Caring is Sharing – Exploiting the Value in Data for Health and Innovation
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Implementing Remote Patient Monitoring for Patients During Systemic Cancer Therapy

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Abstract. Mobile monitoring of outpatients during cancer therapy becomes possible through technological advancements. This study leveraged a new remote patient monitoring app for in-between systemic therapy sessions. Patients' evaluation showed that the handling is feasible. Clinical implementation must consider an adaptive development cycle for reliable operations.

Keywords. bwHealthApp, Chronic disease, Digital health integration, mHealth

1. Introduction

Remote Patient Monitoring (RPM) has the potential to support personalized cancer therapy monitoring outside of hospitals using wearables to capture outpatients' vital signs continuously [1]. Making RPM available for patient care needs the integration of a software platform into clinical processes. In this work a suitable setting is proposed, and its principal applicability is verified in a pilot study.

2. Methods

The bwHealthApp is used to capture data and patient-reported outcomes.[2] It consists of an Android app for the patients' smartphones and a backend server receiving the recorded data via encrypted communication. Doctors manage patients and data via a web interface. Commercial wearables can be connected to the app via Bluetooth Low Energy. Currently a wrist and an in-ear sensor are supplied for heart rate, temperature, oxygen saturation, and step count. The patient can fill out individually scheduled questionnaires and report personal relevant events. A new patient-centered process for RPM was defined and

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[2] See details at https://bwhealthapp.reutlingen-university.de/page/home.

implemented at an oncology day clinic at the University Hospital Tübingen (Fig. 1). Its applicability for users and its practicability of data management was verified with 32 oncological outpatients during cancer treatment from July to November 2022.[3]

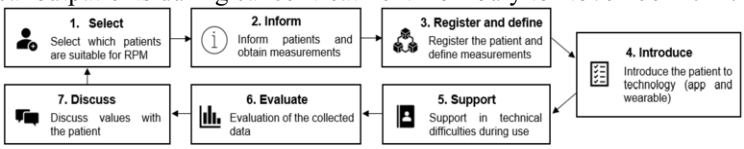

Figure 1. Clinical process for RPM using the bwHealthApp.

After registration and introduction, oncological outpatients should use the app and a wearable for one month. During the first use of the app, participants were observed and interviewed conducting standardized tasks. The actual frequency of use was evaluated, and the system operations for user feedback and software maintenance were examined.

3. Results and Conclusions

During the study, over 20 million values from all subjects were collected. On average, each of the 32 patients generated more than 20.000 data points daily. The frequency of usage was, on average, 14.06 days (SD = 9.35 d) for questionnaires or events and 18.56 days for wearable measures (SD =11.06 d). 14 of 32 patients needed assistance using the bwHealthApp system for the first time. However, 28 of 32 patients stated they had solved at least one task well. Critical comments on the handling of the wearables were expressed by only four participants. Feedback regarding the usability of the app was given. During the period of the study, four releases of the bwHealthApp platform were provided. They consisted of 36 commits for the app and 26 commits for the backend server. The commits included adaptions of user and patient management as well as bug fixes.

The app was, on average, used for half of the observation period. Though individual adherence differed notably. This must be considered in the clinical process, as extended support is needed. The activity of over-average users indicates a willingness to manage technical pitfalls such as battery life despite high symptom burden. During operations, the evolution of the system according to user feedback is possible without limitations based on a suitable DevOps infrastructure. The study showed that ongoing RPM during cancer therapy in times of personalized medicine is feasible but requires a viable integration into the clinical process. For further development and clinical application, feedback on longer use and clinical analysis of the recorded data is needed.

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[3] Ethical approval received from the University of Tübingen (no. 046/2022BO1), chair Prof. Jaschonek.