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Acceptance of a Mobile Application Supporting Nurses Workflow at Patient Bedside: Results from a Pilot Study

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Abstract. Supporting caregivers' workflow with mobile applications (apps) is a growing trend. At the bedside, apps can provide new ways to support the documentation process rather than using a desktop computer in a nursing office. Although these applications show potential, few existing reports have studied the real impact of such solutions. At the University Hospitals of Geneva, we developed BEDside Mobility, a mobile application supporting nurses' daily workflow. In a pilot study, the app was trialed in two wards for a period of one month. We collected data of the actual usage of the app and asked the users to complete a tailored technology acceptance model questionnaire at the end of the study period. Results show that participation remain stable with time with participants using in average the tool for almost 29 minutes per day. The technology acceptance questionnaires revealed a high usability of the app and good promotion from the institution although users did not perceive any increase in productivity. Overall, intent of use was divergent between promoters and antagonist. Furthermore, some participants considered the tool as an addition to their workload. This evaluation underlines the importance of helping all end users perceive the benefits of a new intervention since coworkers strong influence each other.

Keywords. mHealth, nursing, technology acceptance

1. Introduction

The evolution of medicine and of clinical practice, associated to the increase use of computers in healthcare institutions has led to an increase amount of documentation. As a consequence, studies report that up to 30% of a caregivers' time is dedicated to documentation [1]. Although this increased documentation has benefits for the quality of care and patient safety [2], this task is often completed in a nursing office away from the patient. Besides reducing the time spent with the patient [3], performing this documentation away from the patient can generate problems such as delays and transcription errors [4]. Solutions such as computers on wheel have been developed to

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provide access to electronic health record at the patient's bedside but are not always adapted to every environment.

Mobile devices have the potential to offer ubiquitous access to patient information and to facilitate clinical documentation at the bedside. However, the development of a mobile app adapted to the high complexity environment of healthcare is a challenge [5]. The small device size and the tactile interaction paradigm require one to reconsider the best way to provide information. More importantly, introducing a new device at the point of care requires adapting the existing workflow to optimize the new possibilities offered.

We developed the BEDside mobility app to support documentation of nurses at bedside using a user-centered approach. The app provides an integrated view of all the daily tasks that need to be performed by nurses during their shifts. The app offers an easy access to record vital signs and hydration balance and to assess clinical scales. The app is connected to the hospital's clinical information system and automatically syncs all the information entered via the app with the patients' medical files in real time.

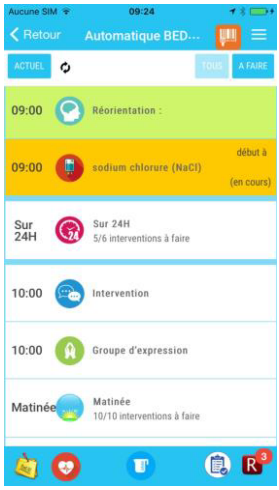

Figure 1 Main screen of the BEDside Mobility app

Independently of its quality, the success of the system is strongly linked to its acceptance in real life practice [6]. In this paper, we report the evaluation of the bedside mobility app based on its usage and acceptance during a one-month pilot study in two wards.

2. Method

The study took place in a surgical ward and a medical ward at the University Hospitals of Geneva. Each ward had about 18 beds.

The app was provided to the participants on institutional smartphones that were an additional to the unit's usual cell phone(s). The app usage was restricted to weekdays from 7 a.m. to 18 p.m. in order to ensure technical support in case of problems.

Participation in the study was on a voluntary basis. Most ward nurses and nursing assistants received a short training about the functionalities of the tool during the week prior to the beginning of the study. The participants were informed that the use of the app was encouraged, but not compulsory during the study. During the whole study, the

investigators conducted frequent visits to the wards to collect feedback from the users, in particular for bugs and suggestions for improvement. These findings were forwarded to the IT team, who corrected the bugs and added minor improvements when possible.

In order to evaluate the usage of the tool by the participants, all actions of the participants in the app were automatically logged by the device for analysis. Moreover, participants were asked to fill in a tailored technology acceptance questionnaire at the end of the study. Neither the participation in the study nor the completion of the questionnaire were compulsory. Our questionnaire was derived from the unified theory of acceptance and use of technology (UTAUT) [7] and was modified to fit in our particular setting. It contained 21 questions with a 7-point Likert scale, which were divided into 5 dimensions: performance (efficiency) (4 questions), effort expectancy (4 questions), social influence (4 questions), facilitating conditions (4 questions) and behavioral intention to use the system in the future (3 questions). Perceived usage during the study and open remarks were also recorded.

3. Results

3.1. Usage

The study in the surgical unit took place from July 3 to July 31, 2017 in the surgical ward and from the August 14 to the September 8, 2017 in the medical ward. During the study period, 27 nurses and nursing assistants used the app 427 times in the surgical ward and 23 participants used the app 239 times in the medical ward.

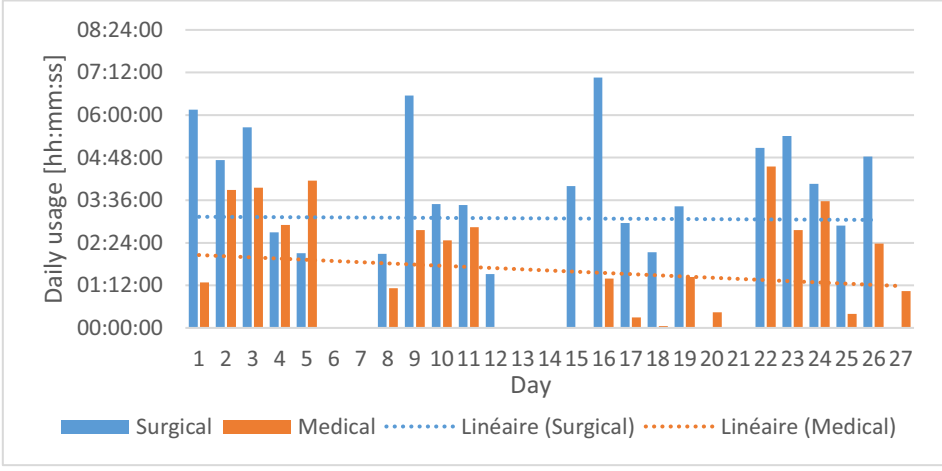

Figure 2. Daily usage of the app in the two wards during the study period

Figure 2 shows the daily duration of app usage in the two wards. We observe in the histogram that the app is not used during the weekend. The graphs also shows a lower utilization during the third week in the medical ward. Overall, the tendency of app use in the surgical ward is stable whereas it decreases in the medical ward.

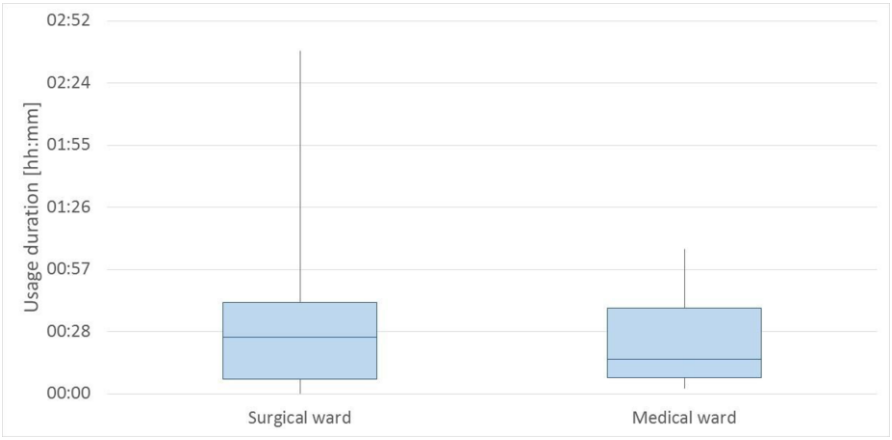

Figure 3. Boxplot of daily usage duration (in minutes) of the BEDside mobility app in the two wards

Regarding the average daily duration of the app use in the ward, the average use duration is higher in the surgical ward although the third quartile were similar in both wards.

3.2. Technology Acceptance

Our tailored UTAUT questionnaires were completed on a voluntary basis. In total, in the two wards 16 care-providers (8 in each ward) responded to the questionnaire. Responders were between 25 and 58 years old (mean of 37 yo.)

Table 1. Mean and standard deviation in the 5 dimension of our tailored UTAUT questionnaire (7-point likert scale)

	Performance	Effort	Influence	Condition	Intention
MEAN	3.7	5.6	5.4	4.7	4.3
SDT	1.8	1.4	1.3	1.7	2.3

The questionnaire results revealed that the application has been considered easy to use with a mean score of 5.6 for the effort dimension. Regarding the promotion of the app usage, the one done by the institution has been judged satisfactory with a mean of 5.4. Although the influence of the hierarchy was recognized, the influence of coworkers was evaluated as weaker (3.9 vs 5.9)

The conditions facilitating the usage have also been considered adequate with an average score of 4.7. The weakest score is related to the performance dimension with a mean score of 3.7. The question “Do you think the BEDside app increased your productivity?” got the lowest score with an average of 3. Intention to use the app in the future obtained an average score of 4.5.

3.3. Other observations

Reported problems during and at the end of the study concerned mostly four topics: connectivity problems, customization, missing functionalities and difficulty to integrate the app into the existing workflow.

4. Discussion

The analysis of the Technology acceptance results suggests that good usability and active institutional promotion of an app are not sufficient to enforce its acceptance.

In the social influence dimension, it is interesting that despite recognizing the active promotion of the app by the institution, care-providers weren't positively influenced by their co-workers. The low final intent to use the app suggests that co-workers may be the real influencers for use. Considering the diffusion of innovations theory, these findings suggest that those who resist change (i.e. late majority or laggards) could potentially negatively affect early adopters. Therefore resistant co-workers should perhaps not be neglected when trying to implement new processes.

Finally our results suggest that perceiving an increase of productivity is a critical point in fostering the adoption of a new tool. This is not a simple issue for complex tools with a long learning curve that only reveal their full potential when fully integrated into the workflow. Users were asked to verify the accuracy of data entry in the EHR as safety measure with this new tool, which probably contributed to the productivity score.

The participants' additional observations highlight some of the challenges of integrating mobile tools to support nursing practices. Care providers already have a very busy schedule and introducing a new tool can potentially increase their workload, even if only temporarily. Connectivity problems should be also handled with care. In our case, most of them were linked to the suboptimal coverage of the existing Wi-Fi. Customization within the app was also a common request. For example, the variability of the amount and type of collected patient information adds a challenge to the design of the entry interface, which needs to be adapted to each context and each patient.

5. Conclusion

We recommend providing a highly responsive support team when you release a new tool in a hospital ward. Requests and concerns must be answered clearly to avoid developing negative feelings. And the strong influence of coworkers in the adoption of new tools underline the importance of not leaving the resisting individuals aside in the process.

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