

# Systematic Evaluation of a Computer-Based Nursing Documentation System

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## Introduction

The documentation of the nursing process is one important part of the clinical documentation. The nursing process provides a systematic methodology for nursing practice. It consists of six phases: 1. Assessment of relevant information; 2. Definition of problems and resources of the patient; 3. Derivation of nursing aims, 4. Planning of the nursing tasks; 5. Execution of these tasks; 6. Evaluation of nursing care. In Germany, paper-based systems have been introduced to support nursing process documentation, but there are frequent reports of high expenses for the documentation, of low quality and of limited user acceptance [1]. It is unclear if computer-based documentation systems can solve these problems. There have been a few studies evaluating the effects of computer-based nursing process documentation [2, 3], but none of them used a controlled study design which allows a direct comparison between paper-based and computer-based nursing process documentation. Therefore, we decided to conduct such a controlled randomised study at the Department of Psychiatry at the Heidelberg University Hospital to compare the old paper-based documentation system (based on forms with mainly free-text entry) to a new computer-based application system.

## Study Design

The overall aim of the study was to decide whether to introduce a computer-based documentation system in Heidelberg. The software PIK 4.0<sup>4</sup> was chosen for the study. It was developed by a Germany-wide working-group, enabling us to participate in its development. PIK fully supported the phases 2 - 6 of the nursing process (support of phase 1 is available since PIK 4.5). The detailed study plan can be found in [4].

### *Study aims*

We wanted to answer the following major questions:

Q1: Is the time effort for documentation with PIK equal to the time effort for paper-based documentation?

Q2: Is the quality of nursing documentation with PIK equal to the quality of paper-based documentation?

Q3: Does the user-acceptance of computers in nursing and of PIK change during the study?

### *Methods*

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We used a randomised controlled trial to compare both documentation systems. One ward of the Department of Psychiatry in Heidelberg was selected (23 beds; 420 patients/year with acute mental disorders; mean time of stay: 20 days; 12 registered nurses, 4 physicians). The study period was set to November 11<sup>th</sup> 1998 - January 17<sup>th</sup> 1999. All patients admitted to this study ward during this period were to be included. They were randomly assigned to the PIK group (documentation only with the computer-based system) or to the control group (documentation only with the paper-based system). We used a mix of quantitative and qualitative methods to answer the study questions, including questionnaires, interviews, self-observations and quality checklists (for details see [4]). To answer Q1, all nurses of the ward were asked to document time efforts for care planning and documentation in relation to each study patient during the whole study period. The times were then calculated per day and per patient and both groups were compared using the Wilcoxon-Mann-Whitney-Test ( $\alpha=5\%$ ). We planned not to include the first 20 patients in the analysis of the data to take into account learning effects. To answer Q2, we constructed a quality checklist which was to be used by two external nursing experts to observe different aspects of quality of all nursing documentations at the end of the study. To answer Q3, we chose validated questionnaires (see table 2) which were to be answered by all nurses before and again after the study. The resulting acceptance scores before and after were then compared using the Wilcoxon-Signed-Rank-Test ( $\alpha=5\%$ ). In addition, we planned to interview five nurses to discuss our findings and to assess their overall judgement.

### **Course of the study**

On three computers in the ward office, the software was installed ten weeks before the study. The nursing process had been established on the study ward for several years. None of the nurses had experience in computer-supported nursing documentation. All nurses got two hours training on the software. The other professionals got an introduction. To achieve data integration, the software was interfaced with the communication server of the Heidelberg Hospital Information System. We then conducted the study according to the study plan. Overall, 60 patients were included (30 in the PIK group, 30 in the control group). The mean age of the patients was 48.0 years for the PIK group (range: 22 - 80 years) and 39.6 years for the control group (range: 19-94 years). The mean duration of stay of the patients was 20.9 days for the PIK group (range: 1 - 85 days) and 21.8 days for the control group (range: 1 - 62 days). During the study period, 17 registered nurses worked on the study ward, 10 of them continuously during the whole time. From 8 of these 10 nurses, all questionnaires were completely available. The mean age of these 8 nurses was 31.5 years (range: 24 - 46 years), 3 were male and 5 were female. On the average, they said to have 2.5 years of experiences with computers (range: 1 - 5 years), and they said to work with computers 3.5 hours a week (range: 1 - 7 hours).

### **Results**

*Q1: Is the time effort for documentation with PIK equal to the time effort for paper-based documentation?*

For the patients included in time analysis (n=40, first 20 not included according to study plan), care planning was done 25 times, planning and documentation of tasks 380 times, report writing 1456 times during study period. For each patient, the daily mean time was calculated (only days with available data were included). Table 1 shows the mean time per day for those patients of both group where data was available (thus if a task like care planning was never done for a patient, this patient is not included in the following statistics):

Category	PIK group			Control group		
	Mean [min]	Stdev [min]	N [patients]	Mean [min]	Stdev [min]	N [patients]
Care planning	<b>16.4</b>	15.4	11	<b>43.3</b>	43.6	6
Planning & documentation of tasks	<b>4.8</b>	3.3	18	<b>2.0</b>	1.2	13
Report writing	<b>6.6</b>	3.0	19	<b>4.7</b>	2.7	19

Table 1: Mean time consumption per day in each category for the nursing process documentation.

Using the Wilcoxon-Mann-Whitney-Test as planned for Q1, we could show that "planning and documentation of tasks" and "report writing" needed significantly more time with the computer-based system than with the paper-based system. For care planning, we could not show a significant difference between both groups.

*Q2: Is the quality of nursing documentation with PIK equal to the quality of paper-based documentation?*

The examination of the nursing documentations of all patients (n=60) showed that 79,3% of the documentations in the PIK group had a complete care planing, but only 50% in the control group. The care plans in the control group contained on average 3.5 problems, 3.3 aims and 3.8 tasks. The care plans in the PIK group contained on average 5.6 problems, 11.3 aims and 18.7 tasks. In 20% of the PIK and in none of the paper-based documentations, tasks were planned but not executed. In the control group, 34.7% of the documentations had items not correctly signed by a nurse (in the PIK group, this was done automatically). All documentations of the PIK group were judged as good legible, but only 14.2% of the paper-based documentations.

Overall, the external nursing experts judged the quality of documentation as equal in both groups (score from 1 = min to 5 = max; PIK group: mean = 2.4; control group: mean = 2.3). Nevertheless, they identified quality differences concerning the following aspects: In the PIK group, care plans were often considered as too unspecific and too long, leading to less individualised care and to many of planned but not executed tasks. In the control group, they mainly criticised often incomplete nursing documentation, illegibility and missing signatures. In the interviews, both nursing experts said that a revision of the pre-defined care plans in the computer-based system and an increased sensitivity of the nurses for the necessity of individualisation of these pre-defined plans could lead to a quality improvement in the computer-based documentations.

*Q3: Does the user-acceptance of computers in nursing and of PIK change during the study?*

Table 2 shows the change in acceptance scores of the 8 nurses during study. These changes were significant (using the Wilcoxon-Signed-Rank-Test as planned) for the acceptance of the nursing process and for the use of computers for nursing documentation. Therefore, the acceptance grew significantly during the study.

Topic	Description of questionnaires used	Acceptance score after study compared to before study		
		Lower	Equal	Higher
Acceptance of ...				
the nursing process	18 items, score 1 to 4; based on [5]	0 nurses	2 nurses	6 nurses
computers in general	19 items, score 1 to 4; based on [6]	1 nurses	2 nurses	5 nurses

computers for nursing documentation	9 items, score 1 to 4; based on [7]	1 nurses	0 nurses	7 nurses
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*Table 2: Change in acceptance scores for 8 nurses during the study.*

After the study, the nurses (n=8) were asked to express their opinions on a questionnaire (scales from 1 = min to 4 = max). They felt more at ease with computers (mean score: 2.4 before the study; 2.9 after the study). They said that the computer-based documentation system leads to a better legibility (mean: 3.7), to a better overview of the nursing care (mean: 3.3), to a higher completeness (mean: 3.1) and to an improved quality of documentation (mean: 3.0). They judged the computer-support as useful for care planning (phase 2 + 3 of nursing process; mean: 3.3), for planning and documentation of tasks (phase 4 + 5; mean: 2.6) and for writing of nursing reports (phase 6; mean: 2,5). They saw time savings during care planning (mean: 2.8), but not during planning and documentation of tasks (mean: 2.2) or during report writing (mean: 2.0). After the study, they felt at ease when using the computer-based system (mean: 3.3). 8 from 10 nurses working on the ward at the end of the study wanted to continue working with computer-based documentation systems.

### **Discussion and conclusion**

The controlled study design allowed us to directly compare the effects of paper-based and computer-based nursing process documentation. We did not try to measure effects on outcome quality, we concentrated on questions which could be answered in a limited amount of time. We evaluated user acceptance because human factors play an important part for the success of information systems [8]. We could not show a significant time saving or an overall quality improvement in the PIK group. What we observed were time savings during care planning and an improvement in legibility and completeness of the documentation. During the course of the study, a slow reduction of mean time in the PIK group could be observed, probably due to learning effects. Based on this observation and on the interviews with the nurses, it can be guessed that after some time, the difference in time between both systems won't be significant any more. The high user acceptance and the rising need for accountability and liability of nursing documentation finally led to the joint decision of the users and the nursing management to continue working with computer-based nursing documentation systems at the Department of Psychiatry in Heidelberg. PIK is now used in practice on one ward and will be soon introduced on other wards. We conducted the study at one ward only, but we could nevertheless find significant effects. It should be further examined if our results are transferable to other departments and to other documentation systems. The study design and the study instruments can be reused in other surroundings, and the results can then be compared between different settings, leading to a more global view on the effects of computer-based nursing process documentation.

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