Scientific Research Project Proposal

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Title
Supporting Nurses through Continuous Vital Sign Monitoring during Ward Admission: A Pilot Study with a remote monitoring device (SmartQare ViQtor) at Amsterdam UMC

Location of the SRP Project
Amsterdam UMC, location AMC – Acute Admission Unit (Division 1), in collaboration with the Department of Clinical Informatics (KIK)

Introduction
Rising healthcare costs, a growing population of elderly people, and persistent staff shortages in healthcare emphasize the need to better distribute the care burden across the healthcare system [12]. Devices and tools for continuous monitoring of vital signs could play a major role in this and are being developed rapidly. Where other hospitals have already tested continuous monitoring and sometimes implemented it in their standard care, Amsterdam UMC is only at the start of a pilot study.
For patients admitted to the general ward, vital signs (such as pulse, respiratory rate, and temperature) are generally measured once per shift and documented in the so-called MEWS (Modified Early Warning Score) [1]. The resulting score provides information about the patient's clinical status and possible deterioration. However, this intermittent measurement, with intervals of 4–12 hours depending on the patient's clinical situation, carries the risk that deterioration of the patient's clinical condition is not recognized immediately [2]. In addition, respiratory rate is known to be one of the most important predictors of clinical deterioration in patients admitted to the general ward [3, 4], while measurement of this vital parameter is often inaccurate [5–7].
It has been demonstrated that the use of continuous monitoring with wearable sensors is feasible on general wards [8, 9] and can be cost-effective [10], but the clinical outcomes remain unclear [8, 9]. Nevertheless, the first large studies on general wards show that the use of continuous monitoring leads to a reduction in ICU admissions and rapid response team calls [8, 11].
At the same time, current staff shortages and the outflow of nurses emphasize the importance of research into the optimal deployment and organization of nursing care [12]. In this context, it is important that nurses actually feel supported by technological innovations in their work. A smart patch that continuously monitors several vital parameters and sends a notification when threshold values are exceeded could help nurses in their tasks and ensure that more time remains available for other care tasks. However, the influence of continuous monitoring on the nurse's work process has been studied only rarely, while it is of great importance for successful implementation [13, 14].

Description of the SRP Project/Problem
The primary aim of this pilot study is to investigate whether nurses are supported in their work process by using the remote monitoring device (SmartQare ViQtor) and its associated software. This support is operationalized as measuring the MEWS earlier than planned according to protocol. The hypothesis is that, by using the smart patch, nurses will perform the MEWS earlier than they would have done without the smart patch. This is regarded as support for the nurse, and the expectation is that this will eventually lead to improved clinical outcomes, because clinical deterioration can be detected earlier and treatment can be adjusted accordingly [8, 9]. In addition, it will be investigated whether clinical deterioration is actually detected by the patch, i.e., whether a

notification precedes clinical deterioration, defined as ICU transfer, rapid response (SIT) team call, confirmed infection, or death [15–17].
The study is designed as an observational pilot study with the ViQtor device. The ViQtor measures the patient's respiratory rate, pulse, skin temperature, Sp02 and activity level every five minutes and automatically sends these data to the electronic health record (EHR) and the Guardian App on the nurse's ZEBRA telephone, allowing trends in these vital signs to be viewed. When vital signs are above or below the threshold value (equal to the EWS threshold) for more than 20 minutes, nurses receive a notification in IQ-messenger on the ZEBRA telephone. Importantly, this is a notification, not an alarm. The notification is automatically forwarded to the EHR. After 14 days, discharge, or ICU transfer, monitoring is stopped.

The smart patch will be applied by nurses to patients admitted to the Acute Admission Department (location AMC). Patients are screened for suitability by the nurse, and the indication for applying the patch is based on the nurse's clinical judgment. Upon transfer to another ward within Division 1 (Internal Medicine, Infectious Diseases, Nephrology) within location AMC, the patient continues to wear the patch and monitoring is continued. A total of 30 patients will be included. Exclusion criteria include age under 18 years, allergy to surgical patches, an expected MRI scan during admission, severe skin abnormalities or open wounds at the application site, and existing non-wireless monitoring. Previous research has shown that the ViQtor is very user-friendly for patients and causes no discomfort [18].

The following data will be collected:

1. A short survey on patient experience with the device (appreciation and wearing comfort) in a subset (15–20) of patients;
2. Quantitative data from the EHR (for validation of the surveys): time points of MEWS measurements, time points of notifications from the smart patch, and whether clinical deterioration occurred (ICU transfer, SIT call, confirmed infection, or death);
3. A short survey completed by nurses after their shift with a patient wearing the smart patch;
4. In-depth interviews with nurses after completion of the pilot, to gain insight into their attitude towards the smart patch and their sense of support.

The intervention will be used in addition to standard care during the pilot study; no changes will be made to standard care, and the protocol for the frequency of MEWS measurement remains unchanged. The pilot is primarily a nursing innovation project (an already approved wearables project at the Hematology department); the scientific evaluation is secondary.
Statistical analyses include descriptive statistics of the survey results and of the sensor data (number of notifications, presence of a notification preceding clinical deterioration), and thematic analysis of the interview results.[14, 19, 20].

Research objective and research questions
Main: To what extent are nurses supported in their work process by the use of a smart patch (Philips Healthdot) for continuous vital sign monitoring during patient admission at the general ward?

Subquestions:

1. How often does continuous monitoring by the Healthdot lead to the MEWS being measured by nurses earlier than planned according to protocol?
2. How often does a notification from the smart patch precede clinical deterioration (ICU transfer, SIT call, confirmed infection, or death) by 24 and 48 hours?
3. What proportion of notifications is experienced as useful by nurses?

4. How do nurses experience the smart patch with regard to satisfaction (usefulness and ease of use), motivation, workload, autonomy, willingness to change, and the influence on their work process, and what are the barriers and facilitators for adoption?
5. How do patients experience wearing the smart patch (appreciation and wearing comfort)?

Expected results

A thesis describing:

1. Insight into the degree to which the ViQtor device supports nurses in their work process, operationalized as the frequency of earlier-than-planned MEWS measurements.
2. Insight into the proportion of notifications that precede clinical deterioration (24 and 48 hours) and the proportion of notifications experienced as useful by nurses.
3. A qualitative understanding of nurses' experiences with the smart patch, including barriers and facilitators for adoption (thematic analysis).
4. Insight into patient experiences with the smart patch (appreciation and wearing comfort).
5. Recommendations for further implementation and optimization of continuous vital sign monitoring with the smart patch within Amsterdam UMC.

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