Digital communication systems can enhance patient and employee satisfaction and may help to reduce physical workload of nurses

Dr. Uli Fischer
Klinikum der Universität München
KUM
München, Deutschland
uli.fischer@med.uni-muenchen.de

Julian Nast-Kolb
Cliniserve GmbH
Cliniserve
Pöcking, Deutschland
julian.nast-kolb@cliniserve.de

Abstract—This study evaluates a system that tries to reduce the workload in nursing and increase nurse and patient satisfaction. The system relies on a digital communication channel that supplements the nurse call system. The system was deployed in two wards at Klinikum der Universität München (KUM) and one ward at Diakoniewerk München-Maxvorstadt (DMM) and additional surveys were conducted to evaluate the effect on patient and nurse satisfaction. Analyzing the nurse call system log together with the communication system log will give us information for possible reduction in walking distances and workload. Preliminary results show that patients and nurses use and accept the system. Due to obstacles throughout the study, it has not yet been concluded.

Keywords—Digital solutions, patient nurse communication system, nursing application, employee and patient satisfaction

I. INTRODUCTION

Stress in nursing has known to be a problem for several years. Especially, since the demographic change is expected to lead to even lower nurse-to-patient rations [1]. This suggests that the individual nurse will likely be prone to even higher stress levels in the future. Several studies examined the reasons for stress related issues in nursing in hospitals [2,6]. These studies often identified effort through documentation and patient service as strong factors for stress. In general, non-nursing related tasks are mostly responsible for stress as they take time away from actual patient care, which cannot be delayed. For most nurses the care for the patient is considered as a key task of the job and therefore not as stress relevant. However, unstructured processes and additional tasks delegated to nurses, have led to a state where nurses only have about 15% of their daily working time left for the actual care for the patient compared to, for example, 21% of their time spent on walking, as studies that analyzed nurses' working days showed [3,4]. Undifferentiated nurse call systems are a large cause of stress for nurses in hospitals, as it interrupts their working routine, does not allow for differentiation of service requests and emergencies and causes double walking distances to fulfill patients' needs. For example, if a patient utilizes the system to request a coolpack, the nurse responds and is only informed on arrival at the patient's bed what the cause for the alarm was and then has to go fetch the coolpack.

To answer these shortcomings, a startup company developed a digital communication system between patients and nurses that can be used adjacent to the existing nurse call system. The system was developed in close cooperation with active nurses of the Munich University Hospital (KUM), with the use of paper prototypes and minimum viable products to ensure a high level of usability and a simple user experience. The main idea is, that patients use their own personal electronic devices to send requests to the ward staff. Personal devices reduce the hardware investment required and are more comfortable for patients. The demographic development suggest that even more patients are expected to bring own devices in the future [7]. The goal of the system is thus to facilitate the daily working routine of nurses, while at the same time also benefiting the patient, who is expected to appreciate the new form of communication. Up to now, patients are often uncertain whether activating the nurse call system is acceptable for non-urgent and service related requests. The intention was, to create a system that provides immediate and tangible benefit for the user, to increase acceptance and adoption rates.

II. BACKGROUND AND OBJECTIVES

The authors first met at the beginning of August 2017 with the goal to improve and test the application in a clinical setting. While the Cliniserve team contributed the technical product and personnel support for the execution of the test, the team at KUM took over the conceptualization of the study as well as providing two wards for the deployment of the system and coordinating the field study. This involved organizing devices for the nurse team from the hospital IT as well as receiving confirmation for the validity of the data security concept developed by the team. The initial draft for the timeline and steps for the study is shown in figure 1.

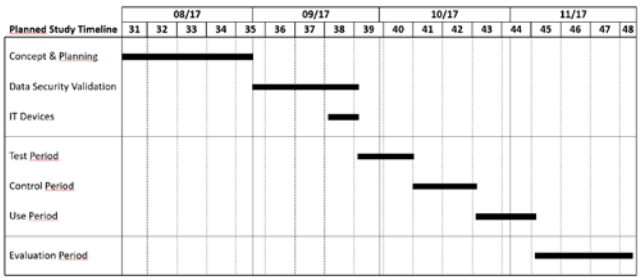

Fig. 1 Planned study timeline

After one month of conceptualization of the study outline, drafting of the required surveys and support documents and the involvement of all additional resources, one month time was estimated as being sufficient to receive clearance for the data security concept. As a data security concept already existed and no personal data was collected as well as no tracking of personnel on a personal level was possible, this estimation seemed reasonable. In parallel, the smartphones for the nursing staff should have been organized from the hospital IT. Smartphones were already on stock from a previous internal use case, so that no procurement processes had to be started. Two weeks were planned for on premises live tests of the system to ensure no small bugs interfered with the study protocol and results. Two wards in the KUM, one mixed private station and one orthopedic/urological general station were asked to take part in the study. The staff and responsible heads of wards were informed, specially trained on the device and supported the study. Finally, two weeks of control period and two weeks of system use period would have concluded the study, with a month remaining for the analysis of the results. The study was hence estimated to be ready for publishing by December 2017.

The three core objectives of the study were (1) to assess the impact of the system on employee and patient satisfaction, (2) to estimate the walking time saved through the application by using step counters to track nurses' walking distances and (3) to test the usability and handling of the new application.

III. Methodology

To track, analyze and evaluate the three core objectives of the study mentioned in section II, the following approach was chosen. Satisfaction (1) and walking distance (2) were to be examined using a case control study design as follows: In a "pre-system use" control period of two weeks, the status quo of nurse satisfaction and walking distances was to be measured. Standardized surveys conducted by the study team with all nurses in the wards asked questions about satisfaction with patient communication, subjective workload and the structure of a few existing processes in the wards. During those two weeks, every nurse on shift was to furthermore wear a step counter and note down the travelled distance during each shift on an anonymized level.

The treatment period would then be initialized by the system being introduced to the staff by the Cliniserve team during shift changes, to ensure each nurse in the two wards would be able to use the system. Patients were informed about the possibility to communicate via the digital system with a flyer also containing the location code. In the same instance, the ward team informed the patients about the study and got written consent to participate, mandatory for the use of the system. Before every patient discharge, the team would then distribute a questionnaire to the respective patients, asking them about their satisfaction with care and service, the nurse call system and the new digital solution. The nurse would still wear step counters during every shift and note down the travelled distance to allow a comparison of distance travelled with and without the digital system. At the end of the system-use period, the team would conduct a survey among all participating nurses with questions assessing the satisfaction with the digital communication solution, patient communication in general and ward processes specifically during the two weeks of treatment.

All satisfaction surveys provided statements and asked participants on a scale from 1 to 6, how much they agreed with the statements (1 representing "very strongly", 6 representing "not at all").

During the analysis phase, a comparison of before and after system-use questionnaires and step counter measurements, would allow the estimation of the net effect of the digital communication system on patient and nurse satisfaction, as well as on the distance walked by nurses during every shift.

To assess the usability and handling of the new application (3), the commonly utilized User Experience Questionnaire was implemented [5]. Patient were to fill out the questionnaire together with the satisfaction survey after the use of the system and before their discharge. Nurses were to fill out the questionnaire post-system-use together with their satisfaction survey. The questionnaire asks for a rating of attributes such as "ease of use", "innovation", "sympathy" etc. on a scale of 1 to 7 with 1 not consistently being positive to control for mindful answers to the survey.

IV. Results

The study is currently in the implementation period. We can complete the study in the upcoming three weeks. After the end of data collection, we will test our hypotheses that the new application can reduce unnecessary care worker pathways and, at the same time, increase service satisfaction in elective patients.

The following limitations and issues led to the substantial delay of the study compared to the timeline described in II. These circumstances also required changes in the study's framework. The actual study timeline after the adjustments is show in figure 2.

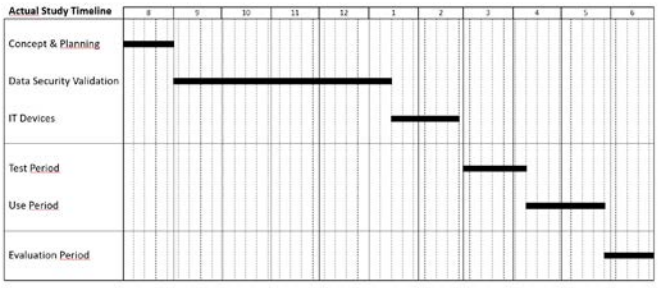

Fig. 2 Actual study timeline

Due to a large amount of data security cases to examine, the clearance of the study through the regulatory data security official at KUM took much longer than initially expected. In Mid-January the team finally had final clearance to proceed with the study. During this time period the study was delayed, and no other measures could be taken. Following up to this, the provision of the nurse smartphones also took longer than expected. This was mostly due to the fact, that technical questions regarding the WIFI communication of the devices (what the adequate security level regarding the network is, which ports to be used) had to be addressed in communication between various stakeholders in KUM.

The test period was then extended as several questions had arisen regarding the implementation of the study. This allowed the fixing of some minor bugs and improvements in patient and nurse onboarding processes (such as updated patient flyers, improvement of app layout). Most of all the formerly supportive staff in the wards in KUM were in some cases annoyed by the constant delays and the perspective of increased workload through the study. To regain the support of the nursing staff, the study team thus decided to remove the step counters from the study objective and to instead rely on a comparison of nurse call system log data and the digital communication system's log data to estimate a proxy for the walking distance saved. With that decision, the control period could be removed from the study timeline, with the interviews prior to system use being conducted at the beginning of the implementation phase. Furthermore, the nurse satisfaction questionnaires before and after the study were shortened slightly. The User Experience Questionnaire for nurses was cut from 24 questions in the standard form to 7 most relevant questions in our case, as nurses refused to fill out the full form.

A respective test for the function of the aforementioned proxy for walking distance was conducted in DMM with a proprietary analysis dashboard, that showed that patients using the digital communication system used the nurse call system 90% less than before for requests involving a required item (such as a cool pack, glass of water etc.) that had to be fetched. Consequently, the distance saved averaging the distance from station room to patient room and the number of requests could be estimated during test runs.

The largest problem, already identified during the test period, was the demographic category and health state of patients in the general station of KUM. While nurses were eager to participate and the active users on both sides content with the system, there were too few able patients to allow for large enough sample sizes. In the private station at KUM, the use of the system was unnecessary to nurses and patients, as the personnel endowment of the station is over-average, with several service staff on shift, as well as a nurse call system with talk-back capability functional and in use. Consequently, only three patients from the general station at KUM participated in the study while no patients at all participated in the private station up to date. With numbers being slightly higher in the test period at the general station, the team is positive that a few more response will be gathered during the remaining weeks. Qualitative nurse feedback in both cases however was positive. As the Cliniserve team had already made good experiences with patient and nurse adoption of the system at the second development partner, DMM, the decision was made to expand the study to a surgical general station at DMM. As the study material, questionnaires and setup also had to go through approval at DMM, the studies implementation period has just started there.

During the constant deployment of the system at DMM during the preceding weeks, on average 7 patients used the system. The patients submitted 3 requests on average per day, which contradicts the worry that patients would use the system to send inappropriate amounts of requests to nurses. On the contrary, nurses stated that they believed patients substituted the digital system for non-urgent requests one to one. As data shows, patients still filed on average 10% of their requests through the nurse call system, indicating they still used it for urgent matters or emergencies.

Initial results of the first study phases as well as qualitative insights are as follows:

Up to date the team received 10 pre-implementation questionnaires by nurses. To the question of how nurses currently receive patients' requests, 100% responded that this happens predominantly through the nurse call system. To the question on how unnecessary walking could be avoided, 70% of nurses responded that this could be achieved with better communication solutions on behalf of the patient and 30% of nurses responded that this could be achieved with better communication solutions in general. These questions indicate that there is a need for a communication solution adjacent to the nurse call system to save walking effort.

Up to date the team received three post-implementation patient questionnaires. The age of the participants ranged from 31 up to 56. The length of stay was between six and 85 days. In average they used the Cliniserve System four times per day. The nurse call system was used less. Based on the three current User Experience Questionnaires, the following results can be drawn:

(1) The digital communication system is very intuitive and easy to use - all patients agreed fully with understanding what the system was for and how to use it. In the User Experience Questionnaire, patients stated that the system was "understandable", "easy to learn", "easy" and not "confusing".

(2) The digital communication system is innovative - all patients stated in the User Experience Questionnaire that it is "novel" and "innovative".

(3) The digital communication system is useful - all patients stated that it is a rather easy to understand supplement to the nurse call system and that it makes the stay more comfortable (2 out of 3). In the User Experience Questionnaire, patients stated that it is "supporting" and "efficient".

Nurses frequently had very positive feedback for the systems design and functionality. As it did not cause them additional effort but saved work or time by delegation or by avoiding double walking distances, every actual use of the system constituted a positive experience.

"Cliniserve saves me double walking with every request as I already know what the patient needs" (Nurse, DMM)

"Because I already know what the patient wants, I can better prioritize" (Nurse, KUM)

Patients using the system often pointed out the convenience of not having to decide whether a request was urgent enough to activate the nurse call system and that they felt that it positively impacted their relationship with nurses.

"I wrote the management a letter, because I like the system so much. It's so much nicer to use Cliniserve to contact the staff than to ring the bell" (Patient, KUM)

"The system gave me freedom and security when I was tied to bed after surgery." (Patient, DMM)

V. Discussion

To increase the service level of patients during hospital stays and at the same time to reduce the workload on nurses, the use of digital technology seems to be an important step. The study so far indicates that both nurses and patients welcome digital solutions that provide them with an immediate benefit and do not cost them extra time.

During the upcoming weeks and with the additional input from DMM ward's patients and nurses, the study team is confident that a large enough sample size will be obtained to derive meaningful results from the following analysis period. As described in section III, the comparison of nurse call system log data and the digital communication system's log data from all wards, which in case of KUM is yet to be obtained from the technical personnel, is expected to provide a first proxy for whether the system saves the staff walking distance. The log data of the new solution furthermore provides insights into the workload nurses face during their shifts. It also provides learnings on the patients' behavior and needs, allowing hospitals to further optimize their patient service. In the long run, the data could be used to dynamically optimize shift planning in wards.

A critical question is, at what point patients in most stations will be able to use their own personal devices, as this is the most limiting part in the study. This usage rate also varies greatly by station type, but ideally a communication system would be able to service all types of stations, with patients with dementia or severe medical conditions always being unable to participate. The Cliniserve team is thus currently testing the use of pre-installed tablets and voice UI assistants in elderly care facilities, with the goal of finding out whether these systems have the potential to increase the number of users.

Whether the system should be extended to other areas of application must be examined in further studies. Interestingly, nurses started submitting requests for new features during the use of the system. For example, nurses wanted to have the possibility to write patients short messages through the system. They also wanted to set reminders for themselves, concerning appointments or tasks. First developments for example include the addition of steering transport services of patients to surgeries. Measuring nurses walking distance explicitly with step counters could add interesting quantitative insights.

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