Quality in fives

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SUMMARY

This thesis describes a study on the support of nurse scheduling. Nurse scheduling is defined as the procedure for providing nursing care by assigning shifts to nursing personnel. This involves a process of determining when each nurse (of a nursing unit) will be on or off duty, which shift will be worked, by whom (of the on-duty nurses), and how weekends, the number of consecutive days worked, requests and vacations will be accounted for. This determination process results in a nursing schedule.

The focus of this study has been on the consequences of the nursing schedules for the performance of the nursing unit. This performance can be divided into three parts: the effectiveness in providing nursing care, the efficiency of a nursing unit and the job satisfaction of the nursing staff. In this study, the influence of a nursing schedule on the nursing unit's performance is identified by means of the concept of 'nursing schedule quality'.

During the last thirty years, many researchers tried to develop a computer program that supported the task of nurse scheduling. In this thesis, these studies are divided into seven distinct approaches. Subsequently, these seven approaches were compared on the effect they have on the performance of the nursing unit (i.e. effectiveness, efficiency and job satisfaction). This comparison showed that none of the discussed approaches scores positively on all comparison criteria.

This study investigated a new approach to supporting nurse scheduling. This approach is called 'Quality Indication Scheduling'. This approach is based on three hypotheses. The hypothesis of formalization states that the concept of nursing schedule quality can be modelled as a concept consisting of independent quality factors and that each of these factors can be operationalized. The hypothesis of robustness asserts that nurse schedulers might give different weights to each of these quality factors when assessing the total quality value of a nursing schedule. And thirdly, the hypothesis of effectiveness asserts that informing nurse schedulers on the values of the quality factors will improve the quality of nursing schedules.

Four research questions were formulated to test these three hypotheses:

1. What are the independent factors of nursing schedule quality?

2. How can one operationalize each of these quality factors?
3. Can the total nursing schedule quality be explained on the basis of a weighted sum of factor values?
4. Does 'Quality Indication Scheduling' improve the quality of nursing schedules?

Four research phases were designed to answer the research questions shown above: a questionnaire, a ranking experiment, an auditing experiment and a scheduling experiment. For each phase, both the design and the results are discussed below.

QUESTIONNAIRE

The analysis of the concept of nursing schedule quality was guided by the first research question. This question asked about the independent factors of nursing schedule quality. Three steps were taken to answer to this question.

Firstly, a survey of literature was conducted in order acquire candidates for these quality factors. This resulted in eight candidates (i.e. possible quality factors).

Subsequently, these candidates were analyzed on independence and perceivability. Three candidates did not survive this analysis. Thus, this step resulted in a working set of five independent and perceivable quality factors of nursing schedules.

The third step involved a questionnaire. The answers given by eighteen nurse schedulers to the question "How would you define nursing schedule quality?" were then qualitatively analyzed in order to validate the working set of five quality factors. The results of this analysis supported each of the five quality factors of this working set.

The results of the analysis of the concept of nursing schedule quality show that this concept consists of five independent quality factors (i.e. 'Quality in Fives'). These factors were identified as completeness, optimality, proportionality, healthiness and continuity. The completeness factor represents the degree to which the quantitative demands for occupation per shift are met. The optimality factor represents the degree to which nursing expertise is distributed over the different shifts. The proportionality factor represents the degree to which each nurse has been given about the same number of night shifts,

evening shifts and weekends off. The healthiness factor represents the degree to which care has been taken of the welfare and health of the nursing staff. And finally, the continuity factor represents the degree to which there is continuity in the nursing staff during the different shifts.

RANKING EXPERIMENT

The operationalization of the concept of nursing schedule quality was guided by the second research question. This question asked about how each of the five quality factors could be operationalized. The ranking experiment was designed to answer this question.

In the ranking experiment, ten nurse schedulers were asked to rank several alternative shift patterns according to their own view on nursing schedule quality. In total, each nurse scheduler was asked to make thirty rankings of a maximum of ten ranking objects (i.e. alternative shift patterns).

The results of the ranking experiments showed that nurse schedulers have the same notion about the values of (most) alternative shift patterns per corresponding quality factor. Those decision aspects, of which the rankings of alternative shift patterns showed a significant coefficient of concordance, were included in the specification of each of the five quality factors. On the basis of these specifications, each quality factor was operationalized into a so-called 'quality indicator'. These quality indicators measure the value of the corresponding quality factor on a scale from zero to one. These quality indicators provide an answer to the second research question. Therefore, the results of the ranking experiment support the hypothesis of formalization.

AUDITING EXPERIMENT

The third research question asked whether the total nursing schedule quality can be explained on the basis of a weighted sum of factor values. The auditing experiment was designed to answer this question.

In the auditing experiment, nurse schedulers were asked to audit fifteen nursing schedules by giving each nurse schedule a quality mark on a scale from one to ten. The results of this auditing experiment showed that the total quality

values of nursing schedules (i.e. the given quality marks) can be explained on the basis of a weighted sum of factor values. In this explanation, the factor values are generic (i.e. vary per nursing schedule), while the summation weights are specific (i.e. vary per nurse scheduler).

The research results of the auditing experiment answer the third research question positively. Therefore, these results support the hypothesis of robustness.

SCHEDULING EXPERIMENT

The application of the concept of nursing schedule quality in order to effectively support the task of nurse scheduling is guided by the fourth and last research question. This research questions asked whether 'Quality Indication Scheduling' improves the quality of nursing schedules. This 'Quality Indication Scheduling' informs nurse schedulers about the factor values of the arranged nursing schedule. This application of the operationalized concept of nursing schedule quality is based on the hypothesis that this information will enable the nurse scheduler to improve the nursing schedule's quality (i.e. the hypothesis of effectiveness). The scheduling experiment was designed to test this hypothesis and thus to answer the fourth and final research question.

The results of the scheduling experiment showed an improvement of thirty percent in nursing schedule quality caused by 'Quality Indication Scheduling'. This improvement consisted of a decrease in low-quality patterns by forty-five percent. This provides a positive answer to the fourth and final research question. Therefore, the results of the scheduling experiment support the hypothesis of effectiveness.

Additionally, the results of the scheduling experiment also showed that all nurse schedulers arranged original final schedules that scored low on the healthiness factor. However, the indication of these schedules' healthiness could be used by the schedulers to increase the healthiness of these schedules. This finding stresses the importance of informing nurse schedulers about this healthiness factor.

CONCLUSIONS

The objective of this study was to develop nurse scheduling support in such a way that it increased the performance of a nursing unit (i.e. effectiveness, efficiency and job satisfaction). The approach designed to attain this objective focused on the operationalization of the causal relation between the nursing schedule and this performance (i.e. the nursing schedule quality).

This study showed how to analyze, operationalize and apply the concept of nursing schedule quality. The analysis was based on the search for independent factors. The operationalization used the communality among nurse schedulers about the interpretation of these factors. And finally, the application showed the effectiveness of informing nurse schedulers about the values of these factors.

Therefore, this study showed that task of nurse scheduling can be effectively supported by means of 'Quality Indication Scheduling'. This approach supports the nurse scheduler by providing quality indicators that measure the schedule's value for each of the quins of quality factors.