nurses were fostered to state nursing outcomes, coherent to the nursing interventions and to the etiologies stated.	
	Accuracy was verified by asking questions and by applying nursing diagnoses, interventions, and outcomes theory.	
Pedagogical approach specified to the content of the session	Internal coherence between nursing diagnoses	

Note: Adapted from Müller-Staub (2006, p. 120).

interventions, and nursing-sensitive outcomes (Müller-Staub, Needham, Odenbreit, Lavin, & van Achterberg, 2008). While the same amount of time was invested in both groups, the intervention group with GCR showed significantly higher results in the accuracy of nursing diagnoses, effectiveness of interventions, and better patient outcomes ($p < .0001$).

In 2008, the GCR program was suspended during the implementation of the electronic nursing documentation system (e-doc) "WiCare Dok" 2008. The e-doc used is an intelligent decision support tool (Courtney et al., 2008) established on the theory-based NNN taxonomy assessment. When patient information is documented in the nursing report or in the assessment, the e-doc uses trigger words to derive hypothetical ND and automatically suggests NDs and makes suggestions automatically. In accordance with the ND chosen by nurses, the e-doc proposes nursing interventions and outcomes. Periodically, nurses are requested to evaluate the process (Burri, Odenbreit, & Scharer, 2010; WigaSoft, 2012). All members of the staff were trained to use the NNN nursing process with the help of e-doc.

The aim of this study was to investigate whether the GCR program has a lasting effect on the whole nursing process. This means changes in the assessment quality, diagnostic accuracy, intervention effectiveness, and outcome (nursing process) as defined by the instrument "Quality of Nursing Diagnoses, Interventions and Outcomes" (Q-DIO; Müller-Staub, Lunney, et al., 2008) (Table 2). The lasting effect of GCR over time was examined from 2005 to 2011 at three measurement points (2005, 2006, and 2011). It was expected that in 2011 the e-doc would support the assurance of quality of the nursing process achieved by GCR. Therefore, the second objective was to test the assumption that the e-doc provided suiting (according to the content in nursing assessments and reports) and sufficient NDs and to examine how well nurses used ND working with the decision support tool (e-doc). Consequently, an assessment and comparison of the frequency and accuracy of ND, as used by nurses and the e-doc were conducted in 2011. The study was based on four research questions: (a) Did the GCR program have a significant, lasting effect on the quality of the nursing process between 2005 and 2011? (b) How frequently and accurately did nurses use ND with the support of the e-doc in 2011? (c) How frequently and accurately did the e-doc suggest ND in 2011? (d) Compared with the actual use of ND by nurses, how many accurate ND did the e-doc suggest in 2011?

Methods

Design

For the first research question, a quantitative comparative design was chosen (Analysis 1). For the second and third research question (Analysis 2), a descriptive design was deemed appropriate.

Measuring Instrument

Müller-Staub et al. (2008) developed the research-based instrument "Q-DIO (Table 2) for standardized evaluation of the quality of the documented nursing process. Psychometric testing showed good internal consistency, stability, and reliability (Müller-Staub et al., 2006, 2010). The instrument consists of four literature-based dimensions within a total of 29 items. Each item is assessed by a Likert scale. Dimension 1 (ND as a process) evaluates assessment quality and has a 3-point scale. Dimension 2 to 4 (ND as product, nursing interventions and nursing-sensitive patient outcomes) contain a 5-point scale. They are used to assess the accuracy of ND, the effectiveness of nursing interventions, and the quality of patient outcomes. The dimensions are added up separately and compared group wise (Table 2, Q-DIO instrument).

Ethical Considerations

The application was submitted to the Ethics Commission of the study hospital and was authorized for all three groups (2005, 2006, and 2011). Nurses were informed about the study and "informed consent" was given by the nursing managers and the corresponding department. The secondary data were coded in SPSS (IBM SPSS Statistics for Windows, Version 21.0, IBM Corp., Armonk, NY, USA) format. The e-docs (Group 3) were forwarded to the researcher in anonymous form.

Samples

Three samples were retrieved from the same hospital in Switzerland. Group 1 (2005) consisted of the results of 36 Q-DIO rated nursing documentation adopted from the post-intervention group of a previous study conducted by Müller-Staub et al. (2007) 1 year after implementing nursing diagnostics. Group 2 (2006) similarly comprised 36 randomly drawn Q-DIO data sets by SPSS (statistics program "PASW Statistics," Vers.19.0, SPSS Inc., 2010). These results originated from 111 GCR post-study intervention data sets of a study from Müller-Staub et al. (2008). Nurses in 2011 had used the e-doc for 3 years. Data of Group 3 (2011) consisted of 36 randomly assigned nursing documentations. While Groups 1 and 2 consisted of randomized and controlled data, Group 3 consisted of a convenience sample, thus preventing a genuine longitudinal research study. Therefore, the outcome was called "long lasting effect." As the data of Group 1 and 2 were used once to answer the first research question, the data of Group 3 were used twice to answer the second to fourth research questions.

Data Collection

In Analysis 1, the Q-DIO data of Groups 1 and 2 were used in secondary analysis. Data for the Q-DIO dimension 1 were missing in Group 2. The nursing documentations of Group 3

Table 2. Measuring Instrument Q-DIO

Measurement instrument Q-DIO	3-point scale		
Nursing diagnoses as process. Information is documented about:	**2**	**1**	**0**

  1. Actual situation, leading to the hospitalization
  2. Anxiety and worries related to hospitalization, expectations, and desires about hospitalization
  3. Social situation and living environment/circumstances
  4. Coping in the actual situation/with the illness
  5. Beliefs and attitudes about life (related to the hospitalization)
  6. Information of the patient and relatives/significant others about the situation
  7. Intimacy, being female/male
  8. Hobbies, activities for leisure
  9. Significant others (contact persons)
  10. Activities of daily living
  11. Relevant nursing priorities according to the assessment
11 Items, maximum score = 22, mean = 2

Nursing diagnoses as product	5-point scale				
	4	**3**	**2**	**1**	**0**

  12. Nursing problem/nursing diagnosis label is documented
  13. Nursing diagnosis is correctly formulated and numbered
  14. The etiology (E) is documented
  15. The etiology (E) is correct, related/corresponding to the nursing diagnosis (P)
  16. Signs and symptoms are formulated
  17. Signs and symptoms (S) are correctly related to the nursing diagnosis (P)
  18. The nursing goal relates/corresponds to the nursing diagnosis
  19. The nursing goal is achievable through nursing interventions
8 items, maximum score = 32, mean = 4

Nursing interventions	**4**	**3**	**2**	**1**	**0**

  20. Concrete, clearly named nursing interventions are planned (what will be done, how, how often, who does it)
  21. The nursing interventions affect the etiology of the nursing diagnosis
  22. Nursing interventions carried out, are documented (what was done, how, how often, who did it)
3 Items, maximum score = 12, mean = 4

Nursing-sensitive patient outcomes	**4**	**3**	**2**	**1**	**0**

  23. Acute, changing diagnoses are assessed daily or from shift to shift/enduring diagnoses
       are assessed every fourth day
  24. The nursing diagnosis is reformulated
  25. The nursing outcome is documented
  26. The nursing outcome is observably/measurably documented
  27. The nursing outcome shows
    - improvement in patient's symptoms
    - improvement of patient's knowledge state
    - improvement of patient's coping strategies
    - improved self-care abilities
    - improvement in functional status
  28. Nursing-sensitive patient outcomes and nursing interventions are internally related
  29. Nursing-sensitive patient outcomes and nursing diagnoses are internally related

7 Items, maximum score = 28, mean = 4	**Total Items 29**

Note: Adapted from Müller-Staub (2006, p. 84).

were assessed in primary analysis using Q-DIO. The validity of the Q-DIO rating by the first author was verified through an independent evaluation of the data by the developer of Q-DIO. In Analysis 2, six variables were chosen by an expert panel to answer the second through fourth research question. Each nursing documentation in Group 3 was subjected to multiple readings and the following were collected (a) total suggested hypothetical ND by the e-doc, (b) accurate hypothetical ND, (c) total of ND used by nurses, (d) accurate ND used by nurses, (e) range of accurate sug-

gestions of hypothetical ND, and (f) range of accurately used ND. Accuracy was defined as the correct content use of ND in terms of the patient situation as stated in the assessment and nursing report, and described not only by ND titles but by defining characteristics and related factors. This analysis was verified through the rigorous use of the NANDA taxonomy (Doenges, Moorhouse, & Murr, 2008).

Data Analysis

Analysis 1 (research question 1: Did the GCR program have a significant, lasting effect on the quality of the nursing process between 2005 and 2011?) evaluated the quality of the documented nursing process over time by comparing the three groups rated by Q-DIO (2005, 2006, and 2011). To achieve this, the mean values of the four dimensions were examined and treated as independent groups. Differences between groups were calculated applying the Mann–Whitney U-test (dimension 1), and the Kruskal–Wallis test with pairwise comparisons and adjustments according to Bonferroni (dimension 2). In dimensions 3 and 4, Kruskal–Wallis and post hoc Games–Howell tests were used (Brosius, 2008; Field, 2009). In Analysis 2, a descriptive design was used to answer the second through fourth research question concerning the use of and support provided for choosing ND. For the second and third research question (How frequently and accurately did nurses use ND with the support of the e-doc in 2011? How frequently and accurately did the e-doc suggest ND in 2011?), the number of ND used by nurses as well as the hypothetical ND suggested by e-doc were calculated along with their degree of content accuracy. For the fourth research question (Compared with the actual use of ND by nurses, how many accurate ND did the e-doc suggest in 2011?), the ratio between the suggestion of accurate ND through the e-doc and the use of accurate ND by nurses were established. Statistical analysis of both research questions was conducted using the program SPSS with the significance level defined at $\alpha = .05$.

Results

Analysis 1 showed that the highest levels of quality of the documented nursing process were found in 2006 after the second training with GCR (Group 2). Groups 1 (introduction of nursing diagnostics to the nursing process) and 3 (introduction of the e-doc, suspended GCR program) were almost on a par. They differed in that Group 1 showed significantly better "assessment quality" than Group 3 ($p = .002$), and Group 3 showed better skills in phrasing exact ND than Group 1 ($p = .05$). An overview of the group differences is given in Table 3.

Research question 1 revealed that despite significant improvements from the first to the second GCR training (Group 2) in 2006, no long-term effect could be found in 2011. This means that Group 3 could not maintain the high-quality level of Group 2, other than for the "accuracy of ND used" ($p = 1.000$).

Concerning electronic documentation, Analysis 1 did not show better results through the use of the e-doc (Group 3). Rather, in contrast to Group 1, Group 3 showed a significant decline in the "quality of assessments" ($p = .002$). Group 2 attained significantly better results in documented interventions and patient outcomes ($p < .000$). However, in the dimension "accuracy of ND used" Groups 2 and 3 didn't show a significant difference ($p = 1.000$), and Group 3 showed a near significant improvement to Group 1 ($p = .05$).

Research question 2 answered in Analysis 2 established that, per patient record, nurses chose a maximum of five different ND (range = 0–5), with 94.7% accuracy. On average, 1.47 distinct, accurate ND ($SD = 1.028$, 95% [CI = 1.12, 1.82]) were selected. In most cases (21 of 36; 58.3%), only one correct ND was chosen, and was used a median of 17.08 times (range = 0–87, $SD = 23.87$, 95% [CI = 9.01, 26.06]).

Research question 3 showed that the e-doc reached a quota of 61.5% accuracy in suggested hypothetical ND. The intelligent electronic expert system identified a total of 30.22 accurate ND (range 0–148, $SD = 30.66$, 95% CI [19.85,

Table 3. Overview of Group Differences in Analysis 1

Intervention	Dim 1	Dim 2	Dim 3	Dim 4
Group 1 Implementation of nursing diagnostics	Rank 1 G1 sig. better than G3 ($p = .002$)	Rank 3 sig. worse than G2, worse than G3	Rank 3 sig. worse than G2, no sig. difference to G3 ($p = .998$)	Rank 3 sig. worse than G2, no significant difference to G3 ($p = .247$)
Group 2 Intervention "Guided Clinical Reasoning"	X	Rank 1 sig. better than G1 ($p = .005$)	Rank 1 sig. better than G1 ($p < .000$) and G3 ($p < .000$)	Rank 1 sig. better than G1 ($p < .000$) and G3 ($p < .000$)
Group 3 Implementation of e-doc and suspended GCR	Rank 2 G3 sign. worse than G1	Rank 2 almost sign. ($p = .05$) better than G1, not sign. worse than G2 ($p = 1.000$)	Rank 3 sign. worse than G2	Rank 3 sign. worse than G2

Note: G, Group; Rank, best rank 1, then 2, then 3; Dim, dimension; sig, significant at $\alpha = .05$.

40.60]) and a range of 9.75 different, accurate hypothetical ND (range = 0–24, *SD* = 5.51, 95% [CI = 7.89, 11.61]) per patient record.

The result of research question 4 was that the average ratio between accurate suggestions of the e-doc and the ND used by nurses amounted to 6.6:1.

Discussion

Given the randomized and controlled data in Groups 1 and 2, the significant enhancement of the quality of the documented nursing process can be attributed to GCR. This result confirms the findings of Müller-Staub et al. (2007, 2008), which state that GCR significantly improves the accuracy of diagnoses and intervention effectiveness, leading to better patient outcomes. Due to its quasi-experimental design, the comparability of the results of Group 3 is limited. The deterioration of the results could be due to multiple factors, including the loss of acquired skills in the GCR program and the introduction of the e-doc. These topics will be discussed subsequently.

Electronic Support and the Maintenance of Acquired GCR Skills

The e-doc was introduced to preserve the high level of quality (Burri et al., 2010). However, while Group 2 (2006) improved significantly by using GCR in comparison to Group 1 (2005), Group 3 (introduction of the e-doc) showed the greatest deficits in documenting the nursing process. In contrast to evidence showing that experience enhances the accuracy of documentation (Paans, Sermeus, Nieweg, & van der Schans, 2010), the results of Group 3 dropped to the level of Group 1 1 year after the implementation of nursing diagnostics. Despite a refresher course in 2008, at the time the e-doc was introduced, the levels of 2006 could not be maintained through 2011. If the results in 2006 were achieved through constant training and guidance of specialized GCR instructors sharpening nurses' critical thinking, clinical reflection and accuracy abilities, it would seem that 3 years between the refresher and the Q-DIO evaluation in 2011 may have been too long to maintain acquired GCR skills. Losing skills over time is a phenomenon also observed in other e-docs supporting the nursing process (Estrada & Dunn, 2012; Kelley et al., 2011; Thoroddsen et al., 2011). While showing the lowest results in the other steps of the nursing process, Group 3, in its use of the e-doc, was on average better than Group 1 and equal to Group 2 in phrasing ND. This makes sense, considering that phrasing ND is an automated process in which the e-doc rigorously guides nurses though the PES-steps (problem, etiology or related factors, symptoms, or defining characteristics by giving standardized suggestions of NANDA-I diagnoses). Furthermore, the e-doc provided more as well as a substantially wider range of accurate ND than those verified and used by nurses. This indicates that the e-doc is an adequate and practical elec-

tronic decision support system, which is a crucial factor in proficient use of e-docs (Ball et al., 2000; Kossman & Scheidenhelm, 2008; Paans et al., 2011). Nevertheless, little use was made of the ND automatically suggested by the e-doc. Six out of seven accurate NDs that were suggested were not selected by nurses. This implies that an explanation other than a failure of the decision support system must be explored.

Influencing Factors and Barriers

Observing clinical practice in the hospital revealed some possible factors in leading to the results found in 2011: a high staff turnover, suspension of the GCR program, and a change of priorities in management. Nevertheless, the results of Groups 1 and 3 show a similar Q-DIO level in stating ND. Therefore, the basic ability to lead the nursing process was not lost. More likely, when compared to the findings of 2006, the advanced ability to conduct a differentiated and reflected nursing process using a broad spectrum of the specific, standardized nursing language NNN seemed to be lacking (Estrada & Dunn, 2012; O'Connor et al., 2000). The study findings suggest that at least one factor leading to the deteriorated results of Group 3 was the lack of practice in critical thinking and clinical reflection. The authors consider the fact of stopping GCR and its specific support in critical thinking as the main factor for the results found. While evidence shows that with experience, e-docs can make ND more efficient and accurate (Estrada & Dunn, 2012), it appears that the broad electronic assistance by offering hypothetical nursing diagnoses based on nurses assess notes in the e-doc could not replace the previous ability to think critically and to reflect on the clinical situation throughout all steps of the nursing process.

Literature shows that there are many barriers to the use of e-docs and nursing diagnostic systems (Kohle-Ersher et al., 2012; Paans et al., 2011; Stevenson et al., 2010). Perhaps the NNN taxonomy or the e-doc was not yet insufficiently understood, and therefore could not be used efficiently by nurses (Lunney, 2006; Müller-Staub et al., 2008; Paans et al., 2011). Structural and environmental barriers such as insufficient time for reflection and documentation could likewise have influenced the decision not to make full use of the suggestions of the e-doc (Ammenwerth et al., 2001; Paans et al., 2011; Urquhart et al., 2009). Another commonly expressed problem with the use of e-docs is the location, speed, accessibility, and reliability of the computer and the e-doc program installed (Huryk, 2010; Kohle-Ersher et al., 2012; Stevenson et al., 2010). These factors could have led to nurses' reluctance to spend time documenting. Moreover, electronic charting is often considered a low priority in comparison to other nursing tasks (Kohle-Ersher et al., 2012). Another explanation for the minimal use of the e-doc could be the attitudes of stakeholders in management and nurses. Lack of acceptance is a well described concept in the literature (Huryk, 2010; Kelley et al., 2011; Maust, 2012). Many nurses have a variety of reasons for their dis-

satisfaction with e-docs that causes them to use them reluctantly or even to decline assistance (Stevenson et al., 2010).

Regardless of the factors contributing to the current situation, the progressive deterioration of the quality of the use of the e-doc in the nursing process must be critically examined. If the nursing process with the NNN taxonomy should depict clinical practice, nurses must be proficient in documenting day-to-day clinical practice using this standardized professional language.

Conclusions

This study proved that the GCR program, when practiced, had a positive effect on the quality of the nursing process over 1 year. However, the researchers were unable to verify a positive lasting effect of the GCR program on the quality of the nursing process documentation, despite the support of an e-doc, when GCR was suspended. The results of this study suggest that the introduction of an e-doc system can help to optimize the nursing process but cannot replace continual advanced application of and support in critical thinking and guided clinical reflection. This study also sheds light on possible factors impacting the assessment quality, frequency and accuracy of nursing diagnoses, intervention effectiveness, and quality of patient outcomes after the introduction of the e-doc in the study hospital. It is concluded that the constant support of nurses, an awareness of barriers to conducting the nursing process and using intelligent decision-support tools correctly are crucial to a high level of quality in nursing process documentation.

Limitations

In Analysis 2, only ND were examined, interventions and outcomes have yet to be studied.

Recommendations

Recommendations to secure the long-term quality and effectiveness of NNN documentation in clinical practice are; (a) It is crucial to implement and constantly support nurses to practice critical thinking and clinical reflection, (b) After the implementation of an e-doc, nurses must be supported regularly both in the correct use of NNN documentation and in the application of the e-doc, (c) Influencing factors and barriers in the use of nursing documentation are to be analyzed and evaluated regularly, and (d) The use and documentation quality of the NNN nursing process should be evaluated periodically, and corresponding feedbacks should be given to clinical nurses. The Q-DIO provides an instrument for such evaluations.

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