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Technology acceptance and actual use of the Medical-Dashboard eHealth application in kidney transplant recipients

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Abstract

Background The integration of a new eHealth self-monitoring application (e.g., monitoring blood pressure, weight, temperature and steps), can help kidney transplant recipients and health care providers tracking important health information the first year after transplantation. However, whether patients with chronic kidney disease actually use internet-delivered interventions is still an underexplored area of research.

Purpose This study examines the influence of self-efficacy, transplant worries, ease of use and usefulness on the actual usage of the Medical Dashboard (MD) eHealth technology. Additionally, the effect of self-efficacy on perceived ease of use and transplant worries on perceived usefulness will be assessed.

Method A prospective questionnaire study was conducted at the Leiden University Medical Centre (LUMC) with a sample of 23 transplant recipients. The Technology Acceptance Model (TAM) was used to explain the possible predictors of usage. Furthermore two additional factors, self-efficacy and transplant worries were added to the model.

Results Higher levels of self-efficacy, transplant worries, perceived ease of use and perceived usefulness did not result in higher levels of actual usage. Additionally, self-efficacy was not associated with the perceived ease of use of the MD. Patients with higher levels of transplant worries did perceive the MD as more useful than less worrisome patients.

Conclusions The current version of the TAM is not yet able to predict actual usage of the MD eHealth technology. Future eHealth studies should improve the predictive ability of the TAM by sufficiently tailoring the model to the health-care setting. For instance, incorporate social and organizational factors such as professional support or personal feedback. Second, self-efficacy regarding self-management had no effect on perceived ease of use. Finally, recipients

experiencing higher levels of transplant related worries might benefit most from the MD eHealth application.

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BACKGROUND

Kidney function & End Stage Renal Disease

The role of kidneys is very broad and has various effects on the human body. For instance, it includes excretion and filtration of the nitrogenous wastes generated by the body each day, and it regulates the conservation of homeostasis in the form of fluid /electrolyte balance (Boyer & Paharia, 2008; Junqueira & J. Carneiro, 2007; Nierstichting, 2015; The National Institute of Diabetes and Digestive and Kidney Diseases, 2015). Moreover, the kidneys release hormones to regulate blood pressure and stimulate bone marrow to produce red blood cells (Amir & Winchester as cited in Boyer and Paharia, 2008; Junqueira & J. Carneiro, 2007; NIDDK, 2015; Nierstichting, 2015). However, when the kidneys do not function in a normal way, we can speak of chronic kidney disease (Boyer & Paharia, 2008). Chronic kidney disease (CKD) can progress to the most severe form: End-stage Renal Disease (ESRD). Treatment is then needed to replace renal function, because of irreversible atrophy of the kidneys (Haynes & Winearls, 2010; Roderick, 2002).

Unfortunately, the burden of kidney disease is growing. The NIDDK (2015) states that in the US one in ten American adults, more than 20 million people, have a level of CKD. Besides the high prevalence of CKD and ESRD highly prevalent, the diseased are also expensive to treat. In 2009 the expenses on ESRD patients in the United States were more than $40 billion (NIDDK, 2015). A major reason for the high costs related to CKD and ESRD is the expensive renal replacement therapy (RTT), a treatment which includes dialysis and transplantation.

Treatment

RTT mostly involves dialysis for treating ESRD of which the most common forms are hemodialysis (HD) and peritoneal dialysis (PD). HD comprises complex processes; it

involves an dialyzer wherein the patient's blood is exchanged through a semipermeable membrane. A connection is made between the dialyzer and the body of the patient arteriovenous (connection between a vein and an artery) or through a catheter (Boyer & Paharia, 2008). According to the NIDDK (2015), patients can also choose for home HD besides in-center HD. Home HD involves a smaller machine that is easier to use and has many benefits. PD involves a surgical placement of an intra-abdominal catheter and exchanges can also take place at home, four or five times a day or at night. Some patients decide to use PD because it is less intrusive on their lives than HD, besides, when PD is conducted at home, patients state to feel more free (Boyer & Paharia, 2008).

Another form of RTT involves renal transplantation. Compared to the different forms of dialysis, transplantation is more cost-effective, provides a higher state of well-being and increases the long-term survival (Davis & Delmonico, 2005). However, there are downsides to this type of treatment, because renal transplantation is an invasive surgical procedure and not always successful. Patients must be healthy enough to endure the operation and have to deal with the difficulties of long-term immunosuppressive medications and the risk of life-long kidney rejection (Boyer & Paharia, 2008). Moreover, RTT can have various effects on Health-related Quality of Life (HRQoL) of renal recipients.

Health-related Quality of Life and Anxiety

HRQoL is an important measure to consider in kidney patients because it reflects the wellbeing of an individual and the capability to function in daily life (Avramovic & Stefanovic, 2011). The World Health Organization (1948) defines HRQoL as a multidimensional and comprehensive measurement that is connected to the individual's health. However, a mixed positive and negative impact on Health-related Quality of Life (HRQoL) in kidney patients was found in previous literature. Several reviews (Avramovic &

Stefanovic, 2012; Liem, Bosch & Hunink, 2008) showed that the overall HRQoL is higher in renal transplant patients compared to dialysis patients. For instance, lower levels of distress and a higher psychological well-being was noted in transplant patients. Likewise, Griva and colleagues (2002) concluded that renal transplantation is attractive and helpful in largely restoring the HRQoL of ESRD-patients.

On the other hand, research suggests that a majority of patients worry about the viability of the transplant and the emotional responses to the transplantation. A reasonable number of studies (Látos et al., 2012; Pascazio et al., 2010; Pisanti et al., 2014) point toward the prevalence of significant negative emotions and transplant worries about allograft (organ tissue) dysfunction, in renal transplant recipients. These worries might negatively affect HRQoL (Griva et al., 2002). To keep functioning in daily life with all the various difficulties and demands of having ESRD, self-management is vital.

Self-management

Self-management demands for kidney patients are extensive. A prior review (Barlow, Wright, Sheasby, Turner & Hainsworth, 2002) defines self-management as: 'The individual's ability to manage the symptoms, treatment, physical and psychological consequences and life style changes inherent in living with a chronic condition'. Self-management is mandatory and requires extensive lifestyle restrictions of the kidney patient, such as strict dietary behavior, control over fluid and potassium intake, blood pressure and medication management (Ong, Jassal, Porter, Logan & Miller, 2013). In addition, managing one's disease includes (self)monitoring for rejection and infection in the first year after transplantation, and is of great importance (Boyer & Paharia, 2008). Examples are (self)monitoring of blood pressure, weight and temperature. Self-care behaviour (a dimension of self-management) can have a direct and positive influence of self on the quality of life in kidney transplant recipients

(Weng, Dai, Huang & Chiang, 2010).

Moreover, Self-management can be enhanced by health care workers in various ways, by teaching the patient problem-solving skills for instance. Accordingly, patients might learn how to take healthier decisions and actions (Bodenheimer, Lorig, Holman & Grumbach, 2002). Finally, the concept of self-management also includes active patient participation (Novak, Costantini, Schneider & Beanlands, 2013), which in turn is an essential feature of shared decision making (SDM) between patient and provider (Lorig & Holman, 2003).

Active patient participation and shared decision making

Patients who are actively engaged in their own care, experience better health outcomes, improvements in blood pressure, cholesterol levels and self-rated health status (Simmons, Wolever, Bechard & Snyderman, 2014). In their review, Simmons and colleagues (2014) defined patient engagement as: (1) understanding the importance of taking an active role in one's health; (2) having knowledge, skills, and confidence to manage health and chronic conditions; and (3) performing health-promoting behaviors.

Moreover, active patient engagement is important in making shared decisions and SDM can be seen as an element of patient-centered care (Brand & Stiggelbout, 2013). Elwyn and colleagues (2010) defined SDM as: 'An approach where clinicians and patients make decisions together using the best available evidence, where patients are encouraged to think and communicate about their preferences for selecting the best course of action'.

Currently, hospitals and other health care instances are trying to create opportunities to keep up with these new emerging trends by using for instance eHealth applications. Kamel and Wheeler state (as cited in Neuhauser & Kreps, 2010) there is a rapid rise of eHealth communication activities through computers and mobile phones. For instance in a web-based portal, which can empower patients to participate and communicate with their care providers

and to self-monitor symptoms in online diaries (Van der Vaart, Drossaert, De Heus, Taal & Van de Laar, 2013).

eHealth

eHealth involves several overlapping areas such as telemedicine, telehealth, and medical informatics (Neuhauser and Kreps, 2003) and strategies in eHealth include health information on the internet, support groups, computer-assisted learning, health interventions and apps. These new and innovative technologies provide opportunities to contribute to health care and make profounder contacts with clients and supporters, including clinicians and patients. (Neuhauser & Kreps, 2003). Diamantidis and Becker (2014) suggest that the integration of new health information technology (IT) platforms into the existing structures of health care for CKD can be an addition to the current strategies for improving health outcomes. For instance the integration of a new eHealth self-monitoring application (e.g., blood pressure), which enables transplant recipients and health care providers to track important health information (Smarr et al., 2011). Even though the number of eHealth interventions is increasing, in their review Kohl, Crutzen & de Vries (2013) stated that the use of internet-delivered interventions is still an underexplored area of research. For this reason it is important to evaluate new eHealth interventions and to question ourselves to which extend patients are able to cope with and accept new eHealth interventions.

Technology Acceptance Model

A method often used for evaluating the acceptance or rejection towards a new technology is the Technology Acceptance Model (TAM). This model (one example illustrated in Figure 1) is a widely used, reliable and predictive model that explains the possible behavioral intention to use a technical innovation (Davis, as cited in King & He, 2006). This behavioral intention is assumed to be predicted by two main convictions: perceived usefulness and perceived ease

of use of a technology (Davis, as cited in Sharp, 2007). Traditionally, the model suggests that a person is more likely to use an application when he or she believes it to be useful (Morris & Dillon, 1997).

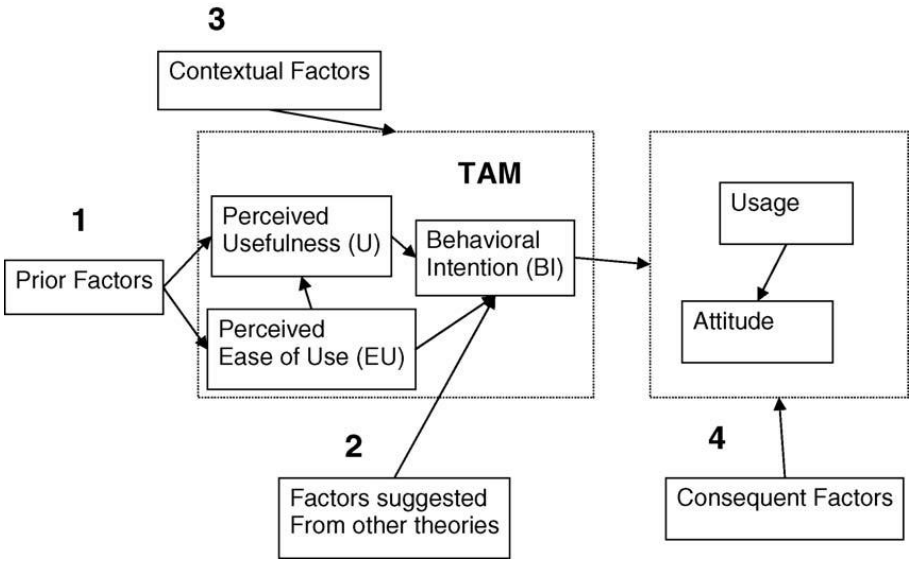

Figure 1. TAM and four categories of modifications. Reprinted from 'A meta-analysis of the technology acceptance model,' by W. R. King, and J. He, 2006, *Information & Management 43*, p. 740–755 Copyright 2006 by Elsevier

TAM has shown to be a trustworthy predictive model, with a lot of modifications been made during the past years. However, there remain some questions regarding the predictive value of the TAM (Marangunić & Granić, 2015). First, previous investigations of the TAM predominately used student participants and it is advised to investigate the TAM in real organizational/business environments (Legris, Ingham & Collerette, 2003). Second, a better understanding is needed of predictive factors that contribute to possible outcome variables of the TAM. This could enhance our understanding of the acceptance of new information technologies (Amoako-Gyampah & Salam, 2004; Karahanna & Straub, 1999; Marangunić & Granić 2015; Moon & Kim, 2001). A final limitation is that most studies use self-report questionnaires to measure whether the application is actually used, instead of relying on

objective statistical measures of actual system use (Donkin et al. 2011; Legris, Ingham & Collerette, 2003).

Actual usage

Self-reports on the outcome of actual usage have several limitations, for example previous studies observed a weak link between self-reported usage and actual usage (Straub et al., 1995). Therefore, measuring objective actual use is ideal (Devaraj & Kohli, 2003; Venkatesh, Brown, Maruping & Bala, 2008), especially when the goal of research is to describe the determinants of use. Actual usage is an objective measure of system usage defined by Straub et al. (1995) as: 'computer-recorded system usage, categorized as heavy, moderate, light or nonuse based on distribution of actual usage'. Actual usage is an important factor to integrate in the TAM, for instance the review of Donkin and colleagues (2011) pointed out that program use of e-therapy is positively associated with physical health outcomes of interventions. For instance, weight management outcomes and interventions aiming at nutrition and vegeTable intake health outcomes (Donkin et al., 2011).

Self-efficacy

Additionally, self-efficacy might be an important predictive factor in the acceptance of new technologies, because self-efficacy is found to increase the use of an intervention (Kohl, Crutzen & de Vries, 2013) and is not explicitly defined in the TAM. Bandura (1997) describes self-efficacy as: 'The confidence that one can carry out a behaviour necessary to reach a desired goal'. Moreover, Barlow, Wright, Sheasby, Turner and Hainsworth (as cited in O'Brien et al., 2013) state that self-efficacy has been found to be the largest predictor of a person's capability to adjust risky health behaviours by taking action. In line with the above, it is suggested that an increased level of self-efficacy is associated with an increased use of an new eHealth technology for monitoring health parameters.

The Medical Dashboard

Furthermore, self-efficacy is assumed to have a positive effect on the perceived ease of use. The reasoning behind this assumption can be found in the Social Cognitive Theory (SCT) of Bandura (1977, 1997). The SCT states that the expectations of an individual's self-efficacy is believed to influence the kind of decisions someone makes. These decisions can determine how persisting and endeavouring one is in performing certain behaviour (Bandura, 1977, 1997). Regarding a new eHealth technology, someone might find a new technology easier to use as a consequence of their level of self-efficacy.

Transplant worries

Another predictive factor suggested is transplant worries. As mentioned before, anxiety is prevalent in transplant recipients and is associated with worries about transplant dysfunction, and fear of kidney rejection (Baines, Jones & Jindal, 2002; Griva et al., 2002; Látos et al., 2012; Pascazio et al., 2010; Pisanti et al., 2014). In the current study it is suggested that patients with high levels of anxiety will use new self-monitoring health technologies more often, because self-monitoring showed positive effects on feelings of confidence in taking control of own care (Jones et al., 2012) and increased feelings of security and reassurance (Jaana, Pare & Sicotte, 2012). Correspondingly, we assume that transplant recipients with increased levels of transplant worries will benefit more from a new self-monitoring application and therefore will find it more useful, in comparison to less worrisome transplant recipients.

Integrating self-monitoring in health care

Last of all, only a few self-management applications through web and/or mobile phone are momentarily available for chronic kidney patients, in contrary to other chronic illnesses like diabetes or cardiovascular diseases (Diamantidis & Becker, 2014). Besides a low availability, the importance of self-monitoring is not always recognized in current health care. Patient's

self-reported health measures, preferences or behavior (e.g., weight, dietary intake) are not always taken into account by health care professionals in the decisions made, nor included in electronic health records (Glasgow, Kaplan, Ockene, Fisher & Emmons, 2012). This is unfortunate, as information from the patient's perspective is valuable information for improving health outcomes. In addition, patients self-reported measures into electronic health records can enhance relationships between patient and provider, improve health management, produce better information and can improve care and human health (Glasgow et al., 2012).

AIM

The aim of the present pilot-study is to evaluate the influence of self-efficacy, transplant worries, ease of use and usefulness on the actual usage of the 'Medical Dashboard (MD), a new eHealth technology developed at the LUMC. Furthermore, the effect of self-efficacy on ease of use and transplant worries on perceived usefulness will be assessed. The extended version of the TAM will be used as a conceptual framework (Figure 2).

This study contributes to the existing body of research examining eHealth applications in transplant recipients earlier diagnosed with ESRD. The MD gives an integrated summary of hospital and patient- reported health measurements, standardized into the routine of health-care. Patients will self-monitor blood pressure, pulse, steps, weight and temperature. Results from self-monitoring and information from the hospital information system will be integrated and displayed in the MD. Moreover, the MD can be used for stimulating (shared) decision making and for patients to actively participate in their own health-care process. The following research questions and hypotheses are formulated.

Research question (1): Will self-efficacy, transplant worries, perceived ease of use and perceived usefulness have a positive influence on actual usage?

Hypothesis 1: Patients with higher levels of *self-efficacy* will *actually use* the device The Medical Dashboard

more than patients with lower levels of self-efficacy.

Hypothesis 2: Patients with higher levels of transplantation worries will *actually use the device more* than patients with lower levels of worries.

Hypothesis 3: Patients with higher levels of perceived *ease of use* will *actually use* the device more than patients with lower levels of *ease of use*.

Hypothesis 4: Patients with higher levels of *perceived usefulness* will *actually use* the device more than patients with lower levels of *perceived usefulness.*

Research question (2): Does self-efficacy influence the *perceived ease of use* of the Medical Dashboard eHealth intervention?

Hypothesis 5: Patients with higher levels of self-efficacy will have a higher *perceived ease of use* than patients with lower levels of self-efficacy.

Research question (3): Does transplantation related worries influence the *perceived usefulness* of the Medical Dashboard eHealth intervention?

Hypothesis 6: Patients with higher levels of transplantation worries will *perceive the device as more useful* than patients with lower levels of worries.

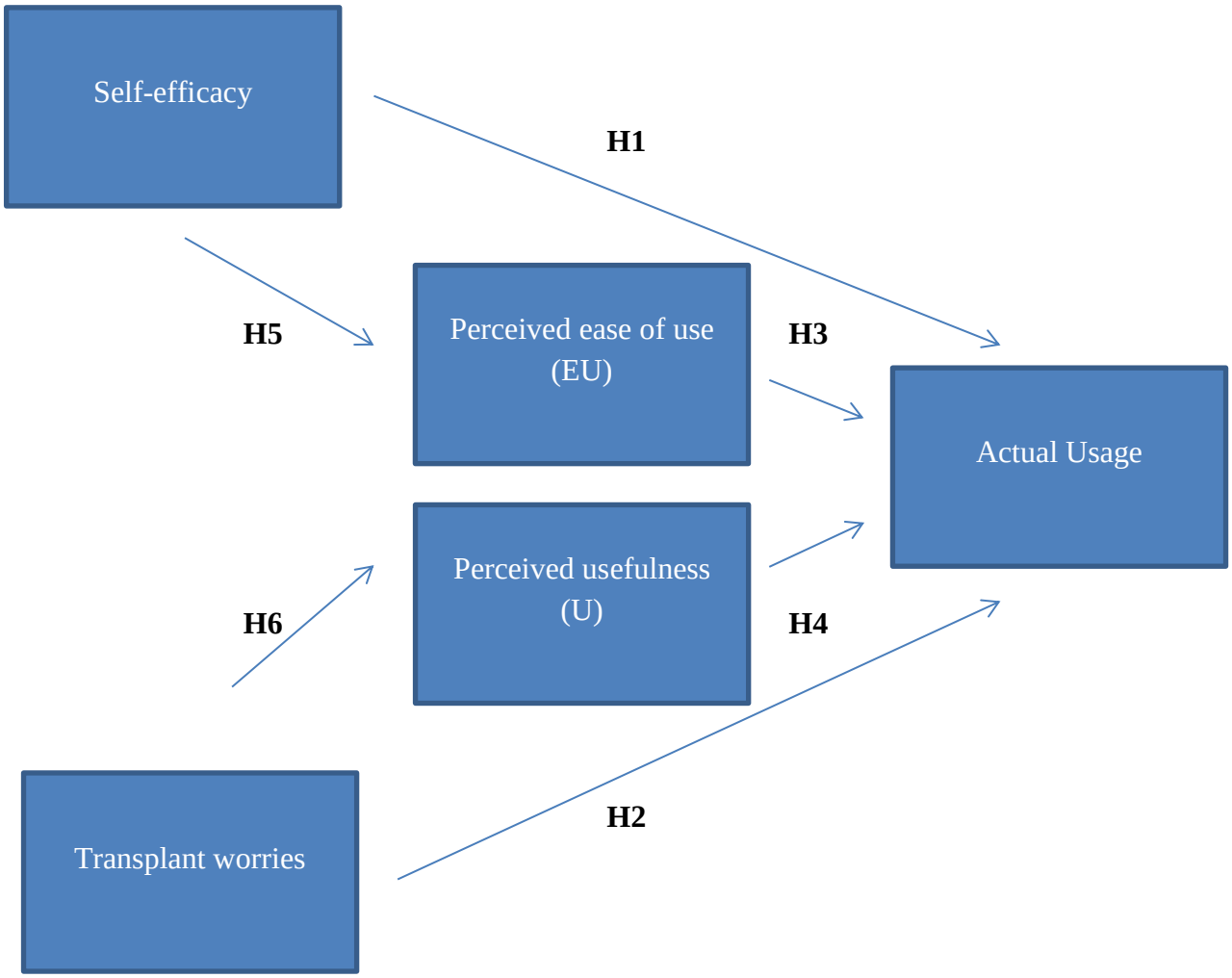

Figure 2. Proposed conceptual model based on the TAM.

METHODS

Design

The Medical Dashboard (MD) was a prospective questionnaire study, conducted at the Leiden University Medical Centre (LUMC). The Medical Ethics Committee decided no formal procedure was necessary for this study. Data was collected between baseline, mid-October 2014, and follow-up at April 2015. Self-efficacy, transplant worries, perceived ease of use and usefulness data was measured by self-report questionnaires at baseline and at follow-up after

approximately three months. Blood pressure, pulse, weight, temperature and steps were self-monitored on the website www.sterkmetvoeding.nl and wearables by the participants.

Participants

During the first year after transplantation patients have the highest risk of kidney rejection. As a consequence, the first year is the most important period for monitoring physical functions regarding kidney rejection. For that reason participation started rapidly after receiving surgery at the kidney clinic of the LUMC. Potential participants were identified by the medical specialists (nephrologist and nurses) and approached by letter to participate in the pilot-study 'the Medical Dashboard'. In total 38 patients were asked to participate and 23 patients (response rate = 60.5 %) provided their consent. Most common reasons for not participating were: being satisfied with traditional self-monitoring, feeling confronted with possible physical weaknesses and the amount of effort. Participation was on a voluntary basis and exclusion criteria were (1) insufficient comprehension of the Dutch language, (2) not having an email address and (3) not having a computer or laptop.

Intervention

Between October 2014 and April 2015 the participants participated in the eHealth intervention 'the Medical Dashboard'. From the start of the intervention, the participants self-monitored their physical state on a daily base, using the website and apps. The website and apps were directly linked to the MD in the Electronic Patient record. Daily updates of self-monitoring were immediately visible for the doctors at the hospital. The MD gave the nephrologists the opportunity to closely monitor the progress of the participant, after surgery. Likewise, the participants were able to keep track of their own progress more closely, and could contact the doctor when needed.

The Medical Dashboard

The MD displayed personal guidelines of particular measurements. The guidelines showed personal values for home and hospital-based measurements for the participants to comply to, and were visualized with colors. For instance, when a blood pressure measurement met the terms of the corresponding guideline, a green color was displayed. When the measurements did not met the guidelines, a red color was displayed. Non-compliance of the personal guidelines was a reason for discussion between doctor and patient, for instance to slightly adjust the guidelines. Moreover, changes in lifestyle, medicine and health goals could be made during the consults in the intervention period.

Procedure

Before the start of the intervention, nephrologists of the LUMC were introduced to and informed about the study and the MD. They were asked to show and discuss the Medical Dashboard with their patients during the consults. Patients who were willing to participate engaged in two meetings and were instructed by a Health Psychology student from the University of Leiden. During the first (baseline) meeting, participants received information about the content of the pilot and received an example of the MD. Furthermore the wearables were provided and installed with the required software on their mobile phones. Also information about the website www.sterkmetvoeding.nl was given and the participants received an instruction manual regarding the website and wearables.

Moreover, participants were informed to monitor themselves from the first meeting (T0) until a second meeting (T1). Additionally, they were asked to proceed self-monitoring their blood pressure, pulse, temperature and weight according to the guidelines of their nephrologist. In general this entailed self-monitoring e.g. blood pressure approximately two times per day. Self-monitoring steps with the accelerometer was on a voluntary base and was recommended to measure on a daily base. At the end of the first meeting a baseline

questionnaire was completed by the participant (T0). After the intervention period, participants were invited for an evaluation of the MD and completed the follow-up questionnaire (T1). All meetings with participants (T0 and T1) took place between October 2014 until April 2015. The intervention duration (time between T0 and T1) varied across participants and ranged from 1 month to 5.5 months (M = 4.27, SD = 1.16).

Materials

Four types of measuring instruments were used for self-monitoring during the intervention: the Medical Dashboard, a self-care module on the website www.sterkmetvoeding.nl and two types of wearables. The MD (as illustrated in appendix 1) gave both patients and doctors access to an electronical summary of hospital measurements and home-based self-measurements. Hospital measurements consisted of creatinine, sodium intake and 24-hours urine. Home-based measurements consisted of: blood pressure, pulse, temperature, weight and steps. Blood pressure, pulse and steps were tracked by use of two types of wearables that were wireless connected to the internet. As a result, self-monitoring data of the participants could automatically be uploaded and was directly visible on their mobile phones and the website.

The following wearables were used (1) ‘the Fitbit’: an accelerometer to record the number of steps, and (2) ‘the iHealth’: a wireless blood pressure and pulse measurement device. The Fitbit and iHealth app were downloaded in the ‘play store’ or ‘apple store’ for mobile phones. The Fitbit wearable was compatible for both computer and smartphone, and the iHealth only for smartphone. Therefore, the provision of the wearables depended on whether the participants had a computer and/or a smartphone. Participants without a compatible smartphone for the Fitbit app were asked to use their computer for installing the Fitbit. If a participant did not have a compatible smartphone for the iHealth app, a normal

blood pressure instrument was given. Participants could also use their own blood pressure device.

Moreover, every participant created a personal account on www.sterkmetvoeding.nl, which gave access to the self-monitoring results as well as to results of the wearables. Because no wireless wearables were used for monitoring weight and temperature, the participants were requested to upload their weight and temperature data directly on their personal account on the website.

Measurements

Actual Usage

The *actual usage* of the MD e-health application, was indicated by the frequencies of self-monitoring: blood pressure, pulse and steps, weight and temperature for each participant. This was recorded by the wearables and website between baseline and follow-up. For the reason that pulse perfectly correlated with the blood pressure records, it was left out of the data-file. For actual usage we used the definition of Straub et al. (1995): 'Computer-recorded system usage, categorized as heavy, moderate, light or nonuse based on distribution of actual usage. However, before the actual usage variable could be used in categorization and further analysis, a few modifications were needed.

For instance, some participants were able to start earlier in the intervention because of an earlier date of surgery than other participants. This led to a prolonged use of the e-health devices for self-monitoring. Thus, it was necessary to correct for the amount of time during which participants engaged in self-monitoring. In SPSS 22.0 an equal 'fixed' period was created. The reason for looking at the amount of usage per 'week' and not per 'day', is because not every participant used the self-monitoring devices every day. Reporting the usage per week made it easier to interpret the data.

After correcting for time, several methods were examined on how to use the frequency of the self-monitoring measurements as an reliable ‘actual usage variable’. First, a composite score of blood pressure, weight, steps and temperature was calculated. The composite score was used to limit the number of analyses by creating one ‘actual usage’ variable. For this purpose, an Principal Component Analysis (PCA) was conducted. Unfortunately, the results of the PCA were not reliable because the results were strongly influenced by the participants who did not record their steps, weight and temperature. The number of participants that did not record measurements ranged from six for frequency of recording weight, to ten for frequency of recording steps. Participants measured blood pressure most frequently and on a regular base (missing value N = 1). Because of the unreliable results of the PCA, blood pressure frequencies, adjusted for the time period of measuring per week was chosen to represent the ‘actual usage’ variable. Afterwards, blood pressure frequency measurements were categorized in light, moderate or high ‘actual usage’ categories.

Table 1. *Descriptives of ‘Actual usage’ (blood pressure measurements per week)*

Descriptives		
n		22
Missing		1
M		7.78
Median		5.83
SD		6.46
Minimum		.57
Maximum		24.67
Percentiles	33 %	3.79
	66 %	8.14

Two types of categorizing were considered:

a) Categorization based on the distribution of actual use of blood pressure per week (*M* = 7.78, *SD* = 6.46). This categorization was based on the distribution of the data (Straub et al., 1995) using the mean score, minus and plus one standard deviation (Table 1). All the scores below 1.32 were labeled as 'light' (7.78 - 6.46 = 1.32), scoring between 1.32 and 14.21 was labeled as 'moderate' (7.78 + 6.46 = 14.21) and scoring 'high' was labeled as scoring higher than 14.21 (Figure 3).

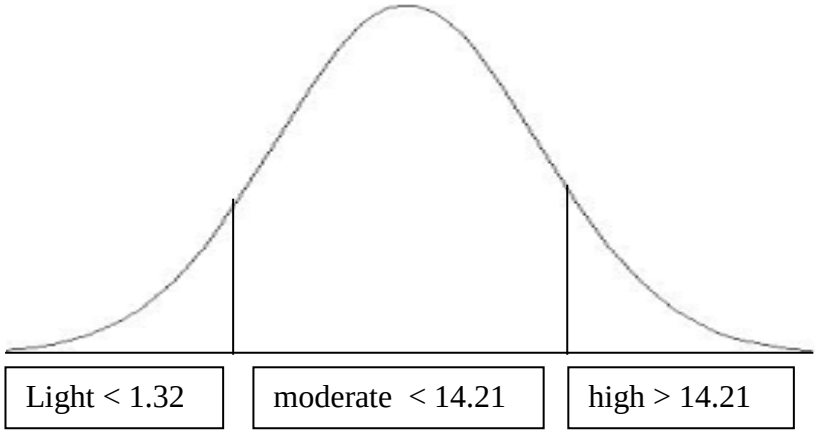

Figure 3. Categorization based on the distribution of actual use of blood pressure per week.

Unfortunately there was an unequal distribution of participants, most people scored in the moderate category. Only 1 participant scored in the light category, 18 participants scored in the moderate category and 3 participants in the high category. It was decided that it would be more useful if the group size is approximately equal. Therefore it was decided to categorize based on an equal group size per category of blood pressure.

b) Categorization based on group size (i.e., equally large groups of participants, Figure 4, Table 2). The categorization was based on percentile scores (shown in Table 1) and used for further analysis in a MANOVA.

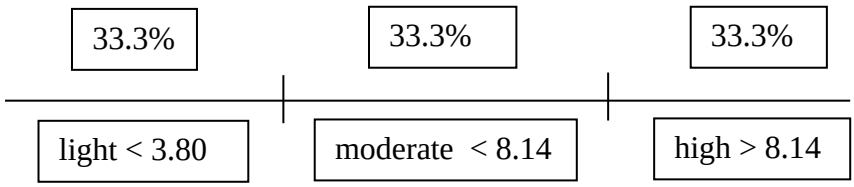

Figure 4. Categorization based on group size.

Table 2. *Descriptives of categorization based on group size*

Categories	Frequency of participants	Percent
Light use	7	31.8
Moderate use	8	36.4
High use	7	31.8
Total	22	100

Self-efficacy

For measuring *self-efficacy*, the Partners in Healthcare (PiH-scale) was used, adapted to ESRD patients (Battersby, Ask, Reece, Markwick & Collins, 2003) and measured at baseline. The scale measured the individual's confidence to carry out behaviour necessary in self-managing their chronic kidney condition (Bandura, 1997). Furthermore, the scale was based on several principles of self-management, for instance: being confident in knowing the condition and the treatment options and in engaging in health promoting activities (Battersby et al., 2003). The PIH-scale included thirteen items, for instance: 'I can monitor the symptoms of my kidney disease'. The items were rated on a nine-point Likert scale ranging from 1 'very bad' to 9 'very good'. Higher scores indicated good self-efficacy of self-management and lower scores indicated a poor self-efficacy of self-management. Furthermore, the internal consistency was found to be high ($\alpha = .85$).

The Medical Dashboard

Transplant worries

For measuring *transplant worries*, the transplant worry-scale of the Transplant Effects Questionnaire (TxEQ) was used, which consisted of six items (Ziegelmann et al., 2002). Transplant worries could not be measured at baseline, as we could not ask for anxiety to lose a graft before surgery; therefore it was measured at follow-up. The scale measured the level of worries and concerns regarding the function of the new kidney (Ziegelmann et al., 2002). Five items of the TxEQ were used: for instance: 'I am worried about damaging my transplant'. The items were rated on a five-point Likert scale ranging from 1 'fully agree' to 5 'fully disagree'. Higher scores indicated more transplant worries and lower scores indicated a less transplant worries. Furthermore, the internal consistency was found to be high ($\alpha = .87$). The item: 'I worry each time my anti-rejection drug regime is altered by my doctor' decreased Cronbach's alpha from $\alpha = .87$ to $\alpha = .16$, therefore the item was left out the scale.

Perceived ease of use

For measuring *perceived ease of use* of the Medical Dashboard, a scale that was not validated yet was measured at follow-up. Perceived ease of use can be defined as 'the degree to which the person believes that using the particular system would be free of effort' (Davis, as cited in Sharp, 2007). The scale consisted of two items, for instance: 'Working with the Medical Dashboard will cost me little effort'. The items were rated on a five-point Likert scale, ranging from 1 'fully agree' to 5,'fully disagree'. Higher scores indicated more perceived ease of use and lower scores indicated less perceived ease of use. Moreover, the internal consistency was found to be reasonable ($\alpha = .61$).

Perceived usefulness

For measuring *perceived usefulness* of the Medical Dashboard, a scale which was not validated yet was measured at follow up. Perceived usefulness can be defined as 'the degree

to which the person believes that using the particular system would enhance his or her job performance' (Davis, as cited in Sharp, 2007). The scale consisted of three items, for instance: 'I find working with the MD useful'. The items were rated on a five-point Likert scale, ranging from 1 to 5, with a score of 1' fully agree' to a score of 5 'fully disagree'. Higher scores indicated more perceived usefulness and lower scores indicated less perceived usefulness. Additionally, the internal consistency was found to be high (α = .87).

Internal Consistency

The reliability of the scales was analysed by performing a Cronbach's Alpha reliability test (Table 3.). A high internal consistency (α = .85) was found for self-efficacy, transplant worries and perceived usefulness. Perceived ease of use showed a reasonable internal consistency (α = .61).

Table 3. *Cronbach's alpha of the scales*

Scale	Number of items	*α*
Self-efficacy	13	.85
Transplant worries	5	.87
Perceived ease of use	2	.61
Perceived usefulness	3	.87

Statistical Analyses

First, the assumptions of multicollinearity, normality, linearity and homoscedasticity were checked. All analysis were conducted in IBM SPSS 22.0 and a significance level of $p < .05$ was applied for testing the hypotheses.

Multivariate analysis of variance.

To assess if higher levels of (the independent interval variables) self-efficacy (=H1), worries (= H2), perceived usefulness (=H3) and perceived ease of use (= H4) are associated with (the independent nominal variable) actual usage, a one-way MANOVA was conducted. In order to conduct a MANOVA, the effect of an independent ordinal variable(s) must be compared to dependent interval/ratio variable(s). Therefore, self-efficacy, transplant worries, perceived ease of use and perceived usefulness were used as dependent interval variables (although these variables were formulated as independent interval variables in the hypotheses). Actual usage was used as the independent ordinal variable (in the hypotheses described as an dependent ordinal variable).

Correlation analysis.

To test if higher self-efficacy is associated with more perceived ease of use and (= H5) and if higher transplant worries are associated with more perceived usefulness (= H6), two Pearson correlation (one-tailed) analyses were conducted.

RESULTS

38 participants were approached and eventually 25 participants took part in the pilot (Table 4). However, two participants were lost to follow-up due to health problems, which makes N = 23 in the total sample. In total 5 participants were female (21.7%) and 18 participants were male (78.3%). The age varied between 22 and 69 years and the mean age was 45 years (M = 44.87, SD = 13.15). The majority of the participants were in the possession of a lower secondary education diploma (39.1%) or a diploma in higher education (34.8%) and used computers (N =19) and the internet (N =20) on a daily base. Furthermore, the participants scored above average on the levels of self-reported self-efficacy, transplant worries, perceived

ease of use and usefulness (Table 5). The data was examined to confirm no violation of the assumptions of univariate and multivariate normality, linearity, outliers and homoscedasticity were made, with no serious violations noted.

Table 4. *Patient characteristics*

Characteristic	*N*	*(%)*	*M*	*SD*	Minimum	Maximum
Gender	18	78.3				
Male	5	21.7				
Female						
Age	23	-	44.87	13.16	22	69
Marital Status						
Single	5	21.7				
Married/Living-together	16	69.6				
Divorced	1	4.3				
Widow/Widower	1	4.3				
Education						
Vocational education	1	4.3				
Lower secondary-education	9	39.1				
Higher secondary-education	5	21.7				
Higher education	8	34.8				
Computer usage						
Daily	19	82.6				
Four times per week	3	13.0				
Two times per week	1	4.3				
Internet Usage						
Daily	20	87.0				
Four times per week	2	8.7				
Weekly	1	4.3				

Table 5. *Patients self-reported levels of self-efficacy, transplant worries, perceived usefulness and perceived ease of use.*

Variable	*N*	Minimum	Maximum	*M*	*SD*
Self-efficacy	23	5.77	9.00	7.75	.81
Perceived usefulness	23	2.00	5.00	3.78	.66
Transplant worries	23	1.40	4.60	3.42	.89
Perceived ease of use	23	1.50	4.50	3.67	.75

Transplant worries, self-efficacy, perceived ease of use and perceived usefulness associations to levels of usage

A one-way between-groups multivariate analysis of variance was conducted to examine if higher levels of self-efficacy (= H3), transplant worries (= H4), perceived ease of use (= H5) and perceived usefulness (= H6) would be associated to higher actual usage of the MD. Using Pillai's trace, there were no significant differences in the categories of actual usage on the combined scores of self-efficacy, transplant-worries, perceived ease of use and perceived usefulness scores $V = 0.16$, $F(8, 34) = 0.36$, $p = .936$. This result is not in line with the hypotheses and therefore it was concluded that participants with higher levels of self-efficacy(= H3), transplant worries (= H4), perceived ease of use (= H5) and perceived usefulness (= H6) are not positively associated with the higher levels of actual usage of the MD. Consequently, no further exploration of the univariate ANOVAs was permitted and these hypotheses were rejected.

Self-efficacy predicting perceived ease of use

To examine if participants with higher scores on self-efficacy would perceive the MD easier to use (= H5), a Pearson correlation (Table 5) was assessed. No significant correlation r = .125, p = > .285 was found. The hypothesis was rejected.

Transplant worries predicting perceived usefulness

To examine if patients with higher levels of transplant worries would perceive the MD as more useful (= H6), a Pearson correlation (Table 5) was assessed. A positive correlation r = .433, p = .019 was found. This is in line with the hypothesis that participants with higher levels of transplant worries perceive the MD as more useful. Therefore, the hypothesis was accepted.

Table 5. *Correlations between Actual Usage, Self-efficacy, Worries, perceived Usefulness and perceived Ease of Use*

		Actual Usage	Usefulness	Worries	Self-efficacy	Ease of use
Pearson Correlation	Actual Usage	-				
	Perceived Usefulness	.216	-			
	Worries	.014	.433*	-		
	Self-efficacy	.160	-.124	-.237	-	
	Perceived Ease of use	.013	.110	-.135	.125	-

Note. *= statistically significant at $p < .05$ (1-tailed) level.

DISCUSSION

New eHealth technologies have rapidly evolved in the last few years and provide strategies for tracking important health information (Smarr et al., 2011). However, the usage of these new eHealth technologies is an area of underexplored research. This study integrated the Medical Dashboard (MD), a new eHealth application for self-monitoring, into the regular healthcare for transplant renal patients. The extended version of the Technology Acceptance Model (TAM) was used as a framework to investigate factors that might be related to usage of the MD. The results of this study showed that higher levels of self-efficacy, transplant worries, perceived ease of use and perceived usefulness did not result in higher levels of actual usage. Additionally, self-efficacy is found not to be associated with the perceived ease of use of the MD. However, patients with higher levels of transplant worries did perceive the MD as more useful than less worrisome patients.

Several explanations exist for the unexpected findings that participants who reported higher self-efficacy (= H1), transplant worries (= H2), ease of use (= H3) and usefulness (= H4) levels, did not actually used the MD more frequently than participants with lower scores on those predictors. An explanation can be found in the method of measuring actual usage. Previous studies typically measured actual usage by self-reports and only a few studies included objective actual usage (Donkin et al., 2011; Legris, Ingham & Collerette, 2003). The current study measured objective (system-recorded) actual usage, which has advantages over self-reports. For objective usage is associated with a lower risk of recall bias (Davis, 1992). A recall bias can occur when participants cannot remember an event because of a long period between the occurrence and the recall of the event (Biemer, Groves, Lyberg, Mathiowetz & Sudman, 1991). Consequently, recalling can result in overestimation or underestimation of the occurrence of the event (Berolo, Steenstra, Amick, & Wells 2015; Biemer et al., 1991). Therefore the use of an objective measure was a strength of this study.

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Nevertheless, this study's use of an objective measure might have contributed to the null-findings. Prior research also indicated that the predictors of the TAM were considerable less associated with objective actual usage than self-reported usage (Straub et al., 1995; Szajna, 1996; Turner, M., Kitchenham, Brereton, Charters and Budgen, 2010). This raises the question why it is harder to establish an objective usage variable in the TAM than self-reported use, especially when the former is expected to have advantages over self-report. One possibility is that the current methods for objective usage measurements might be less valid and reliable. In addition, Turner and colleagues (2010) believed that objective usage measurements might be more difficult to measure because of the requirements of complex computer-recorded methods. As a result, objective usage is studied less extensive than self-report usage studies (Turner et al., 2010).

Additionally, there is a lot of variation in the way previous research measured actual usage, for example including the number of loggings (Dybâ, Moe & Arisholm, 2005), actual usage date from log files (Dasgupta, Granger & McGarry, 2002), generic information of participants application usage (Berolo et al., 2015), or they did not specifically explain their method. In the current study actual usage was measured by using the frequency of blood pressure uploads. Initially, we wanted to measure actual usage with a composit variable that could also take into account the number of steps, weight measurements and temperature measurements. Yet, these measurements could not be integrated in the objective usage variable, as many participants did not record their steps, weight and temperature. Future studies should be aimed at developing methods to measure objective actual usage in a valid, reliable and feasible manner. For example, comparing various methods of computer-recorded use to determine which method is optimal to represent objective usage.

An alternative explanation might be that other factors influence actual usage. In previous research, the TAM model is widely used to predict behavioral intention, which is

suggested to determine one's actual behaviour towards using and accepting new technologies (Ajzen & Fishbein, as cited in Davis, 1986). However this link between behavioral intention and actual usage behaviour is not extensively investigated in previous research (Pynoo & Braak, 2014), nor in this study. Earlier research refer to this weak link as the 'intention – behaviour gap' that refers to the unclear (underlying) process that bridges the discrepancy between intention to act and subsequent actual behavior (Bhattacherjee & Sanford, 2009; Sniehotta, Scholz & Schwarzer, 2005). Additionally, the associations between intention and actual usage were mainly found in lab-settings and for self-reported usage (Yousafzai, Foxall & Pallister, 2007). As a result, it is unknown to which extend behavioral intention influences actual usage and if other factors might explain why we did not find an effect on usage. Nevertheless, behavioral intention is a key aspect of the TAM and future TAM research in health care settings should further investigate the influence of intention (or other factors) on actual usage.

Currently, the TAM model might not be adequate in predicting the use of eHealth applications such as the MD, in the complex organizational environment of health care. Recent research suggested that the adoption of new (e.g. health) technologies in multidisciplinary organizational systems is difficult, because of the diverse technologies used in various groups and inter-related social, technological and organizational factors that might influence the implementation (Cresswell & Sheikh, 2013; Cresswell, Worth & Sheikh, 2010; Legris, Ingham and Collerette, 2003). Legris and colleagues (2003) suggested to extend the TAM with organizational and social factors to improve the predictive ability of the TAM. For instance support of professionals or support of the organizational environment (Cresswell & Sheikh, 2013). Additionally, a recent longitudinal study found that personal feedback during the use of an web-based monitoring application was best in engaging diabetes patients (Nijland, Gemert-Pijnen, Kelders, Brandenburg & Seydel, 2011). Despite the fact that the

nephrologists were instructed to show and discuss the Medical Dashboard with their patients during the consults, most of the time this was not the case. This is unfortunate since personal and interactive feedback can increase patients feelings of being adequately monitored, thus it can motivate them and the staff to be actively participated in self-management and health care and (Nijland et al., 2011).

Besides that no effects of the predictors of the TAM on actual usage were found, also no relationship between self-efficacy and ease of use (= H5) is found. This means that participants who had more confidence in self-managing their chronic kidney disease did not report that the MD was more easy to use. A possible explanation is that self-efficacy was assessed with a generic self-report questionnaire. The questionnaire was mainly directed at patients' confidence in handling their chronic disease. The self-efficacy questions were not targeted at, for instance, their confidence in handling computers or an eHealth technology for self-monitoring their health.

A potential solution would be to adopt a more eHealth application specific self-efficacy definition or operationalization, for instance general computer self-efficacy (CSE), or application specific CSE. General CSE refers to someone's confidence in their own ability in using computers and computer related tasks (Compeau & Higgins, 1995). Specific CSE is the person's belief in own competence in the usage of a specific system or application (Marakas, Yi & Johnson, 1998). Several studies found significant effects of general CSE and specific CSE on ease of use and actual usage (Hasan, 2006; Marakas, Yi & Johnson, 1998; Mun, Yi & Whang, 2003). However, Wangpipatwong, Chutimaskul and Papasratorn (2008) found no effect of general CSE on the perceived ease of use of e-Government websites. Wangpipatwong and colleagues (2008) assumed that even general CSE may be too general, and that a more specific operationalization of self-efficacy regarding the use of the e-Government website should be considered. In line with this, Marakas, Yi and Johnson (1998)

did find that specific CSE had a larger effect on ease of use than general CSE.

Therefore future eHealth research, should consider the development an eHealth specific CSE. A specific CSE adjusted for the MD should be directed at the participants confidence in using apps for self-monitoring and their understanding of the self-care module on the internet. On the other hand, the construct of eHealth specific CSE might overlap considerably with perceived ease of use, which questions the relevance of developing such a specific CSE. By all means, the results of the current and previous research seem to indicate that patients' general self-efficacy with regard to self-management, does not imply that patients feel themselves able to use an eHealth application such as the MD with ease.

A final explanation why no relation between SE and perceived ease of use is revealed, might be due to a ceiling effect. Within the included sample, patients generally scored high on SE and were also familiar in using computers, suggesting that the participants probably had proficient computer skills beforehand. Computer skills may be considered as a specific CSE that is relevant for using the MD. The very high scores and the low level of variance of SE and computer skills might be an explanation for the lack of effect of self-efficacy on ease of use. Future studies should also include patients with lower levels of SE and computer skills.

In our last hypothesis, we argued that transplant recipients with increased levels of transplant worries would benefit more from a new self-monitoring eHealth application and therefore would perceive the MD as more useful compared to less worrisome transplant recipients (= H6). Our results showed that patients with higher levels of transplant worries indeed perceive the MD as more useful. Worrisome patients might experience the MD useful, because it helps them to lower or control their transplant worries, as previous research has found that self-monitoring has positive effects on feelings of confidence in taking control of own care (Jones et al., 2012) and can increase one's feelings of security and reassurance (Jaana, Pare & Sicotte, 2012).

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Nevertheless, based on the current correlation results, conclusions about causality cannot be drawn and therefore a reversed effect cannot be ruled out. Additionally, it was not possible to measure transplant worries at baseline, as we could not ask for anxiety to lose a graft before surgery; therefore transplant worries was measured at follow-up. Hence, it is not clear if participants who scored high on worries, also experienced high transplant worries at baseline. Therefore, patients that initially perceived the MD as more useful might get more worried about their transplant later on. This could be explained by the following reasoning: patients that perceived the MD as useful might initially have been involved in more frequent and up close self-monitoring, which eventually induced more transplant worries. In fact, most patients who refused to participate in the current study, reported that they were concerned that closely self-monitoring would confront them (too much) with their poor health status and therefore self-monitoring could induce extra worrying. In line with this reasoning, some patients might have avoided using the MD on the longer term, because they are were afraid of increased transplant worries, which also could be a reason why no link was found with actual usage. Future eHealth research initiatives should rule out which causal directions in the relationship between transplant related worrying, self-monitoring and perceived usefulness of eHealth applications are most likely.

This study has some limitations. Besides limitations already mentioned, another important limitation is related to the use of the MD. Participants had to keep track of the two separate apps as well as the website, which might have been not feasible for them. It might have caused confusion or it took patient too much time, which could explain why patients did not record their steps, weight and temperature. Future eHealth research should consider developing an integrated application to prevent participants from having to go back and forth between logging into their mobile phone and their computer. Additionally, it is noteworthy that the sample size was small and therefore a larger margin of error is possible (Saunders,

Lewis, Thornhill, Booij & Verckens, 2011), in turn this may have played a role in the null-findings. Moreover, although perceived ease of use and perceived usefulness scores were quite high, some participants reported that the design of the application was somewhat redundant. A clearer eHealth application might positively affect perceived ease of use and perceives usefulness and could encourage and motivate participants in using the application. Finally, it was not possible to measure transplant worries at baseline, what makes it questionable if transplant worries has changed over time or not.

Despite these limitations, various strengths can be observed. To our knowledge, this is the first study incorporating transplant worries into TAM research, which led to the finding that worrisome patients might benefit most of a self-monitoring eHealth application. Another strength is the implementation of the intervention in a natural setting (e.g. the hospital and at home), because many TAM-studies have been performed with students (Legris, Ingham & Collerette, 2003). As a result, the experiences with the MD of the patients and hospital's stakeholders gave us insight in their needs and future directions for improvement. Finally, we attempted to integrate objective actual usage data in executing this study. Although further work is required to gain a better understanding of including objective actual usage data, this study distinguishes itself from other studies who typically use self-report data.

CONCLUSION

In this study, the relationships between renal transplant recipients' self-efficacy, perceived ease of use, perceived usefulness, self-efficacy, transplant worries and actual usage of the MD, a new eHealth application, were investigated by means of an extended version of the TAM. No effect of the predictors were found on actual usage nor an effect of self-efficacy on ease of use. Nevertheless, a positive relationship between transplant worries and perceived usefulness was found. For clinical practise the current results cautiously imply, that

worrisome patients might benefit most of the MD eHealth application. This emphasizes a possible positive effect of the MD on the patients confidence and support in regulating one's own care (Jaana, Pare & Sicotte, 2012; Jones et al., 2012), which is suggested to lower transplant worries. Thus, future interventions in health-care might consider improving patient's perceived usefulness of eHealth applications in order to stimulate positive effects on patient disease-related worrying. However this advice should be taken with caution, since we cannot conclude about causality and therefore we cannot rule out an reversed effect.

Moreover, in the current study the TAM was not yet able to predict actual usage of the MD eHealth technology. Future eHealth studies could improve the predictive ability of the TAM by including a larger sample size and sufficiently tailor the model to the health-care setting. For instance, incorporate social and organizational factors such as professional support or personal feedback. Moreover these initiatives should ensure that agreements with doctors about giving for instance feedback, are kept, since this was not always the case in the current study. Future eHealth research directions are: 1) investigating to what extend a new eHealth application reliefs and supports (transplant or other disease-related) worries, or whether it actually induces worries; 2) Adapt the TAM model to healthcare; 3) Investigate the link between behavioural intention and actual usage behaviour; 4) Develop an eHealth application specific self-efficacy measure and investigate the added value of such a measure; 5) Developing methods to measure actual eHealth application usage in a valid, reliable and feasible manner.

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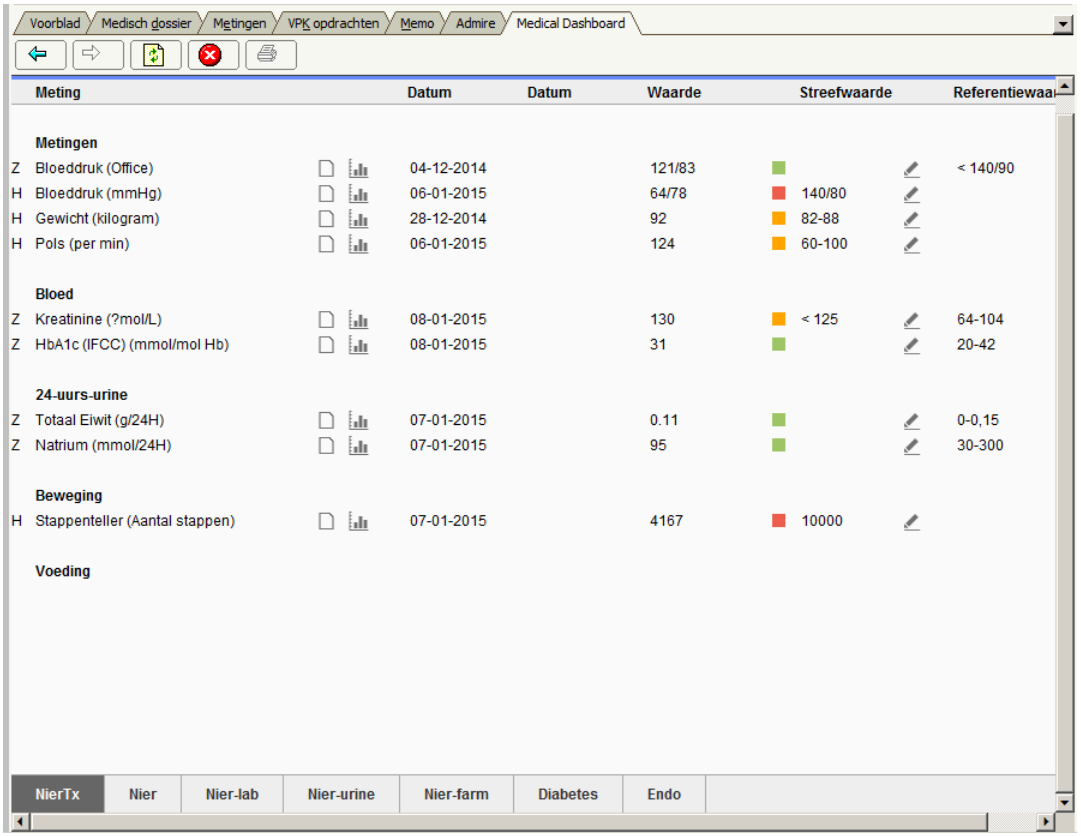
Appendix 1

The Medical Dashboard



	Meting	Datum	Waarde		Richtlijn Persoonlijk	Richtlijn Algemeen
	Biometrisch					
Z	Bloeddruk ZH (mmHg)	4-1-2013	145/85		< 140/85	< 140/90
T	Bloeddruk Thuis (mmHg)	4-1-2013	130/78		< 130/80	< 130/80
T	Gewicht (kg)	4-1-2013	81,5		< 82	< 85
	Laboratorium					
Z	Kreatinine	4-1-2013	125		130	
Z	Cholesterol (LDL) (mmol/l)	4-1-2013	4,2		< 3,0	< 2,6
Z	HbA1c	4-1-2013	40		< 42	< 42
	24 uurs urine					
Z	Natrium (mmol/24 uur)	4-1-2013	210		150	100
Z	Eiwit (gram/24 uur)	4-1-2013	0,5		0,6	< 0,18
	Beweging					
T	Aantal stappen/dag	20-12-2012	6000		5600	10.000

Adapted from: Paul vd. Boog, (2014).

The Medical Dashboard

Appendix 2

Baseline questionnaire

LUMC Medical Dashboard

Vragenlijst gebruikersonderzoek

Bron	Meting	Datum	Waarde		Richtlijn Persoonlijk	Richtlijn Algemeen
	Biometrisch					
Z	Bloeddruk ZH (mmHg)	4-1-2013	**140/85**		< 140/85	< 140/90
T	Bloeddruk Thuis (mmHg)	4-1-2013	**130/78**		< 130/80	< 130/80
	Laboratorium					
Z	Cholesterol (LDL) (mmol/l	4-1-2013	**4,2**		< 3,0	< 2,6
	Voeding					
T	energie (kcal)	20-12-2012	**2450**		2500	2500
T	Natrium (mg)	20-12-2012	**4000**		< 3600	< 2400
	Beweging					
T	Aantal stappen/dag	20-12-2012	**5700**		5600	10.000

Geachte Mevrouw/Mijnheer,

Voor u ligt een vragenlijst. Eerst stellen we een paar algemene vragen. Daarna volgen een aantal vragen over uw verwachtingen over het Medical Dashboard en over uw ervaringen met het hebben van een nierziekte. Het invullen van de vragenlijst kost u ongeveer 10 minuten.

De antwoorden zijn niet *goed* of *fout*, maar hebben betrekking op uzelf. Het gaat erom dat u de vragen zo eerlijk mogelijk beantwoordt en uw eigen mening geeft. Het is niet de bedoeling dat u erg lang gaat nadenken over de antwoorden.

Bij de meeste vragen staan een aantal antwoordmogelijkheden aangegeven. U kunt het antwoord dat voor u het meest van toepassing is aankruisen. Het kan voorkomen dat u een 'verkeerd' hokje aankruist en dat u dit wil veranderen. Geef dit aan door het 'verkeerde' hokje helemaal zwart te maken. Kruis daarna het juiste antwoord aan. Wilt u altijd bij alle vragen één antwoord aankruisen?

Mocht u vragen hebben over het invullen van de vragenlijst dan kunt u contact opnemen met een onderzoeker van het Leids Universitair Medical Centrum, mevrouw Sandra van Dijk, op telefoonnummer 071-5273913, of via email: S.van_Dijk@lumc.nl.

Wanneer de hele vragenlijst is ingevuld, kunt u de vragenlijst inleveren bij Vera Zonderop. De antwoorden op de vragenlijsten zijn alleen ter inzage voor de onderzoekers en zullen anoniem behandeld worden aan de hand van de persoonlijke code die op de vragenlijst staat.

Bij voorbaat hartelijk dank voor het invullen van de vragenlijst!

Algemene vragen

Hieronder volgen enkele algemene vragen over uzelf. Wilt u bij elke vraag een kruisje zetten in het hokje dat het beste bij u past.

1. Wat is uw geboortedatum? ……-…….-…….. (dag/maand/jaar)

2. Bent u….
   - ☐ Alleenstaand
   - ☐ Getrouwd / samenwonend met partner
   - ☐ Gescheiden (niet samenwonend)
   - ☐ Weduwe / weduwnaar
   - ☐ Anders, namelijk ……

3. Heeft u kinderen?
   - ☐ Ja, hoeveel? …….
   - ☐ Nee

4. Wat is de hoogste (school)opleiding die u heeft afgemaakt?
   - ☐ Lager onderwijs (basisschool)
   - ☐ Beroepsonderwijs
   - ☐ Middelbaar voortgezet onderwijs
   - ☐ Hoger voortgezet onderwijs
   - ☐ Hoger (beroeps-)onderwijs

5. Werkt u op dit ogenblik?
   - ☐ Nee
   - ☐ Ja, deeltijd (.....uur per week)
   - ☐ Ja, voltijd

6. Hoe vaak per week zit u achter de computer?

- ☐ Dagelijks
- ☐ Vier keer per week
- ☐ Twee keer per week
- ☐ Wekelijks
- ☐ Een keer in de twee weken
- ☐ Maandelijks
- ☐ Nooit

7. Hoe vaak per week zit u op internet?

- ☐ Dagelijks
- ☐ Vier keer per week
- ☐ Twee keer per week
- ☐ Wekelijks
- ☐ Een keer in de twee weken
- ☐ Maandelijks
- ☐ Nooit

8. Heeft u een e-mailadres?

- ☐ Ja
- ☐ Nee

Omgaan met uw nierziekte

Omgaan met een nierziekte betekent dat u zelf maatregelen neemt om zo goed mogelijk met uw nierziekte om te gaan. De volgende uitspraken zijn bedoeld om na te gaan in welke mate u denkt dat u in staat bent om zulk soort maatregelen te nemen of dingen te doen. Kruis het hokje aan dat het beste overeenkomt met uw inschatting.

		Heel slecht				Vol-doende				Heel goed
1.	Ik weet en begrijp wat mijn nierziekte inhoudt	☐	☐	☐	☐	☐	☐	☐	☐	☐
2.	Ik weet welke mogelijkheden er zijn om mijn nierziekte te behandelen	☐	☐	☐	☐	☐	☐	☐	☐	☐
3.	Ik kan meebeslissen over de behandeling van mijn nierziekte	☐	☐	☐	☐	☐	☐	☐	☐	☐
4.	Ik regel de (vervolg) afspraken die mijn arts heeft voorgesteld en kom die ook na	☐	☐	☐	☐	☐	☐	☐	☐	☐
5.	Ik gebruik mijn medicijnen zoals mijn arts heeft voorgeschreven	☐	☐	☐	☐	☐	☐	☐	☐	☐
6.	Ik begrijp waarom ik de verschijnselen van mijn nierziekte moet bijhouden en noteren	☐	☐	☐	☐	☐	☐	☐	☐	☐
7.	Ik kan de verschijnselen van mijn nierziekte bijhouden en noteren	☐	☐	☐	☐	☐	☐	☐	☐	☐
8.	Ik weet wat ik moet doen als de verschijnselen van mijn nierziekte erger worden	☐	☐	☐	☐	☐	☐	☐	☐	☐
9.	Ik kan zelf ingrijpen als de verschijnselen van mijn nierziekte erger worden	☐	☐	☐	☐	☐	☐	☐	☐	☐
10.	Ik kan met de fysieke gevolgen van mijn nierziekte omgaan	☐	☐	☐	☐	☐	☐	☐	☐	☐
11.	Ik kan met de sociale gevolgen van mijn nierziekte omgaan	☐	☐	☐	☐	☐	☐	☐	☐	☐
12.	Ik kan met de emotionele gevolgen van mijn	☐	☐	☐	☐	☐	☐	☐	☐	☐

	nierziekte omgaan								
13.	Het lukt mij om steeds gezonder te gaan leven	☐	☐	☐	☐	☐	☐	☐	☐	☐

		Geheel oneens	Oneens	Enigs-zins oneens	Noch eens, noch oneens	Enigs-zins eens	Eens	Geheel eens
1.	Ik kan zelfstandig beslissingen nemen over wat het beste is voor mijn gezondheid	☐	☐	☐	☐	☐	☐	☐
2.	Ik vind het belangrijk dat mijn arts mij betrekt bij mijn behandeling	☐	☐	☐	☐	☐	☐	☐
3.	Ik vind het prettig als mijn arts bepaalt wat het beste voor mij is	☐	☐	☐	☐	☐	☐	☐
4.	Ik durf binnen mijn behandeling zelf keuzes te maken	☐	☐	☐	☐	☐	☐	☐

Veel mensen met een nieraandoening bezoeken regelmatig een nefroloog in het ziekenhuis. De onderstaande uitspraken gaan over de manier waarop u zich ondersteund voelt door uw nefroloog. Wilt u aankruisen in hoeverre u het oneens of eens bent met deze stellingen?

		Geheel oneens	Oneens	Enigs-zins oneens	Noch eens, noch oneens	Enigs-zins eens	Eens	Geheel eens
1.	Mijn nefroloog laat mij voldoende keuze bij beslissingen	☐	☐	☐	☐	☐	☐	☐
2.	Ik voel me begrepen door mijn nefroloog	☐	☐	☐	☐	☐	☐	☐
3.	Mijn nefroloog heeft er vertrouwen in dat ik	☐	☐	☐	☐	☐	☐	☐

	dingen in mijn leven kan veranderen						
4.	Mijn nefroloog moedigt me aan vragen te stellen	☐	☐	☐	☐	☐	☐	☐
5.	Mijn nefroloog luistert naar hoe ik de dingen zou willen aanpakken	☐	☐	☐	☐	☐	☐	☐
6.	Ik kan mijn gevoelens delen met mijn nefroloog	☐	☐	☐	☐	☐	☐	☐
7.	Mijn nefroloog stelt vast in welke mate ik betrokken wil worden bij beslissingen.	☐	☐	☐	☐	☐	☐	☐
8.	Mijn nefroloog gaat na welke zorgen (angsten) ik heb over de aanpak van problemen.	☐	☐	☐	☐	☐	☐	☐

U doet mee aan een gebruikersonderzoek op de afdeling Nierziekten. Hoewel u nog geen of nauwelijks ervaring heeft met het Medical Dashboard willen we graag weten wat uw verwachtingen zijn over het Medical Dashboard.

		Helemaal mee eens	Mee eens	Niet eens/ niet oneens	Mee oneens	Helemaal mee oneens
1.	Meedoen met het Medical Dashboard gebruikersonderzoek zal mij duidelijk inzicht geven in mijn gezondheid	☐	☐	☐	☐	☐
2.	Door mee te doen met het Medical Dashboard gebruikersonderzoek zal ik mijn gezondheid kunnen verbeteren.	☐	☐	☐	☐	☐
3.	Door mee te doen met het Medical Dashboard gebruikersonderzoek zal ik beter op mijn gezondheid kunnen letten.	☐	☐	☐	☐	☐
4.	Met behulp van het Medical Dashboard zal ik een grotere rol kunnen spelen binnen de zorg	☐	☐	☐	☐	☐

voor mijn eigen gezondheid.

5.	Werken met het Medical Dashboard zal me weinig moeite kosten.	☐	☐	☐	☐	☐
6.	Een nadeel van meedoen met het Medical Dashboard gebruikersonderzoek vind ik dat ik veel tijd kwijt zal zijn aan het uitvoeren en invullen van zelfmetingen.	☐	☐	☐	☐	☐
7.	Werken met het Medical Dashboard zal ik interessant vinden.	☐	☐	☐	☐	☐
8.	Werken met het Medical Dashboard zal ik als iets vervelends ervaren.	☐	☐	☐	☐	☐
9.	Werken met het Medical Dashboard zal ik prettig vinden.	☐	☐	☐	☐	☐
10.	Werken met het Medical Dashboard zal me een onrustig gevoel geven.	☐	☐	☐	☐	☐
11.	Werken met het Medical Dashboard zal ik nuttig vinden.	☐	☐	☐	☐	☐
12.	Werken met het Medical Dashboard zal het contact met mijn dokter kunnen verbeteren.	☐	☐	☐	☐	☐
13.	Door het werken met het Medical Dashboard zal ik me geruster kunnen voelen over de werking van mijn nieuwe nier.	☐	☐	☐	☐	☐
14.	Door het Medical Dashboard zal ik een beter gevoel van controle krijgen over mijn nierziekte.	☐	☐	☐	☐	☐
15.	Door het Medical Dashboard zal ik beter vragen kunnen stellen aan mijn nefroloog.	☐	☐	☐	☐	☐
16.	Door het Medical Dashboard zal ik beter doelen voor mijn gezondheid kunnen stellen.	☐	☐	☐	☐	☐

Bij het gebruikersonderzoek wordt u ook gevraagd om metingen bij te houden. We willen u graag een paar vragen stellen over bewegen.

Bewegen

1. Hoe vaak heeft u de afgelopen twee weken aan recreatieve fysieke activiteiten of sporten gedaan gedurende tenminste 30 minuten (bijvoorbeeld wandelen of fietsen) en zo ja, hoeveel gemiddeld?
   ☐ Nooit

☐ .....keer per week gedurende .....minuten per keer

2. Heeft u van uw nefroloog wel eens het advies gekregen om meer lichaamsbeweging te nemen?
   ☐ Ja
   ☐ Nee

3. In hoeverre zijn de volgende uitspraken op u van toepassing?

		Helemaal mee eens	Mee eens	Niet eens/niet oneens	Mee oneens	Helemaal mee oneens
a.	Ik zou graag meer willen bewegen	☐	☐	☐	☐	☐
b.	Ik heb er vertrouwen in dat ik meer kan bewegen als ik het probeer	☐	☐	☐	☐	☐

Dit is het einde van de vragenlijst.

Heeft u misschien nog opmerkingen?

……
……

……

……

……

……

……
……

Hartelijk dank voor het invullen!

Appendix 3

Follow-up questionnaire

LUMC Medical Dashboard

2e Vragenlijst gebruikersonderzoek

Bron	Meting	Datum	Waarde		Richtlijn Persoonlijk	Richtlijn Algemeen
	Biometrisch					
Z	Bloeddruk ZH (mmHg)	4-1-2013	**140/85**		< 140/85	< 140/90
T	Bloeddruk Thuis (mmHg)	4-1-2013	**130/78**		< 130/80	< 130/80
	Laboratorium					
Z	Cholesterol (LDL) (mmol/l	4-1-2013	**4,2**		< 3,0	< 2,6
	Voeding					
T	energie (kcal)	20-12-2012	**2450**		2500	2500
T	Natrium (mg)	20-12-2012	**4000**		< 3600	< 2400
	Beweging					
T	Aantal stappen/dag	20-12-2012	**5700**		5600	10.000

Geachte Mevrouw/Mijnheer,

Voor u ligt een vragenlijst. Eerst stellen we een paar algemene vragen. Daarna volgen een aantal vragen over uw verwachtingen over het Medical Dashboard en over uw ervaringen met het hebben van een nierziekte. Het invullen van de vragenlijst kost u ongeveer 10 minuten.

De antwoorden zijn niet *goed* of *fout*, maar hebben betrekking op uzelf. Het gaat erom dat u de vragen zo eerlijk mogelijk beantwoordt en uw eigen mening geeft. Het is niet de bedoeling dat u erg lang gaat nadenken over de antwoorden.

Bij de meeste vragen staan een aantal antwoordmogelijkheden aangegeven. U kunt het antwoord dat voor u het meest van toepassing is aankruisen. Het kan voorkomen dat u een 'verkeerd' hokje aankruist en dat u dit wil veranderen. Geef dit aan door het 'verkeerde' hokje helemaal zwart te maken. Kruis daarna het juiste antwoord aan. Wilt u altijd bij alle vragen één antwoord aankruisen?

Mocht u vragen hebben over het invullen van de vragenlijst dan kunt u contact opnemen met een onderzoeker van het Leids Universitair Medisch Centrum, mevrouw Sandra van Dijk, op telefoonnummer 071-5273913, of via email: S.van_Dijk@lumc.nl.

Wanneer de hele vragenlijst is ingevuld, kunt u de vragenlijst in bijgaande antwoordenvelop opsturen (een postzegel is niet nodig). De antwoorden op de vragenlijsten zijn alleen ter inzage voor de onderzoekers en zullen anoniem behandeld worden aan de hand van de persoonlijke code die op de vragenlijst staat. Wilt u de vragenlijst binnen 1 week na ontvangst invullen en opsturen?

Bij voorbaat hartelijk dank voor het invullen van de vragenlijst!

The Medical Dashboard

Steun van uw nefroloog

De onderstaande uitspraken gaan over de manier waarop u zich ondersteund voelt door uw nefroloog. Wilt u aankruisen in hoeverre u het oneens of eens bent met deze stellingen?

		Geheel oneens	Oneens	Enigs-zins oneens	Noch eens, noch oneens	Enigs-zins eens	Eens	Geheel eens
1.	Mijn nefroloog laat mij voldoende keuze bij beslissingen	☐	☐	☐	☐	☐	☐	☐
2.	Ik voel me begrepen door mijn nefroloog	☐	☐	☐	☐	☐	☐	☐
3.	Mijn nefroloog heeft er vertrouwen in dat ik dingen in mijn leven kan veranderen	☐	☐	☐	☐	☐	☐	☐
4.	Mijn nefroloog moedigt me aan vragen te stellen	☐	☐	☐	☐	☐	☐	☐
5.	Mijn nefroloog luistert naar hoe ik de dingen zou willen aanpakken	☐	☐	☐	☐	☐	☐	☐
6.	Ik kan mijn gevoelens delen met mijn nefroloog	☐	☐	☐	☐	☐	☐	☐
7.	Mijn nefroloog stelt vast in welke mate ik betrokken wil worden bij beslissingen.	☐	☐	☐	☐	☐	☐	☐
8.	Mijn nefroloog gaat na welke zorgen (angsten) ik heb over de aanpak van problemen.	☐	☐	☐	☐	☐	☐	☐

Uw transplantatie

U heeft een donornier gekregen. Mensen die een nieuwe nier krijgen verschillen in de mate waarin ze zich wel of geen zorgen maken over hun nieuwe nier. Wilt u aankruisen in hoeverre u het oneens of eens bent met de onderstaande stellingen?

		Helemaal mee eens	Mee eens	Niet eens/ niet oneens	Mee oneens	Helemaal mee oneens
1.	Wat betreft mijn donornier heb ik het gevoel iets kwetsbaars bij me te dragen	☐	☐	☐	☐	☐
2.	Ik aarzel om bepaalde activiteiten te ondernemen omdat ik bang ben schade toe te brengen aan mijn donornier	☐	☐	☐	☐	☐

		Helemaal mee eens	Mee eens	Niet eens/ niet oneens	Mee oneens	Helemaal mee oneens
3.	Ik maak me er zorgen over dat mijn donornier beschadigd raakt.	☐	☐	☐	☐	☐
4.	Ik houd mijn lichaam beter in de gaten dan voor de transplantatie	☐	☐	☐	☐	☐
5.	Ik maak me iedere keer weer zorgen als mijn arts het schema voor het innemen van mijn medicijnen tegen afstoting wijzigt	☐	☐	☐	☐	☐
6.	Ik blijf me afvragen hoe lang mijn donornier blijft functioneren	☐	☐	☐	☐	☐

Meedoen aan het gebruikersonderzoek

Bij het gebruikersonderzoek werd u gevraagd om metingen bij te houden. We willen u graag een paar vragen stellen over bewegen.

Bewegen

4. Hoe vaak heeft u de afgelopen twee weken aan recreatieve fysieke activiteiten of sporten gedaan gedurende tenminste 30 minuten (bijvoorbeeld wandelen of fietsen) en zo ja, hoeveel gemiddeld?
   ☐ Nooit
   ☐ .....keer per week gedurende .....minuten per keer

5. Heeft u van uw nefroloog in de afgelopen periode het advies gekregen om meer lichaamsbeweging te nemen?
   ☐ Ja
   ☐ Nee

6. In hoeverre zijn de volgende uitspraken op u van toepassing?

		Helemaal mee eens	Mee eens	Niet eens/niet oneens	Mee oneens	Helemaal mee oneens
a.	Ik zou graag meer willen bewegen	☐	☐	☐	☐	☐
b.	Ik heb er vertrouwen in dat ik meer kan bewegen als ik het probeer	☐	☐	☐	☐	☐

We willen graag weten wat uw ervaringen zijn met het Medical Dashboard. In hoeverre bent u het eens met de onderstaande uitspraken?

		Helemaal mee eens	Mee eens	Niet eens/ niet oneens	Mee oneens	Helemaal mee oneens
1.	Meedoen met het Medical Dashboard gebruikersonderzoek heeft mij duidelijk inzicht	☐	☐	☐	☐	☐

	gegeven in mijn gezondheid					
2.	Door mee te doen met het Medical Dashboard gebruikersonderzoek heb ik mijn gezondheid kunnen verbeteren.	☐	☐	☐	☐	☐
3.	Door mee te doen met het Medical Dashboard gebruikersonderzoek heb ik beter op mijn gezondheid kunnen letten.	☐	☐	☐	☐	☐
4.	Met behulp van het Medical Dashboard heb ik een grotere rol kunnen spelen binnen de zorg voor mijn eigen gezondheid.	☐	☐	☐	☐	☐
5.	Werken met het Medical Dashboard heeft me weinig moeite gekost.	☐	☐	☐	☐	☐
6.	Een nadeel van meedoen met het Medical Dashboard gebruikersonderzoek vond ik dat ik veel tijd kwijt was aan het uitvoeren en invullen van zelfmetingen.	☐	☐	☐	☐	☐
7.	Werken met het Medical Dashboard vond ik interessant.	☐	☐	☐	☐	☐
8.	Werken met het Medical Dashboard heb ik als iets vervelends ervaren.	☐	☐	☐	☐	☐
9.	Werken met het Medical Dashboard vond ik prettig.	☐	☐	☐	☐	☐
10.	Werken met het Medical Dashboard gaf me een onrustig gevoel.	☐	☐	☐	☐	☐
11.	Werken met het Medical Dashboard vond ik nuttig.	☐	☐	☐	☐	☐
12.	Werken met het Medical Dashboard heeft het contact met mijn dokter kunnen verbeteren.	☐	☐	☐	☐	☐
13.	Door het werken met het Medical Dashboard heb ik me geruster gevoeld over de werking van mijn nieuwe nier.	☐	☐	☐	☐	☐
14.	Door het Medical Dashboard heb ik een beter gevoel van controle gekregen over mijn nierziekte.	☐	☐	☐	☐	☐
15.	Door het Medical Dashboard heb ik beter vragen kunnen stellen aan mijn nefroloog.	☐	☐	☐	☐	☐
16.	Door het Medical Dashboard heb ik beter	☐	☐	☐	☐	☐

doelen voor mijn gezondheid kunnen stellen.

		Helemaal mee eens	Mee eens	Niet eens/ niet oneens	Mee oneens	Helemaal mee oneens
17.	De meeste patiënten zullen het Medical Dashboard graag willen gebruiken.	☐	☐	☐	☐	☐
18.	De meeste nefrologen zullen het Medical Dashboard graag willen gebruiken.					
19.	Het Medical Dashboard biedt goede ondersteuning om doelen te stellen.	☐	☐	☐	☐	☐
20.	Het Medical Dashboard biedt goede ondersteuning om nieuwe gedragingen op de langere termijn vol te kunnen houden.	☐	☐	☐	☐	☐
21.	Het Medical Dashboard sluit goed aan bij de problemen die patienten ervaren.	☐	☐	☐	☐	☐
22.	Het Medical Dashboard heeft de consulten met de nefroloog veranderd.	☐	☐	☐	☐	☐
23.	Het Medical Dashboard sluit goed aan op de zorg die ik krijg.	☐	☐	☐	☐	☐
24.	Het Medical Dashboard zorgde ervoor dat ik actiever bij mijn behandeling betrokken ben geraakt.	☐	☐	☐	☐	☐

Wat is uw oordeel over het Medical Dashboard als geheel? Geef een rapportcijfer van 1-10

Heel slecht	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	Heel goed
	1	2	3	4	5	6	7	8	9	10	

Wat vindt u goed aan het Medical Dashboard? U kunt meerdere punten noemen.

Dit is het einde van de vragenlijst.

Heeft u misschien nog opmerkingen?

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Hartelijk dank voor het invullen!