MEDINFO 2023 — The Future Is Accessible
J. Bichel-Findlay et al. (Eds.)

doi:10.3233/SHTI231006

PD-Buddy: A Feasibility Study of Mobile Health to Support the Management of Peritoneal Dialysis

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Abstract. People experiencing peritoneal dialysis (PD) are expected to document considerable clinical information at home, yet timely and accurate data collection, and sharing of data with their health team is associated with challenges. Mobile health technologies present an opportunity to bridge home and hospital care. PD-Buddy is a novel smartphone and web-based platform which guides people experiencing PD through their dialysis treatment. The platform was tested in a feasibility study with (n=33) people attending a Peritoneal Dialysis Clinic in Brisbane, Australia. The study evaluated adoption and satisfaction of the system among users (patients and clinicians), as well as infection rates. Findings indicate PD-Buddy to be a user-friendly solution that could expand access to, and improve, the quality of healthcare for people experiencing PD. It could reduce burdens for regional and remote populations, such as travelling to receive specialty care, and improve monitoring, timeliness, and communications with and within their care teams.

Keywords. mHealth, kidney disease, chronic health, dialysis, patient experience

1. Introduction

Peritoneal dialysis (PD) is now widely accepted as safe and effective renal replacement therapy (RRT) in people with end stage kidney disease. Data suggest that PD results in better preservation of residual kidney function (RKF) as compared to haemodialysis (HD) in the initial years of therapy, [1] better quality of life with less disease intrusion, higher satisfaction, and the ability to travel [2,3]. As PD is a home-based therapy, adherence to treatment is of paramount importance as non-adherence has been shown to have major consequences including an increased risk of mortality, hospitalization, and health care costs [4,5].

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As part of the PD process, people experiencing PD are expected to document considerable clinical information at home including weight, blood glucose levels, blood pressure (BP), their PD regimen, and ultrafiltration volume (UV) (fluid removed during PD). Traditional management methods typically include the use of a paper-based exercise book for record keeping. However, this approach is associated with numerous challenges as people with PD needs juggle the competing priorities of everyday life with detailed health record-keeping, and the timely and accurate sharing of their data with their health providers.

Mobile health technologies are becoming increasingly common to support the management of chronic conditions, particularly as they present an opportunity to bridge home and hospital care. Leveraging from a validated design [6] that links post heart attack patients to clinicians throughout a smartphone-based cardiac rehabilitation program, PD-Buddy, a smartphone application (app) and Internet-based interactive platform, was developed to accompany and guide people experiencing PD through every step of their dialysis journey by monitoring health measures, providing educational multimedia and assisting in their appointment scheduling and medication management.

The PD-Buddy platform was developed through a collaboration between Metro South Hospital and Health Service (Logan Hospital) and the CSIRO. The design was conceived to enable clinicians to provide timely interventions when appropriate and reduce unnecessary visits to the PD clinic. The project team hypothesized that the PD-Buddy platform would support not only the people on PD at home, but also health providers, thereby facilitating more efficient health service delivery. The aim of this study was therefore to evaluate the adoption and satisfaction of both patient and clinicians involved in PD and determine if the platform would be suitable for future implementation.

2. Methods

2.1. Study Design

This study included a user consultation and co-development phase to determine user needs and values and inform platform development. The resulting feasibility study focused on user adoption and satisfaction of the platform, informed by patient and clinician experience surveys. Secondary outcomes included the number of recorded PD peritonitis and exit site infection rates.

2.2 PD-Buddy platform development (intervention)

The patient-facing app features data capture (ultra-filtration volume, BP, BGLs, weight, exercise, stress, symptoms, and medication) from the patient carrying their smartphone throughout the day. The app provides visual (graphical) and textual reports on entered data, and the entries automatically update to the web-based clinician dashboard. It also delivers motivational notifications and provides educational multimedia content (such as links to appropriate educational materials). The password protected, clinician dashboard enables health providers from different specialised disciplines to regularly assess their patient's progress and provide early care intervention as required. Data can similarly be reviewed by the health providers during PD clinic appointments to aid in discussions with patients. The patient profile is compiled through the clinician dashboard to ensure that each patient's app is tailored and individualized according to their specific needs. The PD-Buddy app is available through the App Store (iOS) and Play Store (Android). A username and password, needed to activate the app, are emailed (via the clinician dashboard) to an address accessible on the patient's smartphone. The PD-Buddy system is illustrated in Figure 1:

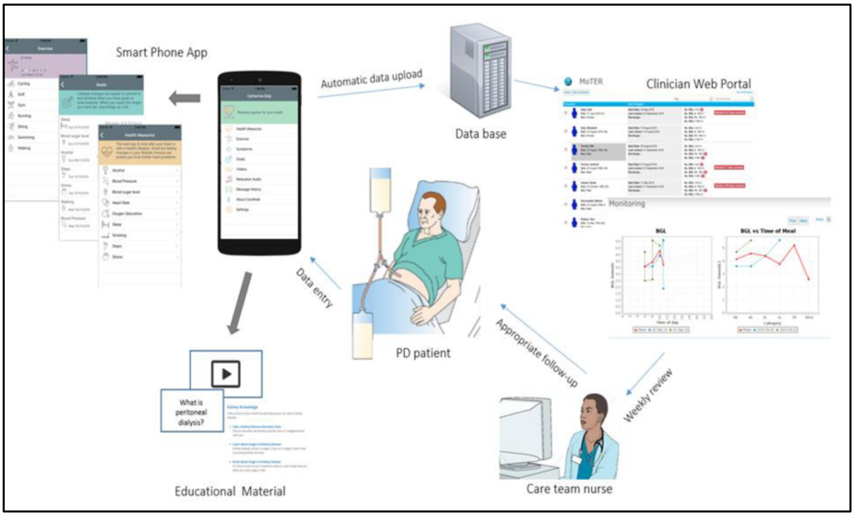

Figure 1. Schematic illustration of a PD-Buddy system.

2.3 Participants

The study aimed to recruit at least 30 patients for the feasibility study. All patients that met the inclusion criteria [a) undergoing PD at Logan Hospital, b) age 18+, c) owning and ability to use smartphone, d) ability (and willingness) to upload data either via WiFi or mobile data, and e) ability to read and converse in English] were invited by the PD clinic nurse to participate in the study. Those who had other co-morbidities that limited participation and/or a known history of major psychiatric illness were not eligible to participate. Signed consent was obtained for all interested participants and individuals who did not wish to be involved in the research were offered the routine care.

2.4 Data collection and analysis

All user satisfaction surveys to the patients in the study were administered with the assistance of their clinic nurse at 6 months, and clinician surveys delivered by CSIRO researchers at completion of the study. Historic data (for comparison number of infection cases) were obtained through retrospective analysis of an equivalent number of medical records for patients who had been on PD at 12 months prior to the start of the study and who were not included in the current study. Use of the PD-Buddy platform was determined by examining the frequency and features uploaded to the portal from patients' smartphones.

3. Results

A total of 33 patients from the PD clinic at Logan Hospital consented to participate in the study between June 2017 and July 2018. Males comprised 52%. Data extracted from the PD-Buddy portal showed a very high usage by the patients. The features most consistently used were the dialysis fluid exchange volumes (Automated Peritoneal Dialysis (APD) and Continuous Ambulatory Peritoneal Dialysis (CAPD)) with average entries varying from 19-23 per month over six months. Similarly, BP, weight and BGLs' were entered regularly. Other app entries included symptoms (ankle swelling/constipation/ dizziness/ drainage/ filling problems/ facial swelling/ itchiness/ nausea/ shortness of breath) and exercise (cycling/gym/running/walking). The ability to upload photos was utilised by 13 patients, with a total of 50 photos uploaded to the portal. Almost half of these were uploaded by two of the patients.

The patient evaluation survey was completed by 12 patients (75% of completers). A number of patients did not complete the survey due to being transferred to haemodialysis or other services (n=8) and also death (n=2). All respondents agreed that the app was easy and convenient to use, fitted well with their lifestyle, routine, and the way they manage their health. All respondents indicated that they would recommend the app to other people with kidney disease. The messages and educational links were found to be useful by the majority of users. Responses to the user satisfaction survey by clinicians indicated that all agreed the PD-Buddy dashboard was easy to use, improved their efficiency of caring for their patients and that the app was preferred over the paper-based record keeping. The majority believed that the PD-Buddy dashboard reduced the number of appointments their patients required.

The number of PD-related infections (peritonitis and ESI) was noteworthy lower (peritonitis app=6, no-app=27; ESI app=4, no-app=11) in the group of patients using the app compared to historical data. However, the results were not statistically significant, likely due to small sample size.

4. Discussion

This study explored the feasibility of a mobile health platform to support the management and facilitation of at-home PD treatment. The findings suggest PD-Buddy is a user-friendly solution that could support the quality of healthcare for people needing PD. While PD treatment is typically favored over haemodialysis, [7] it remains resource intensive for health services, and labor intensive for people with competing priorities and co-morbidities [8]. Alternate means of data collection and care-coordination are needed to achieve optimum care delivery, particularly for less privileged and/or marginalized populations [9]. Within Australia and other countries which experience geographic challenges in health care delivery, mobile health technologies present a valuable option in extending and complimenting health service delivery. Given its acceptance and adoption by both clinician and patient users, PD-Buddy could reduce burdens for regional and remote populations, such as travelling to receive specialty care, improvements to monitoring, timeliness, and communications with and within care teams. Currently, the PD-Buddy platform remains active within the Logan hospital, a demonstration of its acceptance and the demand for innovative solutions in PD management. A priority for future research will be understanding if and how the platform could be improved and extended to support culturally-specific and geographically distributed care delivery.

5. Conclusions

This study contributes to the growing evidence supporting the acceptability of digital innovation in the context of PD. It also showcases the value of co-creation in the development of mobile health solutions, with high levels of data capture and acceptability by all participants likely a result of considered consultation. Future iterations of PD-Buddy and other platforms should prioritize culturally, linguistically and geographically diverse populations in their co-creation phases to extend the reach of care.

Acknowledgements

The research team would like to acknowledge the participants and their families for their generous feedback and co-operation in facilitating this research.

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