



Usability and experience testing to refine an online intervention to prevent weight gain in new kidney transplant recipients

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Objectives. Weight gain in the first year following kidney transplantation increases the risk of adverse health outcomes. Currently, there is no recognized intervention available to prevent weight gain after kidney transplantation. An online kidney transplant-specific resource, entitled Exercise in Renal Transplant Online (ExeRTiOn), has been co-created by a multi-professional team, including patients, to assist with weight prevention. This study aimed to evaluate patient and health care professional usability and experience of the ExeRTiOn online resource.

Design. Qualitative study utilizing 'Think-Aloud' and semi-structured interviews.

Methods. Participants ($n = 17$) were purposively sampled to include new kidney transplant recipients ($n = 11$) and transplant health care professionals ($n = 6$). Kidney transplant recipient participants were from a spread of physical activity levels based on scores from the General Practice Physical Activity Questionnaire (GPPAQ). 'Think-Aloud' interviews assessed the usability of ExeRTiOn. Semi-structured interviews explored participants' experience of ExeRTiOn, weight gain, and physical activity. The data set were analysed thematically. Participant characteristics, including login data and self-reported body weight, were collected.

Results. Data analyses identified valued intervention content and usability aspects which were summarized by two themes. The first theme 'You need to know how to manage yourself' included subthemes: (1) the resource filled a guidance gap, (2) expert patient content resonated, and (3) the importance of goal setting and monitoring progress. The second theme 'room for improvement' included subthemes: (2) web support and (2) content and operational change suggestions.

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Conclusions. Results have allowed for identification of potential areas for resource refinement. This has facilitated iterative enhancement of ExeRTiOn in preparation for a randomized controlled feasibility trial.

Statement of contribution

What is already known on this subject?

- Significant weight gain in the first year post-kidney transplantation increases the risk of adverse health outcomes, such as graft failure
- Weight gain remains an issue for kidney transplant recipients despite current advice on diet and exercise regimes
- Online interventions for weight loss in the overweight and obese populations have shown clinically important changes in body weight

What does this study add?

- Reports critical experiential and usability data for a novel online kidney transplant-specific weight gain prevention intervention
- Supports the use of goal setting and self-monitoring for promoting healthy physical activity and nutrition behaviour

Background

Post-kidney transplant weight gain

Despite the benefits of kidney transplantation for end-stage kidney disease (Ersoy, Ersoy, & Yildiz, 2012), Kidney Transplant Recipients (KTRs) are at risk of post-transplant diabetes (Baker, Mark, Patel, Stevens, & Palmer, 2017), coronary arterial disease (Baker *et al.*, 2017), post-transplant hypertension (Ward, 2009), and significant weight gain (Friedman, Miskulin, Rosenburg, & Levey, 2003). Weight gain within the first year of receiving a kidney transplant is of clinical interest. One third of new KTRs experience post-transplant weight gain (Glicklich & Mustafa, 2019). Weight gain within the first year of greater than 5% is associated with a threefold increase in kidney graft loss (Ducloux, Kazory, Simula-Faivre, & Chalopin, 2005). Furthermore, weight gain of greater than 15% is associated with increased non-kidney related mortality within 10 years (Vega, Huidobro, De La Barra, & Haro, 2015). Therefore, interventions should target weight gain as a potentially modifiable risk factor for new KTRs (Henggeler *et al.*, 2018).

Post-kidney transplant weight gain is multifactorial and may be influenced by increased appetite (Cashion *et al.*, 2014), which can be further exacerbated by immunosuppressant medications (Aksoy, 2016), altered eating behaviours associated with the lifting of dialysis dietary restrictions (Stanfill, Bloodworth, & Cashion, 2012), reduced functional capacity due to preceding uremic myopathy (Koufaki, Greenwood, Macdougall, & Mercer, 2013), and muscle atrophy (Greenwood *et al.*, 2015; Van Den Ham *et al.*, 2005). In addition, KTRs do not reach the level of physical activity of age-matched healthy controls (Nielens *et al.*, 2001). Qualitative reports have identified medication use, fear of injuring the new kidney, and the burden of other health problems as barriers to maintaining a healthy weight post-kidney transplantation (Stanfill *et al.*, 2012). KTRs report early support services are desperately needed (Stanfill *et al.*, 2012).

A systematic review and qualitative synthesis ($n = 1,238$ KTRs) evaluating the challenges and motivations towards self-management in KTRs concluded that enhancing self-efficacy, and providing an opportunity for social accountability, were motivators for self-management (Jamieson *et al.*, 2016). Inconsistent and vague education from

clinicians, fear of graft rejection, medical side effects, and struggling to reverse behaviours established whilst on dialysis were identified as potential barriers (Jamieson *et al.*, 2016). Fear of injuring the new kidney has also been associated with low self-efficacy (Zelle *et al.*, 2016). These studies suggest that current KTR patient information needs are inadequately addressed. Early interventions to promote self-management and enhance self-efficacy for KTRs are warranted.

Access to physiotherapists and dieticians for overweight and obese people living with CKD is variable across the globe (Chan & Soucisse, 2016; Orazio, Murray, & Campbell, 2012; Stenvinkel, Ikizler, Mallamaci, & Zoccali, 2013). KTRs are not routinely offered weight management interventions in the UK. Attending multiple and frequent hospital appointments post-transplantation can be 'exhausting' (Jamieson *et al.*, 2016). This can be exacerbated by return to work pressures and the aggregated travel burden to and from hospital, which makes attendance to additional face-to-face rehabilitation services challenging (Greenwood *et al.*, 2015). Online interventions provide a possible solution to enhance care and reduce patient burden.

Weight gain prevention interventions

There is currently no universally accepted weight gain prevention intervention for new KTRs. Two randomized controlled trials (RCT's) have evaluated the effect of complex interventions on weight gain in KTRs (Henggeler *et al.*, 2018; Tzvetanov *et al.*, 2014). Henggeler *et al.* (2018) reported no significant difference in weight gain at 6 months, when comparing intensive nutrition support and exercise prescription to standard care. However, the overall study cohort gained less than 5% body weight in the first year, which is of clinical significance. This finding could be partially explained by the high standard of care offered in this study, which exceeds UK clinical practice for KTRs. Tzvetanov *et al.* (2014) showed no significant between-group difference in body mass index (BMI) when comparing 12 months of exercise and nutrition counselling to usual care in obese KTRs. A RCT compared the effects of 6 months of face-to-face nutrition counselling and physical activity by a renal dietician, to usual care on insulin sensitivity in new KTRs (Kuningas *et al.*, 2019). Whilst there was no change in insulin sensitivity, the authors reported a significant mean between-group difference in body weight over the 6-month study (-2.47 kg [-4.01 to -0.92]; Kuningas *et al.*, 2019).

Whilst no evidence exists for online interventions to prevent weight gain for KTRs, research from the obese and overweight literature suggests that online behavioural weight management interventions can help regulate food intake and modify activity, leading to clinically meaningful weight loss (Little *et al.*, 2017; Neve, Morgan, Jones, & Collins, 2010). Online resources are likely to require personalized feedback and support to achieve statistically and clinically significant weight reduction (Sherrington *et al.*, 2016). Research investigating online interventions to support KTRs is needed.

Design of the ExeRTiOn resource

A Patient and Public Involvement (PPI) exercise conducted at the authors Renal Unit, revealed that KTRs had difficulty accessing face-to-face weight management clinic services, and would value an online resource to help support them to adopt a healthy lifestyle after transplantation (Greenwood, 2015). This PPI exercise identified KTRs were connected with online services, and readily use 'PatientView' to track their blood results from home. PatientView is presently used by 90% of UK renal units (The Renal

Association, 2020). The authors felt that a reactive website would be more practical than a mobile application for this study. This would allow users to engage with the research from multiple Internet-compatible devices, and also reduce costs associated with mobile phone application updates. This PPI led to the inception of an online resource, and an appreciation of its existing context.

An online kidney transplant-specific resource, entitled Exercise in renal transplant online (ExeRTiOn) was designed by the research team, comprising of; four expert KTR patients, a psychologist, two renal physiotherapists, two renal dieticians, two renal specialist nurses, a nephrologist involved in kidney transplantation care, and input from a software company (SPIKA Ltd, London, UK). The KTR patient experts contributing to ExeRTiOn were volunteers from a UK renal unit from a range of different ages, genders, and ethnicities. They identified pertinent topics to be covered by ExeRTiOn and contributed to the content including patient quotes and tips. The physiotherapists and dieticians in the team were able to draw on experiences from an established face-to-face National Health Service (NHS) renal weight management clinic (Cook, MacLaughlin, & Macdougall, 2008; MacLaughlin *et al.*, 2012).

Design of the ExeRTiOn online resource, like the design and development of any other digital or complex intervention was non-linear, iterative and complex (Blandford, 2019; Bradbury, Watts, Arden-Close, Yardley, & Lewith, 2014; O’Cathain *et al.*, 2019). ExeRTiOn was designed pragmatically and utilized a combination approach intervention design (O’Cathain *et al.*, 2019). The initial design was informed by; input from our target population (KTRs), clinical experience from the renal weight management service, the self-efficacy theory (Bandura, 1977), recognized Behaviour Change Techniques (BCTs) to promote healthy eating and physical activity (Michie, Ashford, et al., 2011), and guidance for digital intervention development (Bradbury *et al.*, 2014; The LifeGuide Team, 2013; Yardley *et al.*, 2012).

Consensus meetings amongst the team identified relevant BCTs from the CALO-RE taxonomy to support healthy physical activity and diet (Michie, Ashford, et al., 2011) for the inclusion in the ExeRTiOn resource. These included the following: the setting and revision of goals, action planning, prompting of self-monitoring of physical activity and weight, motivational interviewing such as confidence and importance rulers (Hall, Gibbie, & Lubman, 2012), and education from clinical experts and patients (Michie, Ashford, et al., 2011). The online resource drew on Bandura’s principle of self-efficacy, which can be defined as an individual’s own belief in their capacity to perform a certain behaviour (Bandura & Adams, 1977). It was anticipated that the ExeRTiOn resource would enhance self-efficacy of healthy eating and physical activity behaviours.

The research team acknowledge that future feasibility testing and process evaluation are needed to further develop and evaluate the ExeRTiOn resource (Bradbury *et al.*, 2014; Moore *et al.*, 2015). Therefore, the results from this current study will inform a mixed-methods feasibility RCT where half the participants will receive the revised ExeRTiOn resource with monitoring from a study physiotherapist.

Study aims

Early involvement with key stakeholders and target users is crucial to uncover usability and experience, and to inform development and refinement of digital health care interventions (Blandford, 2019; Bradbury *et al.*, 2014). Therefore, this study aimed to evaluate the usability (functionality, navigation, and interactivity) of the patient-facing ExeRTiOn online resource, report participant experience using ExeRTiOn, and identify

emergent themes and valued content of ExeRTiOn in a sample of new KTRs and health care professionals (HCPs). This was achieved through think-aloud interviews and semi-structured interviews.

Methods

Summary of the ExeRTiOn resource content

For the purpose of this current study, participants were testing aspects of the patient-facing ExeRTiOn prototype in a supervised one-off research visit. They did not have access outside of the study visit. The ExeRTiOn prototype has 12 weekly sessions, including both a patient-facing website, and a physiotherapist-facing back-end website. Table 1 summarizes the content of the twelve sessions. Figures 1 and 2 demonstrate screen grabs.

The linked back-end website (see Figure 3), allows the study physiotherapist to monitor participant log in times, adherence to sessions, goals, weekly physical activity and weight graphs, and also answer any questions through the secure inbuilt messaging system.

After extensive testing of the ExeRTiOn prototype by the research team, content and functionality issues were rectified in preparation for qualitative evaluation. This included testing of both the patient-facing and back-end websites by the authors, the software company, and clinical colleagues who had not had direct involvement in the design.

Study design and procedure

This study employed 'think-aloud' and semi-structured interviews, in parallel with the Generalised Physical Activity Questionnaire (GPPAQ; Physical Activity Policy Health Improvement Directorate, 2009).

Ethical approval

A favourable ethical approval was provided (North West Greater Manchester Central Research Ethics Committee and the Health Research Authority) on the 23rd of March 2018. The study was registered online (clinicaltrials.gov). Consent was not given for the full publication of transcripts.

Participant recruitment

All participants were recruited from a London NHS Foundation Trust Renal Unit from the 31st of May 2018 to the 18th of February 2019 using approved patient information sheets, a document summarizing online data security and privacy specific to this study, and consent forms. Participants were purposively sampled (Patton, 2002) for a range of age, ethnicities and gender. KTR participants were included in the study if they had received a kidney transplant within the past 3 months, able to provide written consent, and had a BMI of 18.5 kg/m² or above. They were excluded from the study if they were pregnant, had an unstable medical condition (e.g., unstable angina), or had a significant cognitive impairment documented in medical records preventing them from testing ExeRTiOn. HCP participants were recruited from the kidney transplant multi-disciplinary team at a London NHS Trust. Recruitment ended when no new descriptive codes, categories, or

Table 1. Summary of the key components of the ExeRTiOn prototype

Session title	Sessions elements
Welcome Session*	<p>Tick box agreement and expectations</p> <p>Introduction video by expert physiotherapist</p> <p>Virtual tour of website and main functions</p> <p>Baseline GPPAQ</p>
Session 1: Goal setting	<p>Video from expert physiotherapist and patient on SMART goal setting</p> <p>Summary of session including patient 'top tip' quotes</p> <p>User encouraged to set their first goal plan</p>
Session 2: Managing Cravings	<p>Video from expert renal dietician on cravings and hunger post-transplant</p> <p>Interactive activity: cravings versus hunger</p> <p>Summary of session including patient expert 'top tip' quotes</p> <p>User prompted to revisit goals/ set new goal</p>
Session 3: Food planning and labels	<p>Second GPPAQ</p> <p>Video from expert dietician on planning food and how to read food labels</p> <p>Reference resources in 'my library' such as food label card</p> <p>Summary of session</p>
Session 4: Activity after transplant	<p>Video from expert physiotherapist on activity after kidney transplantation</p> <p>Reference to resources in 'my library'</p> <p>Interactive activity: reviewing effort levels whilst exercising</p> <p>Summary of session</p>
Session 5: Choosing your activity/exercise	<p>Video from expert physiotherapist on exercise options, demonstration of a few key exercises from the home exercise diary tab</p> <p>Interactive activity: user selects the focus of their physical activity</p> <p>Reference to 'exercise diary' and 'my library' resources</p> <p>Summary of session</p>
Session 6: Healthy eating- it's a balance	<p>Videos from expert dietician on all the major food groups</p> <p>User able to select which video they choose to view</p> <p>Interactive activities on different food groups</p> <p>Signposting to resources in 'my library'</p> <p>Summary of session</p>
Session 7: Quantity and Quality- they both matter	<p>3rd GPPAQ</p> <p>Video from expert dietician on portion control tips and strategies</p> <p>Interactive activity on portion sizes</p> <p>Signposting to resources in 'my library'</p> <p>Summary of session</p>
Session 8: Activity planning	<p>Video from expert physiotherapist on how to plan activity</p> <p>Patient example of activity planning</p> <p>Interactive activity: activity plan template</p> <p>Summary of session</p>
Session 9: Keeping on track whilst also having fun	<p>Video from expert physiotherapist</p> <p>User able to select various topics such as eating out, on holiday, Christmas and celebrations to see top topics and further information</p>

Continued

Table 1. (Continued)

Session title	Sessions elements
Session 10: Overcoming barriers	4th GPPAQ Video from expert physiotherapist with expert patient about common barriers to activity and food post-transplant Interactive worksheet on barriers Summary of session
Session 11: Problem solving	Video from expert physiotherapist on problem solving Interactive worksheet on problem solving Summary of session
Session 12: Preventing setbacks	Video on relapse prevention by expert physiotherapist Interactive worksheet summarizing key learning, barriers, and future plans Completion of 12-week programme content
Other components website	Secure message system to the study physiotherapist Home exercise diary tab including written and pictorial information of exercises that can be done at home or in a gym Short cut to goals page including SMART goal setting, action plan and using the confidence and important ruler My library tab which includes custom made resources and links to external websites Self-monitoring graphs of weight and physical activity

Note. Key: *Welcome session = this is completed by all users once at sign up to the online intervention SMART refers to Specific, Measurable, Achievable, Realistic, and Timed Goals, edu = education, GPPAQ = General Physical Activity Questionnaire which is built into the website to appear at the start of every 4th session to gather physical activity data.

themes emerged from the data. This was decided by consensus amongst the research team.

Data collection

All participants completed a single supervised study visit (taking approximately 50–90 min) between the 21st of November 2018 and the 1st of March 2019. Participant characteristics were recorded at study entry. All interviews were conducted in a private room within the NIHR Clinical research facility at a London NHS Foundation Trust Hospital. Qualitative data were collected via ‘think-aloud’ interviews (on the patient-facing ExeRTiOn website) and were immediately followed by a semi-structured interview using a topic guide. Refer to Supinfo S1 and Supinfo S2 for the topic guides.

Think-aloud interviews assess usability, which is defined as how easily one can use and interact with an online system without any formal training (Benbunan-Fich, 2001). In this study, ‘think-aloud’ interviews followed a standardized protocol including a ‘warm-up activity’ (Eccles & Arsal, 2017) to get participants accustomed to speaking out loud. Participants were set up with a testing account and password by the corresponding author. They were instructed to reset their password and use this account alongside their participant number ensuring no personal identifiable material were entered into the online testing platform. Participants then performed supervised tasks whilst vocalizing

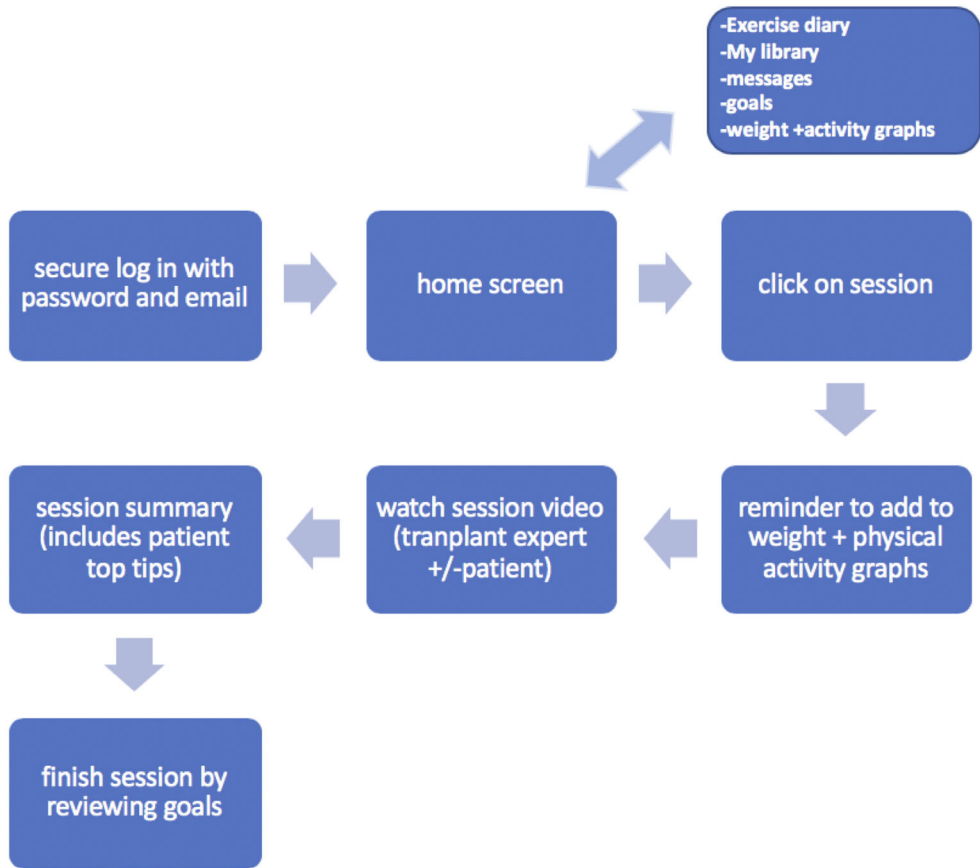


Figure 1. A typical flow for the user through the website. The user can either enter a session directly or engage with other functional tabs such as my library, message function, goal setting, and the weight and activity graphs. [Colour figure can be viewed at wileyonlinelibrary.com]

out loud their actions and encounters with the online resource. Prompting from the researcher was standardized and kept to a minimum (Draper, 1998).

KTR participants completed 'Think-aloud' interviews on two different tasks on an NHS computer. Firstly, all the KTR participants reviewed the welcome session and goal setting session (session 1). These sessions were considered to be the key foundation sessions of ExeRTiOn and would therefore need to be reviewed by all participants. The second task involved reviewing an additional session (from session two to twelve), which was randomly allocated to each participant using a free online randomization website (List randomizer, n.d.). Sessions two to twelve were reviewed by a different KTR participant, based on this random allocation. For example, session two was randomly allocated to participant 01 to review, and session three was randomly allocated to participant 08 to review. Immediately following the two think-aloud tasks, KTR participants underwent an individual semi-structured interview to capture their experiences of ExeRTiOn, and their thoughts and experiences with weight gain and physical activity following kidney transplantation.

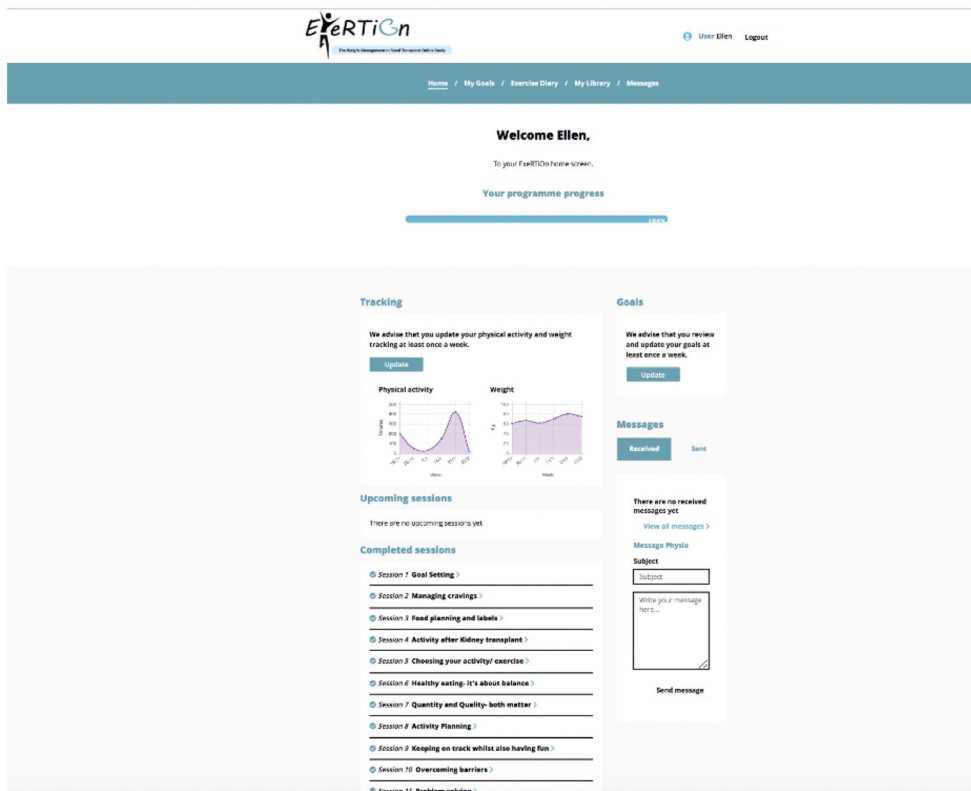


Figure 2. Home screen layout of patient-facing website. Home screen features include; progress bar, tracking, goals, sessions, and message function. Navigation panel at top of screen allows user to access goals page, exercise diary, my library, and messages. [Colour figure can be viewed at wileyonlinelibrary.com]

HCP participants were provided with a tour of both the patient-facing website and the back-end websites, demonstrating the key features. They were then provided with a login and password to the patient-facing website and invited to complete ‘think-aloud’ interviews on both the welcome package and first session. They had the option to continue exploring sessions if they wished. This was followed immediately by a semi-structured interview to explore experiences of the ExeRTiOn prototype, and experiences working with KTRs in terms of weight gain and physical activity.

All interviews were audio-recorded, and field notes were completed. All transcripts were imported into NVivo © for mac (version 12) and coded as per the data analysis plan. The interviewer had extensive knowledge of the ExeRTiOn prototype. They were able to use field notes, alongside the transcripts, to decipher where in the website issues were occurring. Additional data collected included; GPPAQ data, website login data such as time taken to complete sessions, and self-reported physical activity (in minutes) and body weight (in kilograms) that was entered into the website. The GPPAQ data were analysed as per the guidelines (The Department of Health, 2009), and categorized using the physical activity index (PAI; active, moderately active, moderately inactive and inactive; The Department of Health, 2009).

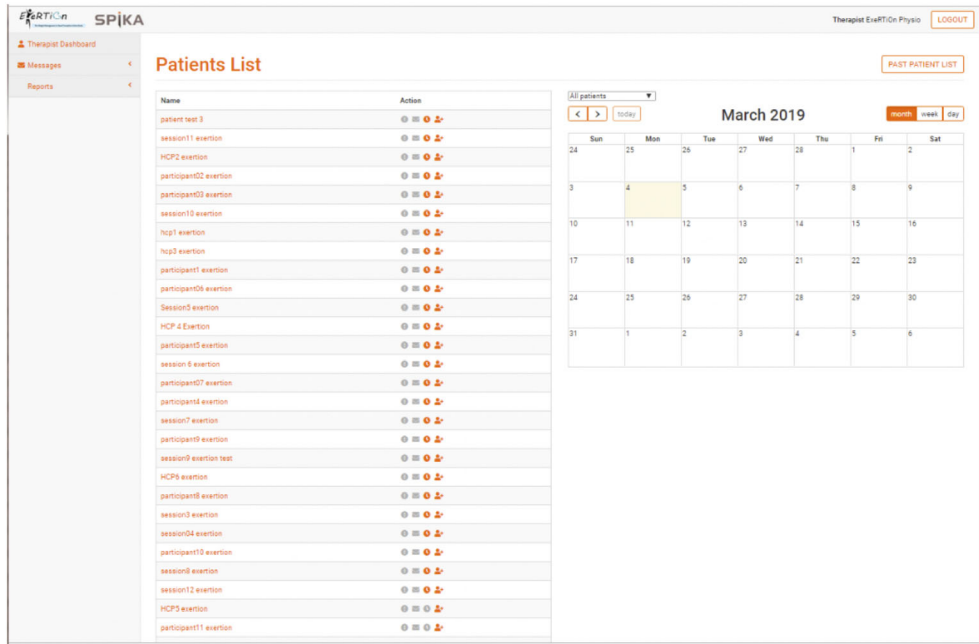


Figure 3. Physiotherapist home screen (back-end). The back-end website is linked to the patient-facing website. It requires a secure login and password. The back-end home screen allows the study physiotherapist to be able to view; messages to and from participants, view reports on weekly session compliance, session log in times, GPPAQ data, goals data, and weekly weight and physical activity data. [Colour figure can be viewed at wileyonlinelibrary.com]

Data analyses

All interviews ('Think-aloud' and semi-structured) were transcribed verbatim. Transcripts were read and re-read, codes were created, and data were analysed inductively, using thematic analysis (Braun & Clarke, 2006, 2013). Memos were made to note where in the prototype usability issues, and positive and negative experiences were occurring. Deviate case codes were employed to ensure all perspectives that diverge from the dominant trends were not overlooked.

To ensure reflexivity, a reflective journal was used throughout the study to differentiate between participants experiences and the primary author's own thoughts and experiences. To ensure rigour, an external qualitative researcher (JG), with no involvement in creating ExeRTiOn, validated emergent codes and themes. These strategies aimed to insure that the themes were inductive, attributed to the content from the interviews conducted in this study, rather than the researchers' perceptions.

Results

A total of seventeen participants were recruited, including eleven KTRs and six HCPs. Figure 4 summarizes participant flow. Ten KTRs were recruited to test all the sessions. An additional KTR participant was recruited to achieve data saturation. This was deemed necessary as one participant required extensive prompting to use the computer (how to scroll, how to use a mouse etc). This participant took 55 min to complete task 1 compared

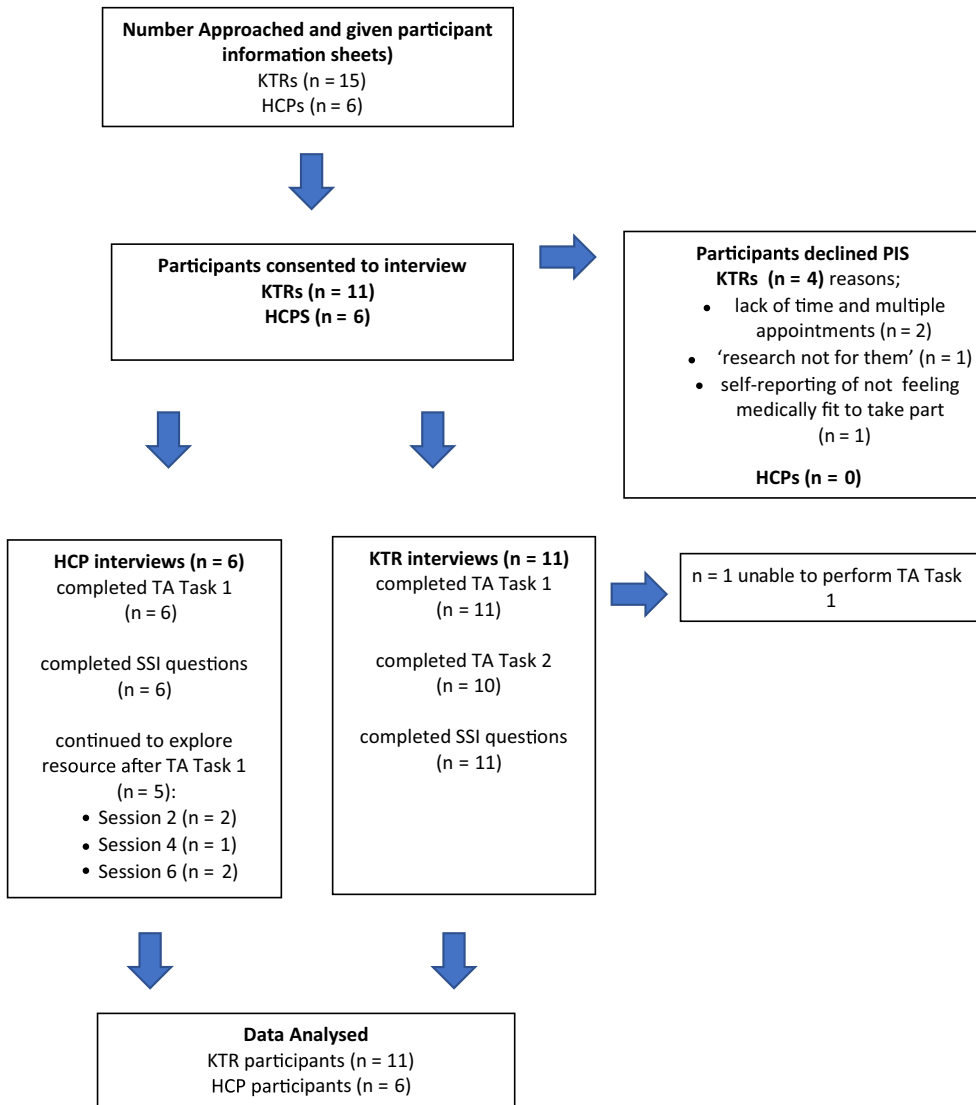


Figure 4. Participant flow diagram. KTR = Kidney Transplant Recipients, HCP = health care professionals, TA= ‘think aloud’ interviews, SSI = semi-structured interviews. Interviews, SSI = semi-structured interviews. [Colour figure can be viewed at [wileyonlinelibrary.com](https://onlinelibrary.wiley.com)]

to the mean time of 19.5 ± 12.9 min (range 6 to 55 min). This resulted in that participant just completing task 1 of the ‘think-aloud’ tasks, and the semi-structured interview questions. Participant 11 therefore completed the additional session (task 2). The mean time to complete task 2 was 13.6 ± 7.3 min (range 7 to 27 min). The mean time to complete task 1 for the HCP participants was 7.58 ± 6.97 min (range 3 to 21 min). All but one of the HCP participants continued to explore sessions after completing task 1 (Figure 4).

There were no dropouts from this study. All participants completed the one-off study visit. Due to the wealth of data generated from ‘think-aloud’ interviews, a sample of five

Table 2. KTR participant characteristics

Variable	KTR participants (<i>n</i> = 11)
Age participants (mean years)	50 ± 14
Males	45% (5)
Ethnicity	White Caucasian 54% (6) Black African and Caribbean 28% (3) Asian 9% (1) Other 9% (1)
Transplant vintage (mean days)	43 ± 19
Type transplant	91% (10) single Kidney transplant 9% (1) combined liver-kidney transplant
Donor Type	27% (3) Living related 73% (8) Deceased Donor
eGFR (mean) in ml/min/1.73 m ²	48 ± 19.2
Creatinine (mean) in mmol/l	136 ± 50
Number of comorbidities	1 46% (5) 2 36% (4) 3 9% (1) 4 9% (1)
Type of dialysis prior KTx	HD 36.5% (4) PD 36.5% (4) No dialysis 18% (2) HD and PD 9% (1)
Time on dialysis prior KTx (mean weeks)	26 ± 27
Smoking History	Non-smoker 73% (8) Ex-smoker 27% (3) Current smoker 0%
Diabetes diagnosis	T2 Diabetes 18% (2)
Hypertension diagnosis	82% (9)
Self-reported physical activity (mean in minutes with range)	82 ± 122 (10 to 410)
Self-reported weight (mean in kg with range)	82.0 ± 18.5 (53.7 to 111)
BMI (mean in kg/m ²)	27.8 ± 3.8
Time taken to complete welcome and goals session (mean in minutes and range)	19.5 ± 12.9 (6 to 55 min)
Time taken to complete randomized session (mean in minutes and range)	13.6 ± 7.3 (7 to 27 min)
Type of goal set (proportions)	18% food goal (2) 73% activity goal (8) Set no goal 9% (1)

Note. Means and standard deviations are presented for continuous data. Frequency numbers and proportionate percentages are shown for categorical data. KTR = kidney transplant recipient, HD = haemodialysis, PD = peritoneal dialysis, kg = kilograms. Comorbidities included a medical history of; diabetes, hypertension, cerebrovascular event, osteoarthritis, brain haemorrhage, cardiovascular disease, cancer, or respiratory disease.

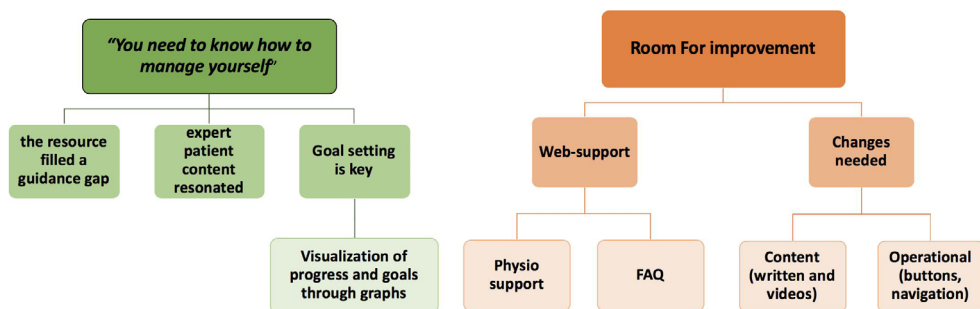


Figure 5. Summary of the emergent themes and subthemes from thematic analyses. The first theme was 'you need to know how to manage yourself'. Stemming from this included the following subthemes: (1) the resource filled a guidance gap, (2) expert patient content resonated, and (3) the importance of goal setting and monitoring progress. The second theme was room for improvement. Subthemes included (1) web support and (2) content and operational change suggestions. [Colour figure can be viewed at wileyonlinelibrary.com]

participants is said to be able to uncover 80% of usability problems and issues (Benbunan-Fich, 2001). Therefore this sample was of sufficient size to detect any existing usability issues within the ExeRTiOn resource. Table 2 summarizes the KTR participant characteristics.

KTR participant GPPAQ PAI were; active ($n = 4$), moderately active ($n = 1$), inactive ($n = 6$). All KTRs were prescribed triple immunosuppressant therapy, including oral prednisolone (mean \pm *SD* dosage 6.78 ± 3.2 mg, range 5–15 mg). HCP participants included a consultant nephrologist ($n = 1$), transplant nurses ($n = 2$), renal dieticians ($n = 2$), and a renal physiotherapist ($n = 1$), with a mean clinical experience of 12 ± 8 years.

Qualitative data were triangulated from transcripts, field notes, and reflective journal entries. Two themes emerged from the data set which are summarized in Figure 5.

Theme 1: You need to know how to manage yourself

This theme, which arose from reports across the whole data set, suggests that participants felt that the website was needed and could support new KTRs to follow a healthy lifestyle after transplantation.

You know some of us, we just sit back, we don't care. After my transplant what else. You need to know how to manage yourself. You need to achieve your goal if you want to lose weight. (P04, female KTR)

They need something like this. Definitely. Yeah Definitely without a shadow of a doubt. Because there was lot of things when I'd had the transplant that I was thinking I didn't know. And I've had to research or ask. This makes it a lot easier. (P07, female KTR)

There were three key subthemes that contributed to this theme including; (1.1) the importance of goal setting and monitoring progress, (1.2) the resource filled a guidance gap, and (1.3) Expert patient content resonated with participants.

1.1 *The importance of goal setting and monitoring progress*

Goal setting and planning was considered to be a key feature of ExeRTiOn by the majority of KTR and HCP participants. Goal setting was widely perceived as a tool to support users to shift their aspirations from general statements to precise dietetic and physical activity goals. It appeared to be important to participants that these goals were individualized to each user's ability to promote adherence.

Setting the goals. Is it's a sort of-it's an achiever for you. Because when you set your goals you try and stick to them. You make sure it works out, like for health reason. When you set your goal, you have to make sure you go by them, because it's for your own good. For your own happiness and your confidence. (P01, male KTR)

In contrast, one participant varied from the rest of the data set and did not agree with the individualized goal setting approach. He reported he wanted a drop-down list of goals to select from.

I'm lazy, I don't want to do that. That's if you had a list of goals, maybe 20 or 30, whatever it is. I can just go there and say, 'I want to lose weight'. (P11, male KTR)

Self-monitoring of weight and physical activity, through the tracking weight and physical activity graphs frequently aligned with accountability. Participants suggested these graphs could allow them to visually keep track of their progress.

I think it's it will keep me on track. Especially doing the weight. (P05, female KTR)

It's very simple, to just look at. I like this immediate-I can see exactly where I am going. Am I winning, or am I losing. (H05, female Nephrologist)

Setting goal plans, and tracking graphs of physical activity and weight, appeared to be valued by this sample and align with accountability.

1.2 *The resource filled a guidance gap*

Participants reported that ExeRTiOn was a helpful mode of delivery for providing new KTRs with much-needed specific physical activity and dietetic guidance after transplantation. Participants felt that ExeRTiOn answered their queries and could therefore bridge the guidance gap and assist their self-management after transplant.

We have nowhere to turn to. I kept on saying 'is there a website? (P07, female KTR)

It will be effective really. I mean when I had my transplant, I had to start asking 'what do I do? (P11, male KTR)

Some participants expressed feeling uncertain regarding the type and amount of activity they could initially perform post-transplant, which was exacerbated by fear of injuring the new kidney. Participants expressed the sentiment that ExeRTiOn could possibly address some of this unmet need.

It's kind of hard to know how much you can do, how much you can't. Because at first, you don't want to do anything (laughter). Yeah. You can't even read a book. Erm its really nice to have guidelines and know where you're supposed to be. I think it's a really good idea. (P06, female KTR)

Figure 6 depicts a coding tree summarizing the subtheme 1.2.

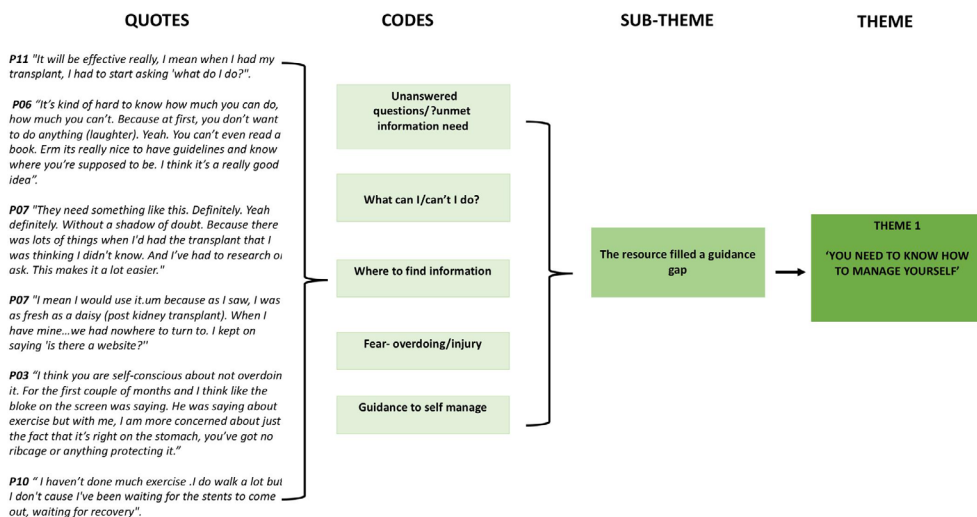


Figure 6. Detailed coding tree for subtheme 1.2. The coding tree depicts quotes and codes that form the subtheme: the resource filled a guidance gap. [Colour figure can be viewed at wileyonlinelibrary.com]

1.3 Expert patient content resonated with participants

Having ‘real’ KTRs imbedded within the online resource, particularly featuring in the videos, and ‘top tip’ quotes on the summary pages, appeared to resonate and be meaningful to participants.

Obviously the er doctor can only give what they’ve learn. They haven’t necessarily experienced going through surgery so, yeah. You need a bit of a balance (P10, male KTR)

It’s nice hearing (patient expert name) talk. I just think it’s—I guess for some patients it might seem daunting. Mightn’t it? . . .If they want to start making changes to their lifestyle, and the way that he broke it down, and the way that he was explaining it, makes it seem nice and achievable (H03, female dietician)

This real world account was consistently valued by participants and appeared to normalize the variability of many participants post-operative experience.

If you were doing that. You’d say ‘well you know (patient expert name) been through that. You know and come out the other side’. Um which I thought was a big plus. (P05 a female KTR)

Whilst the majority of the sample valued the expert patient input, one participant did not agree with comments raised by the expert patient.

I didn’t necessarily agree with some of the things he said. You would be doing it by actually going and checking your weight. . . I didn’t think you actually needed him. (P07, female KTR)

The majority of the participants felt it was important to have both the professionals and KTR experiences captured in the videos featured in the ExeRTiOn online resource. Honest and lived-in KTR experience was seen as a key feature.

Theme 2: Room for improvement

Whilst the website was well received by participants, there were aspects that could be improved to increase engagement with new KTRs. This theme encompassed the subthemes of the importance of web support from both the physiotherapist monitoring the website, and the website itself. This theme also encompassed content changes (text and video) and operational change suggestions (buttons and navigation).

2.1 Web support

There were various views on how the study physiotherapist, who would monitor the participants online profiles, should support participants to engage with ExeRTiOn. One suggestion to improve accessibility to the online content arose from a few participant interviews.

Have you got a question and answer part of it? You could have like a drop down list of frequently asked questions and answers underneath. (P07, female KTR)

I don't know if there is a help function on there. (P02, male KTR)

Participants welcomed the idea of weekly automated emails or messages through the website to remind them to complete the weekly sessions.

If there's a 12-week programme, what would be useful would be a text reminder or an email reminder. (P02 a male KTR)

However if participants became unwell, or had issues engaging with ExeRTiOn, they felt they would want personalized and individualized feedback from the study physiotherapist, rather than an automated message.

Probably something a bit more personal. . .because I think sometimes you think 'oh well that's just come out automatically'. (P09, female KTR)

They have a chance to say 'well actually, I've got a bit of a problem because I was trying to do this and that didn't happen. (P07, female KTR)

If something was going wrong, yes, rather than just getting an automatic message that was just saying 'keep going for your goals! and you're like 'well I haven't been on 3 weeks'. I would prefer something more personable. (H06, female dietician).

Some participants suggested an initial face-to-face induction session with the study physiotherapist would be needed.

I think eer first steps you need it face to face to start with. . .then you can do it on your own at home. (P04, female KTR)

Others felt that if they weren't meeting their goals, they would like specific feedback from the physiotherapist.

It may want some reminder if things are not progressing to say look um. 'You know your weight has increased' saying or not. Or 'your activity is not improved'. To give some feedback. (P08, male KTR)

Whilst the online intervention appears to promote self-management, participants express the need for some support from the website such as a frequently asked questions

tab and reminder emails. They also felt that personalized feedback from the study physiotherapist monitoring the website would improve participant experience and foster engagement.

2.2 Content and operational change suggestions

Usability testing revealed various examples of content and operational changes suggested by the participants. These included suggestions to simplify the session list layout on the home screen, the addition of extra navigation buttons, and increasing the size of headings and tick boxes.

Have all the sessions there, you've still got ticks or what you have done and haven't done (P10, male KTR about simplifying home screen layout)

I am assuming, I didn't go onto it, but assuming there is a button taking you back to the home screen? (P02, male KTR regarding an extra navigation button to assist returning to the home screen).

Whilst tracking of self-reported weight and physical activity was seen as a valued function of ExeRTiOn, participants suggested that the description of what type of activities that could be included needed clarification.

So does physical activity include housework as well? Or not? (P02, male KTR)

Does the physical activity include walking? Or is it just actual exercise? (P06, female KTR)

I think I would like to know what activity I am allowed to include (H05, consultant nephrologist)

Written content changes, such as clearer definitions were suggested as strategies to enhance usability of ExeRTiOn.

There were a variety of responses from participants in regard to the ideal length of the educational videos within ExeRTiOn. The majority of the participants felt the videos were too long.

I'd definitely say shorter than eleven minutes- I think. (P06, female KTR)

It felt a bit too long. . . I was looking at how far we have got to go (P05, female KTR)

About three (minutes). Because you need to get the attention. And them to not tune out and get bored. (H01, Kidney Transplant Nurse)

Some participants felt that the length of the video should depend on the subject matter and its importance.

If it's 12 minutes and fills everything in, then it needs to be 12 minutes. (P03, male KTR)

It depends on the subject, there's no point having a 3 minute video every time because one video might not fit enough in. (P10, male KTR)

The ideal length of video seemed to vary across the sample. To optimize engagement, the length of videos will be revised. Applying the constructive feedback from participant interviews to the planned revisions of the ExeRTiOn resource should improve experience and engagement.

Discussion

This study aimed to explore the usability and experience of the patient-facing ExeRTiOn prototype and identify valued content. The results from this study, have allowed the research team to better understand the target end-users (new KTRs), and involve them early in the intervention development process. Early involvement of target end-users in digital health intervention design and refinement can enhance acceptability (Valdez & Ziefle, 2019). To our knowledge, this is the first study to report the usability and experience of an online resource designed specifically to prevent weight gain for new KTRs.

The overall experience was deemed positive by both the KTR and HCP participants. The results, particularly Theme 1 'you need to know how to manage yourself', suggests that the experience of the online resource could perhaps assist with self-management. The recognized BCTs to support healthy eating and physical activity behaviour change; goal setting and prompting of self-monitoring behaviours (Michie, Ashford, et al., 2011) were valued by our sample of KTRs and HCPs (Theme 1.1). These valued functions could perhaps allow users to be accountable for their physical activity and weight.

The specific kidney transplant content was felt to be a crucial component to the success of the ExeRTiOn prototype. Participants identified that ExeRTiOn could fill an existing guidance gap within information that is currently provided post-kidney transplant (subtheme 1.2). A systematic review of qualitative studies reported that participants experienced 'frustrating ambiguities' when information provided by clinicians was unclear and conflicted previous recommendations, which influenced self-management behaviour (Jamieson *et al.*, 2016). Therefore, providing new KTRs with specific guidance on physical activity through the ExeRTiOn online resource could potentially address the identified inadequacies of education which may be encountered during routine post-operative kidney transplant care.

All but one of the KTR participants in this current study valued the patient expert content which helped to normalize the kidney transplant journey. Jamieson *et al.* (2016) also reported the positive benefit of peer-support and shared experience. Both KTR and HCP participants in this current study felt that an online resource was a worthwhile mode to deliver personalized education, self-monitoring and support, to promote and facilitate adoption of healthy eating and physical activity behaviours post-kidney transplantation.

Threats to user privacy is a challenge in digital health care (Blandford, 2019). Studies investigating user perceptions with digital health interventions suggest mental health data is perceived to be the most sensitive (Stawarz, Preist, Tallon, Wiles, & Coyle, 2018), in comparison to general and physical health data (Valdez & Ziefle, 2019). In this current study, there were no concerns raised about data security and privacy from participants. This is perhaps due to the detailed information provided during the recruitment process on data security and privacy. In addition, the ExeRTiOn prototype involved limited personal information, and focused on physical health data (weight, physical activity, and goals).

Participants in the current study felt that web support (subtheme 2.1) was an important issue to be addressed in revisions of the ExeRTiOn online resource. Optimizing support could improve resource usability and acceptability for new KTRs. Participants also felt that personalized feedback would perhaps foster better engagement. The need for human interaction and personalized feedback, is echoed in online weight loss studies in the overweight and obese populations (Bradbury, Dennison, Little, & Yardley, 2015; Sherrington *et al.*, 2016). The research team plan to review the support provided within

the ExeRTiOn online resource, and also the physiotherapist support that will accompany it, in the planned feasibility RCT.

Subtheme 2.2 (content and operational changes) demonstrates helpful suggestions from our participants on how the website might be optimized to enhance usability and experience. One of the suggested changes included reviewing the 'ideal' length of the educational videos. Whilst videos can be used as an effective education tool, considerations need to be made to ensure optimal learning and engagement (Brame, 2016). Research suggests that education videos need to be 6 min or less to achieve optimum median engagement of close to 100% (Guo, Kim, & Rubin, 2014). When the length of the video increased, the median engagement time reduced, with 9- to 12-min videos reporting only 50% median engagement (Guo *et al.*, 2014). In this current study, there was variance in participant reports as to the ideal length of the ExeRTiOn educational videos. The research team plan to reduce the length of videos to within 6 to 9 min.

Whilst there is some current evidence emerging, which evaluates the effects of face-to-face complex interventions that combine dietician input, exercise therapy and behaviour change on weight gain in KTRs (Henggeler *et al.*, 2018; Tzvetanov *et al.*, 2014), more research is warranted. Existing studies report variable intervention doses, standards of usual care, and outcomes, make it difficult to determine what the best intervention is to prevent weight gain in new KTRs. To our knowledge, ExeRTiOn is the first online resource to explore weight gain prevention in new KTRs.

The development and refinement of the ExeRTiOn online resource is a complex and iterative process. The results from this study will inform further refinements and research. Firstly the authors plan to utilize the MoSCoW method, a recognized prioritization tool, to inform the needed revisions to the prototype (Bradbury *et al.*, 2014). MoSCoW stands for; (1) 'Must have' changes the essential changes to enhance usability and experience, (2) 'Should have' changes which are important but no essential features, (3) 'Could have' changes include useful to have features (dependant on budget constraints), and, (4) 'Would like' features include changes that are not currently essential or important, but could be considered in future projects (Kuhn, 2009). The research team will prioritize the results from this current study, using the MoSCoW method, to inform the essential and important changes needed to enhance usability and experience of the ExeRTiOn resource. Refinements will be made with the software company in preparation for the planned follow-up feasibility RCT.

Secondly, the results from this current study will inform a *post-hoc* evaluation of the revised ExeRTiOn intervention using the Behaviour Change Wheel Methodology (Michie, Van Stralen, & West, 2011). This will allow the research team to evaluate the mechanisms of action, and also create a theoretical framework for this intervention (Michie, Atkins, & West, 2014).

Limitations

Limitations of this current study include its single-centre design, and the fact that the corresponding author who created ExeRTiOn also conducted the interviews. To address the potential interviewer bias, the following strategies were employed: (1) probing questions to address negative feedback of ExeRTiOn were utilized in the topic guide, (2) use of a reflective journal, and (3) the research team consulted an external qualitative researcher (JG) to validate codes and themes. Another limitation to this study is the fact that usability testing was conducted within a supervised one-off research study visit. This limitation will be addressed in the planned mixed-methods feasibility study. The study

team plan to interview a purposive sample of intervention participants who adhere to the 12-week ExeRTiOn resource, and those who do not adhere to the intervention. This will allow the research team to gather further data with the resource when it is used independently in participant's homes. A further limitation to note is that no human computer interaction researcher was involved in the study. However, one of the researchers and the software company had extensive experience working on previous health behaviour change online products, and this experience was critical. Despite the limitations, this study has allowed the research team to better understand their target audience of new KTRs and also ensure that the novel online resource will address their specific needs. Based on the results of this study, the research team plan to revise the ExeRTiOn resource, in preparation for a bi-centre mixed-methods feasibility RCT.

Conclusion

An online weight gain prevention resource, designed specifically for new KTRs, was created and evaluated by our research team. The ExeRTiOn online resource has the potential to provide new KTRs with much-needed information to foster self-management and mitigate the fear-avoidance behaviour that is often associated with returning to physical activity post-kidney transplantation. Both KTR and HCP participants identified that goal setting, self-monitoring graphs, patient expert content, and physiotherapy support were valued content in the ExeRTiOn prototype. This study has allowed the research team to further understand their target user population and make informed revisions to the online resource. Revisions will be implemented using the MoSCoW method prior to utilizing the ExeRTiOn resource in a planned RCT.

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Conflicts of interest

All authors declare no conflict of interest.

Author contribution

EC, SG, and JC conceived and designed the study. EC involved in data acquisition. EC, JG, SG, and JC analysed and interpreted the data. EC, JG, SG, and JC involved in statistical

analysis. SG, JC, and JG supervised and mentored the study. Each author contributed important intellectual content during manuscript drafting or revision and accepts accountability for the overall work by ensuring that questions pertaining to the accuracy or integrity of any portion of the work are appropriately investigated and resolved. EC and SG take responsibility that this study has been reported honestly, accurately, and transparently; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

Data availability statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions. Consent was not given for the full publication of transcripts.

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Supporting Information

The following supporting information may be found in the online edition of the article:

Supplementary Material S1 Topic Guide for KTR participants.

Supplementary Material S2 Topic Guide for HCP participants.