Mobile Technology Affinity in Renal Transplant Recipients

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ABSTRACT

Background. Medication nonadherence is a common problem in renal transplant recipients (RTRs). Mobile health approaches to improve medication adherence are a current trend, and several medication adherence apps are available. However, it is unknown whether RTRs use these technologies and to what extent. In the present study, the mobile technology affinity of RTRs was analyzed. We hypothesized significant age differences in mobile technology affinity and that mobile technology affinity is associated with better cognitive functioning as well as higher educational level.

Methods. A total of 109 RTRs (63% male) participated in the cross-sectional study, with an overall mean age of 51.8 ± 14.2 years. The study included the Technology Experience Questionnaire (TEQ) for the assessment of mobile technology affinity, a cognitive test battery, and sociodemographic data.

Results. Overall, 57.4% of the patients used a smartphone or tablet and almost 45% used apps. The TEQ sum score was 20.9 in a possible range from 6 (no affinity to technology) to 30 (very high affinity). Younger patients had significantly higher scores in mobile technology affinity. The only significant gender difference was found in having fun with using electronic devices: Men enjoyed technology more than women did. Mobile technology affinity was positively associated with cognitive functioning and educational level.

Conclusions. Young adult patients might profit most from mobile health approaches. Furthermore, high educational level and normal cognitive functioning promote mobile technology affinity. This should be kept in mind when designing mobile technology health (mHealth) interventions for RTRs. For beneficial mHealth interventions, further research on potential barriers and desired technologic features is necessary to adapt apps to patients' needs.

Every year ~2,100 kidney transplantations are performed in Germany [1]. Despite the long waiting time and the significant symptom relief following successful transplantation, medication nonadherence to the complex and strenuous immunosuppressive medication regimen is a main problem in the aftermath, not just in renal transplant recipients but in all types of solid organ transplantation [2–10]. Nonadherence in renal transplant recipients (RTRs) is estimated to be 35.6% per year, and transplant rejection and loss due to nonadherence are common [4].

One central question after transplantation is how to improve nonadherence once identified. Several studies suggest that mobile technology health (mHealth) interventions might be a good way to maintain or, if necessary,

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improve adherence [11–14]. However, other studies fail to prove increased adherence due to mHealth interventions [10,15]. These heterogeneous findings might be due to differences of mobile technology affinity in different patient samples. Mobile technology affinity describes the manifestation and extent of interest in and preferences toward mobile technologies, such as smartphones and tablets. Until now, it is unclear how pronounced mobile technology affinity in RTRs is, which patients are the users of mobile technologies, and which groups of patients therefore might benefit from mHealth interventions. According to McGillicuddy et al [11], only a small number (7%) knew of the opportunity to use a mobile device for monitoring their medications, but almost 80% stated a positive attitude toward an mHealth intervention if it was free [11]. Analyzing technology-using behavior in RTRs is the first step to find out which patients can be reached by mHealth interventions. Except for one Chinese study from 2016, there have been no studies focusing on mobile technology affinity in RTRs. In a sample of 94 living-donor RTRs, Zhu et al [16] explored use of smartphones and apps to manage the immunosuppressive medication regime: 24.5% of the participants used smartphone apps, especially young patients and those with a high educational level; overall, 91.5% owned a smartphone, and more than one-half were willing to use smartphone apps for medication management [16]. In the iNephro initiative, Becker et al [14] analyzed users of the free iPhone app "Medikamentenplan" ("Medication Plan") regarding demographic data and time and frequency of app use. The aims were to identify target groups for medication adherence apps and, in the long run, to see how an app can improve regular and timely medication intake. The majority of the users were middle-aged and male. However, only 13% ($n = 292$) were patients after transplantation (eg, kidney and/or liver) [14].

mHealth approaches are of fundamental importance owing to the progressing technologization of not only individual life styles and environments, but also of health care services: Worldwide there were >3.4 billion internet users in 2016, with numbers rapidly growing over the years [17]; in Germany, ~70% of the population uses the internet [18] with an almost equal gender distribution [19]. In a study among psychosomatic patients, 74% had access to the internet at home and 60% actually used the web to search for health-related information [20]. As for mobile technology, ~47% of the people worldwide used a smartphone in 2016; for 2020 it is estimated that the rate will be 57.7% [21]. The number of smartphone users in Germany grows similarly; currently there are 49 million people using smartphones (~60.5%) [22]. Smartphones also get increasingly important for patients' self-management in chronic diseases of various kinds [23]. Silva et al estimate that ~1.7 billion people worldwide will have downloaded health-related smartphone application, including apps for self-monitoring and medication control [24].

The idea of implementing electronic support for multidrug-using patients has top priority these days. In addition to lower costs, electronic health records provide more efficiency and safety in data management and individual patient care [24]. In December 2015, the German government passed a new law concerning safe digital communication and applications in the health care system, the "E-Health-Gesetz" [25]. Because drug interactions still cause many deaths, this law demands that patients who take ≥3 different drugs receive a proper medication plan by their attending physician (since October 2016). Moreover, the physician is obliged to inform the patient about this legal claim for a medication plan. Starting in 2018, the medication plan needs to be provided on the electronic health card ("Gesundheitskarte") [26,27]. This part of the E-Health-Gesetz is particularly relevant for patients after transplantation, because they need to take at least 2 or 3 different immunosuppressive medications. Based on the electronic medication plan, a next step could be to import the provided data into a smartphone app to support the patient's timely and correct medication intake.

The aim of the present study was to answer the following questions: Do RTRs in Germany use mobile technologies, such as smartphones, tablets, etc., and to what extent? Can groups of patients be specified that profit from mHealth interventions? We hypothesized significant differences in age, educational level, and cognitive capacity regarding technology affinity and expected study participants of younger age, better cognitive functioning, and higher education to show higher levels of technology affinity [16].

METHODS

Sample Description and Procedure

This cross-sectional study was conducted at the University Hospitals of Erlangen and Cologne, Germany. Institutional Ethics Boards in both participating institutions gave approval. Written informed consents were obtained from all participants. Potential study participants—adult RTRs—were recruited via telephone call before or face-to-face during a follow-up care appointment ($n = 147$).

The following inclusion criteria were established: age ≥18 years, consent to participate, ≥6 months after transplantation, and no nonrenal allografts. Exclusion criteria were mental disability and insufficient German language skills.

Consenting patients received a written study description and the self-report questionnaire via mail. After completion at home, the participants brought the questionnaire to their follow-up visit, in which they underwent an examination of cognitive function. Overall, 121 patients agreed to participate, and 114 completed the questionnaire (Erlangen: $n = 76$; Cologne: $n = 38$).

Measures

Sociodemographic Variables and Transplant-Related Data. Sociodemographic data were collected by means of a questionnaire, including sex, age, family status, and educational level. Educational level was measured as the highest achieved German (or foreign equivalent) school-leaving certificate (8-9 years, 10 years, or ≥12 years of school).

Technology Experience Questionnaire. The first 6 items of the Technology Experience Questionnaire (TEQ; abbreviated version adapted from Becker et al [14]) are rated on a 5-point