Musculoskeletal Science and Practice 33 (2018) 53–60

Contents lists available at ScienceDirect

Musculoskeletal Science and Practice

journal homepage: www.elsevier.com/locate/msksp

Original article

Integrating self-management support for knee injuries into routine clinical practice: TRAK intervention design and delivery

Kate Button[a,b,*], Kevin Nicholas[a], Monica Busse[c], Mark Collins[a], Irena Spasić[d]

[a] Cardiff and Vale University Health Board, Heath Park, Cardiff CF14 4XN, United Kingdom
[b] School of Healthcare Sciences, Cardiff University, Eastgate House, Newport Road, Cardiff CF24 0AB, United Kingdom
[c] South East Wales Trials Unit, Centre for Trials Research, Cardiff University, Heath Park, Cardiff CF14 4YS, United Kingdom
[d] School of Computer Science & Informatics, Cardiff University, Queens Building, 5 The Parade, Cardiff, CF24 3AA, United Kingdom

ARTICLE INFO

Keywords:
Self management
Knee
Internet
Physiotherapy

ABSTRACT

Background: TRAK is a web-based intervention that provides knee patients with health information, personalised exercise plans and remote clinical support. The aim of this study was to fully define TRAK intervention content, setting and context and develop the training through an implementation study in a physiotherapy out-patient service.

Methods: A mixed methods study. **Phase 1** was a qualitative interview study, whereby fifteen physiotherapists used TRAK for 1 month with a patient of their choice. Interviews explored patient and physiotherapist views of TRAK intervention and training requirements. In **Phase 2** seventy-four patients were recruited, all received conventional physiotherapy, a subset of 48 patients used TRAK in addition to conventional Physiotherapy. Aspects of feasibility measured included: *uptake* and *usage of TRAK*.

Results: Patients and physiotherapists reported that TRAK was easy to use and highlighted the therapeutic benefit of the exercise videos and personalised exercise plans to remind them of their exercises and the correct technique. Patients reported needing to use TRAK with the guidance of their treating physiotherapist initially. Physiotherapists highlighted appointment time constraints and lack of familiarity with TRAK as factors limiting engagement. In Phase 2, 67% patients accessed TRAK outside of the clinical environment. A total of 91% of patients were given a personalised exercise plan, but these were only updated in 34% of cases.

Conclusion: A comprehensive training package for patients and clinicians has been defined. The refined TRAK intervention is reported using the 'Template for Intervention Description and Replication in preparation for a definitive randomised control trial.

1. Introduction

Musculoskeletal pain is recognised globally as negatively impacting healthy aging and is associated with reduced function, frailty, loss of independence during everyday activities and reduced overall physical and mental well-being (Palazzo et al., 2014; Briggs et al., 2016). Globally, the impact of living with musculoskeletal pain is reported to be as high as 21.3% of total years lived with disability (Vos et al., 2012), with the knee being one of the most commonly affected joints (Uk, 2013). Treatments, including physiotherapy, that support individuals to exercise or be physically active in general are recommended (Button et al., 2012; NICE, 2014; Dobson et al., 2016), but these need to be delivered within a supported self-care framework that helps individuals to manage their musculoskeletal condition long term (Kroon et al., 2014; Button et al., 2015; Dziedzic et al., 2016). This includes providing health information and education, supporting behaviour change, facilitating communication, teaching technical skills and personalisation of care (Burd and Hallsworth, 2016; De Silva, 2011; Dobson et al., 2016; Dziedzic et al., 2016; Gordon et al., 2016; Rees and Williams, 2009; Walsh et al., 2016). Despite this, a recent systematic review has identified that current supported self-care interventions for knee conditions often have a poorly defined exercise or physical activity component (Button et al., 2015). Furthermore, using technology and the Internet offers a potential to deliver supported self-care exercise interventions within a physiotherapy rehabilitation setting. However, to date modern technology has been underutilised for this purpose (Button et al., 2015) or has not been fully adopted in clinical practice due to clinicians' beliefs about the benefits to their job or patient

* Corresponding author. School of Healthcare Science, Cardiff University, Eastgate House, Newport Road, Cardiff CF24 0AB, United Kingdom.
E-mail addresses: Buttonk@cardiff.ac.uk (K. Button), Kevin.Nicholas@wales.nhs.uk (K. Nicholas), BusseM@cardiff.ac.uk (M. Busse), Mark.Collins@Wales.nhs.uk (M. Collins), SpasicI@cardiff.ac.uk (I. Spasić).

https://doi.org/10.1016/j.msksp.2017.11.002
Received 12 July 2017; Received in revised form 1 November 2017; Accepted 2 November 2017

recovery and insufficient or inadequate infrastructure (Liu et al., 2015).

To address these deficiencies, our team of researchers developed TRAK, a web-based intervention that represents a low-cost platform for supporting rehabilitation of knee conditions, with a potential to enhance the quality of treatment components, such as health information provision, rehabilitation monitoring, remote support and personalised exercise progression (Button et al., 2013; Spasić et al., 2015), thereby supporting self-management. Preliminary data on the prototype TRAK usability and acceptability revealed that TRAK-based intervention is of high value to patients with restricted access to healthcare premises. On the other side, clinicians indicated that TRAK would provide them with unprecedented means of monitoring self-rehabilitation and improving exercise progressions (Spasić et al., 2015). Based on these positive findings the next step in the research is to introduce TRAK into clinical practice alongside usual care, to identify how TRAK intervention should be re-designed and delivered so that it is implementable in the healthcare setting. Therefore, the aim of this study was to integrate TRAK into the physiotherapy out-patient service of one NHS (National Health Service) Health Board and to evaluate patient and physiotherapist use and views of TRAK to fully define TRAK intervention content, setting and context and develop the training for a future trial. The findings of the current study are reported using the 'Template for Intervention Description and Replication (TIDieR) checklist' (Hoffmann et al., 2014) which guides detailed reporting of an intervention to a level required to support a future randomised control trial (RCT).

2. Methods

This was a mixed methods study with two sequential phases: a qualitative interview study with physiotherapists and patients evaluating the experience of integrating into routine care (phase 1) and a cohort study exploring aspects of TRAK feasibility such as TRAK uptake and usage, over 12 weeks of rehabilitation (phase 2). In addition, physiotherapists provided further insights into the practicalities, context and training required to use TRAK in everyday practice. A flow chart of the study is shown in Fig. 1. A mixed methods approach was required to optimize the future intervention by combining both patient and physiotherapist experience and understand how TRAK works in a healthcare setting (O'Cathain et al., 2007).

Before the study could commence TRAK was integrated into the local NHS IT infrastructure within Cardiff and Vale University Health Board (C&V UHB), to make it fully comply with NHS information governance. The technical requirements for TRAK to be integrated into the IT infrastructure were that computers were running on Windows 7 and had Internet Explorer 9 installed. Tablet computers were also supplied to each participating department. Fig. 2 provides a screenshot

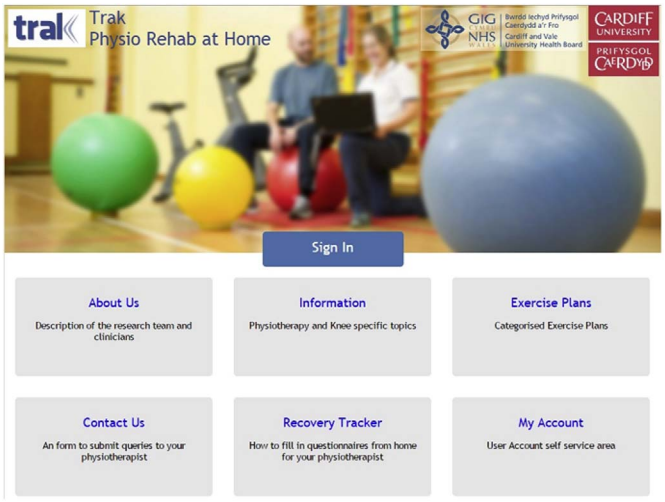

Fig. 2. Screenshot of TRAK homepage.

of the home page of TRAK. The final version is accessible at this URL along with a description of the full functionality of TRAK: http://trakphysio.org.uk/Home.

2.1. Phase 1

A convenience sample of fifteen physiotherapists were recruited from the out-patient service within C&V UHB. Individuals were recruited through advertisement and information sessions about the study. Physiotherapists ranged in experience, with representation from all grades of physiotherapists. Each Physiotherapist was required to attend a training session which explained the aims of the study and demonstrated the functionality of TRAK. The physiotherapists weren't given any specific guidance on how to integrate TRAK into a consultation but were asked to deploy TRAK in their clinical practice with a patient of their choice for 4 weeks. This was so their natural behaviour could be studied to inform the training and design for a full RCT. The patient was given a user account to access TRAK from home as part of their treatment. The Physiotherapists recruited a total of 16 patients (6 male, 10 female, mean age 39 years) that matched the selection criteria for the study:

Inclusion criteria:

- Adults ages 18 years and above.
- Have a knee condition, which is chronic, acute and/or post-surgical.

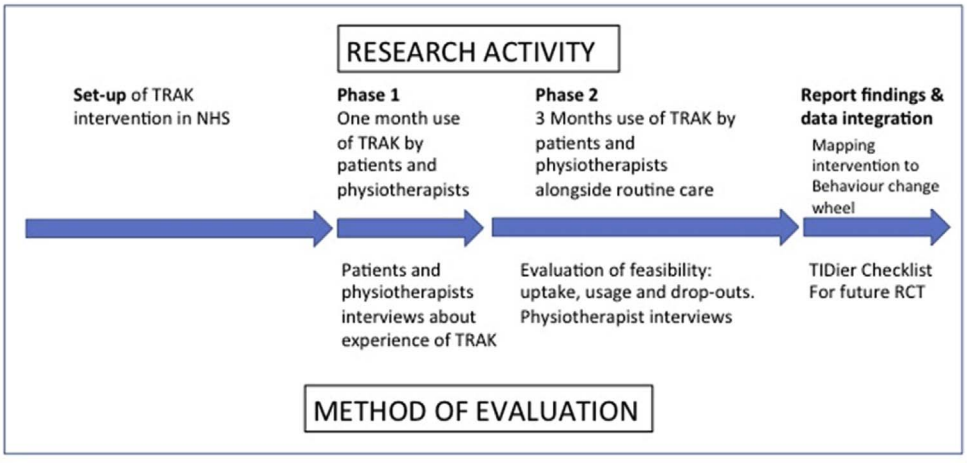

Fig. 1. Flow chart of study phases.

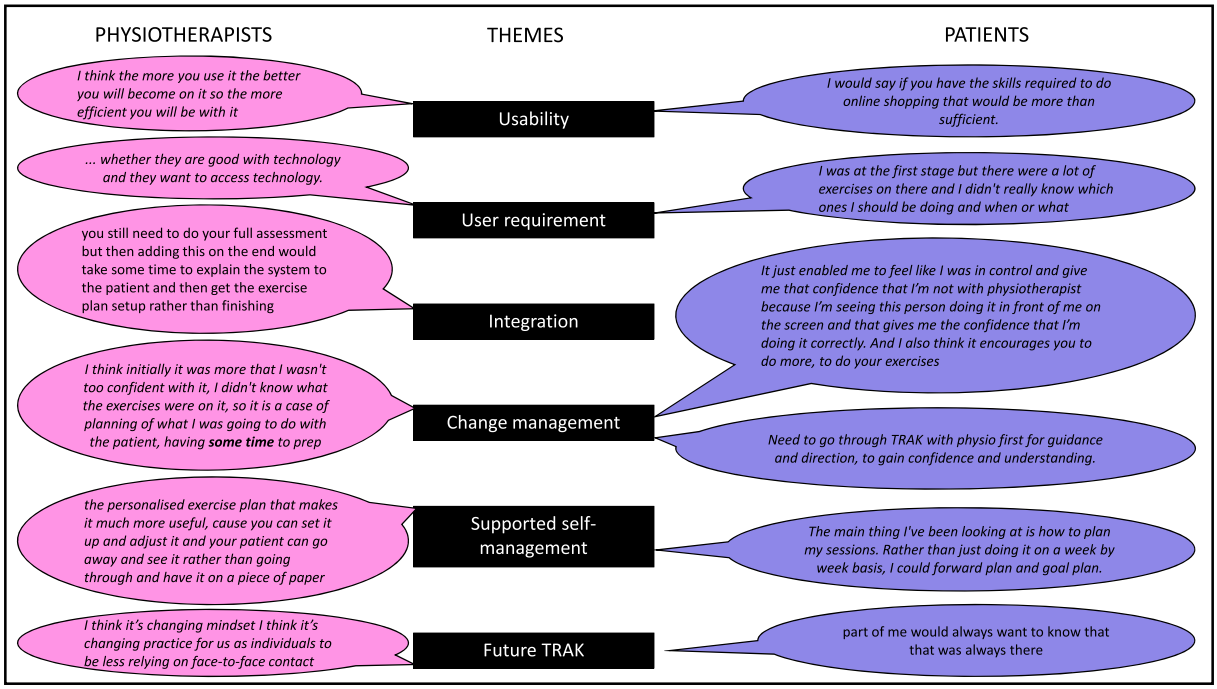

Fig. 3. Themes from Patient and Physiotherapist interviews and supporting quotes.

- Attend C&V UHB for treatment of the knee condition.
- Able to read and write English.
- Able to give written informed consent.
- Have Internet access at home.
- Deemed appropriate for an exercise supported self-management approach.

Exclusion criteria:

- Complications associated with knee injury or surgery such as deep vein thrombosis or infection.

Having used TRAK for at least 4 weeks, both patients and physiotherapists were interviewed in relation to the following main topics: TRAK website functionality, TRAK implementation in clinical practice, barriers and facilitators and future role of TRAK. All interviews were digitally recorded and then transcribed verbatim. An inductive thematic approach was used for data analysis following the steps outlined by (Braun and Clarke, 2006). Two researchers familiarized themselves with the manuscripts. They both coded and recoded the data, themes were agreed upon with a third researcher. A summary of themes was produced for each manuscript that included extracted text to support this. Finally, all the themes were reviewed and detailed definitions produced.

2.2. Phase 2

In this phase, TRAK was implemented more widely into routine care within C&V UHB. Eight of the originally recruited physiotherapists were available to participate. In addition to these, we recruited three new physiotherapists. Based on the findings from Phase 1, we modified the training to emphasise the self-care aspect of the intervention and re-iterated TRAK functionality. All 11 physiotherapists underwent the new training, which was delivered in the form of a 1 h presentation to each individual or a small group in each department. This was delivered in a very informal manner so that there was plenty of time to answer questions. In addition to explaining TRAK intervention, the training session also covered the theory behind self-management to help physiotherapists understand why TRAK was developed and assist them with integrating it into patient care. This also covered practical issues such as spending face-to-face time using TRAK with patients and not simply directing them to use it at home, the need to practice using TRAK to increase familiarity and some of the feedback about the videos and personalisation from Phase 1.

Convenience sampling was used to identify fifty consecutive new patients who were attending for a consultation appointment with one of the participating physiotherapists and met the inclusion criteria (same as Phase 1). Both types of users, i.e. physiotherapists and patients, were again asked to use TRAK intervention as part of the rehabilitation process, this time for a total of 12 weeks. Alongside this a reference group of 50 patients were recruited who were not being treated by the participating physiotherapists. Formal sample size calculations were not undertaken. Instead we set a pragmatic target of 100 patients based on the number of new patients seen by each physiotherapist and the number of knee referrals.

To be able to fully define the content of the training and how the TRAK intervention should be delivered in the future, aspects of feasibility were measured to include: Number of eligible patients who were invited to use TRAK and characteristics of those who consented to participate, number of patients who completed treatment, number of TRAK participants who accessed TRAK outside of their initial consultation, number of participants who completed the follow-up assessment after 12 weeks, number of patients who were given a personal exercise plan and the number of times a personal plan was updated, use of the contact us function of TRAK and number of treatment sessions given.

Physiotherapists were interviewed after 12 weeks, similar to previous interviews in Phase 1. Data were analysed using an inductive thematic analysis (Braun and Clarke, 2006).

The qualitative and quantitative findings from the different phases of the study were integrated for completeness, to ensure that the different aspects of the research question were answered and represented the different user groups.

3. Results

Both Physiotherapists and patients were interviewed about their experience of using TRAK. The themes from these interviews are detailed in Fig. 3, along with supporting quotes.

3.1. Patient interviews **phase 1**

3.1.1. Theme 1: TRAK usability

The patient participant group reported that overall TRAK was easy to use overall. Only basic skills of using the Internet and technology were reported to be required.

3.1.2. Theme 2: user requirements

TRAK users identified specific requirements of what they expected TRAK to be able to do. All users reported the value of the exercise videos to their rehabilitation but they required better sign posting on how to select appropriate exercises, what order to do them in and when they should do them. Although there was a lot of information available on TRAK it did not guide the user on prescribing their own exercise plan and the number of exercises was overwhelming without guidance from their treating clinician. This was counteracted by co-producing an exercise programme with their physiotherapist and personalising it to their own needs.

Overall it was indicated that the information section was too wordy, which made it less user friendly. Only a small proportion of patients used the email supported, 'contact us' function. Patients reported that they had not needed to use it as they either had further face-to-face appointments booked or they had easy access to their physiotherapist. Some patients indicted that they would have used 'contact us' option in relation to exercise progression had they had to wait a long time between appointments.

3.1.3. Theme 3: change management

In order to be able to use TRAK as part of their care patients identified that this was facilitated by their treating physiotherapist demonstrating TRAK to them and setting a personalised exercise plan. Using TRAK together with their physiotherapist improved patients' understanding and confidence.

3.1.4. Theme 4: TRAK supporting self-management

Patients reported using different approaches to self-management. Some patients used TRAK to self-direct their rehabilitation and to set their own goals based on the available exercise information. Others took a more passive approach and followed the content of TRAK to guide their rehabilitation away from the physiotherapy department, in particular the personalised exercise plans. The exercise videos were indicated to increase motivation and confidence with their rehabilitation and exercise technique. The videos also reminded them of what exercises to do when they were not able to gain timely access to the physiotherapy department. This supports the need for a blended approach to treatment combining face-to-face treatment and TRAK.

3.1.5. Theme 5: future TRAK consultation model

All patient participants were asked to indicate if by using TRAK face-to-face consultations could be reduced in number. Overall users reported that this could be achievable as a blended approach to treatment i.e. by combining face-to-face contact alongside using TRAK. Suggestions included spreading out appointments, timing consultations with progression points between phases and having two appointments and only then switching to remote follow-up using TRAK.

3.2. Physiotherapist interviews

All fifteen physiotherapists were available for follow-up at the end of phase 1. From the 11 physiotherapists that started phase 2, six were interviewed. Three physiotherapists were not interviewed as they undertook further self-care training and we felt this would influence their interview responses. Two physiotherapists rotated to a different job whilst participating in the study. The physiotherapists participating in phase 2 used TRAK with more patients over a longer time span, which provided some deeper insights into the intervention.

3.2.1. Theme 1: implementation of TRAK

Physiotherapists introduced TRAK into the consultation by either going through the functionality together with the patient on a tablet or desktop computer or by letting the patient browse independently. Physiotherapists reported that to improve implementation in the future they would need to improve their own proficiency in using TRAK and allow patients time to explore TRAK before a consultation.

Physiotherapists reported not changing the consultation to integrate TRAK. Most often TRAK was introduced as an additional component to the consultation.

Physiotherapists reported that TRAK would be valuable in the rehabilitation of a wide range of patients across different age groups, activity levels and conditions. The most important requirement was that the patient can use technology, has access to it and want to use technology as part of their rehabilitation.

3.2.2. Theme 2: usability

Like the patient cohort the physiotherapists reported that TRAK was easy to use and didn't identify any further training but they did identify a lack of familiarity with TRAK as restricting their efficiency.

3.2.3. Theme 3: user requirements

Physiotherapists expected to be able to design personalised exercise plans for patients to support their treatment away from the physiotherapy department. The physiotherapists did identify some additional functionality that they would expect from TRAK such as a search function to quickly find a particular exercise, thumbnail image beside each video and creation of a video playlist. Overall physiotherapists did not see the need for the 'contact us' function for remote support because patients could have face-to –face appointments as required and there was some apprehension that it would add extra time/burden to their workload.

3.2.4. Theme 4: change management

Although physiotherapists found TRAK easy to use they did express some difficulties changing practice to integrate TRAK into usual care. Some of the barriers identified include lack of familiarity with TRAK, lack of confidence and insufficient time within a consultation. By the end of phase 2 physiotherapists reported becoming more familiar with TRAK, but they focused almost exclusively on using exercise videos and personalised plans. Physiotherapists were starting to identify benefits of incorporating TRAK into care over their traditional methods of exercise prescription, such as drawing out pictures.

3.2.5. Theme 5: the role of TRAK in a supported self-management approach

Overall, the physiotherapists felt that TRAK had a role to play in a supported self-management approach to physiotherapy by giving patients the ability to take control of their rehabilitation. There were reported examples of patients using TRAK between appointments to identify their own exercises and used this to guide their face-to-face contact with the physiotherapist. Conversely, physiotherapists also reported wanting to limit patient access to specific exercises on TRAK, in case the patient selected any inappropriate exercises.

All physiotherapists identified that TRAK could support self-management if the patient was equipped with the right skills but there was no discussion about supporting the patient in developing these skills.

3.2.6. Theme 6: future TRAK consultation model

Physiotherapists were asked if using TRAK could reduce the number

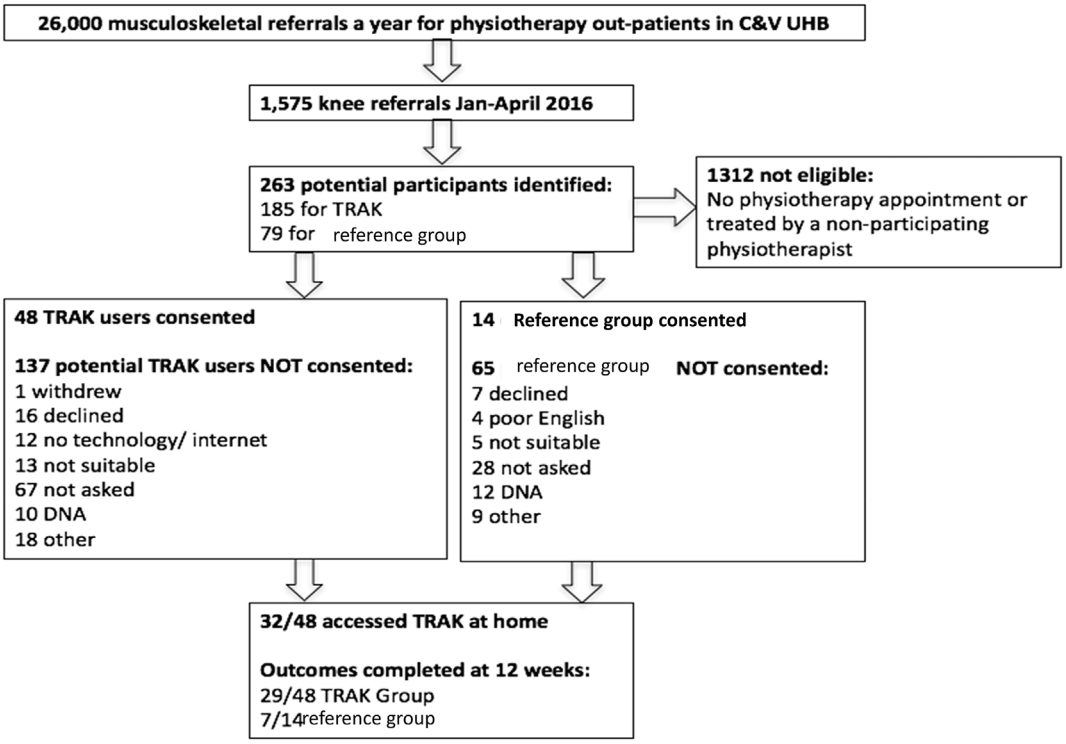

Fig. 4. Flow chart of study patient participants in Phase 2.

of face-to-face consultations. Overall, they were mostly willing to consider this as an option but were more uncertain than the patient cohort. Physiotherapists identified that this would require a shift in current working practice, which may be achievable if the timing and length of appointments could be flexible to accommodate this. The most common concern was about maintaining good communication with patients.

3.3. TRAK feasibility

A total of 49 out of 181 new patients (one withdrew) consented to participate in the TRAK intervention. Only 14 out of 79 patients consented as part of a reference group to have the conventional physiotherapy care. Details of recruitment are illustrated in the flow chart in Fig. 4. The age, gender and Knee Osteoarthritis and Outcome Score subscales for pain, symptoms, activity of daily living, quality of life and sport (Roos et al., 1998), of participants that consented are detailed in Table 1. Out of the 48 TRAK users, 32 logged onto TRAK outside of their face-to-face physiotherapy appointment and 16 never accessed TRAK. After 12 weeks, we contacted all participants to complete the follow-up patient rated outcome measures. We received responses from 29 out of 48 TRAK users (60% response rate), and 7 out of 14 responses from the reference group (50% response rate). There was a 72% response rate in the individuals that engaged with the TRAK treatment at home (Fig. 4). We found that the number of face-to-face treatment sessions was the same for TRAK users and the control group (5 face-to-face consultations). This is reassuring because physiotherapists expressed concern that using TRAK could increase their workload.

Physiotherapists accessed TRAK to co-produce a personalised exercise plan for 29 out of 32 (91%) TRAK users but 3 out 32 TRAK users did not have a personal plan. Only 11 (34%) of the personalised plans were updated over time, 6 plans were updated once and 5 plans were updated twice. Of note the physiotherapists did not offer TRAK to 67 patients that were eligible for the study. Insufficient access to technology at home was stated as a reason for not participating in 12 cases.

Across all of the personalised plans a total of 60 different exercises were prescribed. The most frequently used exercises were those from the early rehabilitation phase for strengthening (straight leg raise and static quadriceps), balance (single leg balance) and functional/neuromuscular control (mini squat). Only 5 exercises were prescribed exclusively from the advanced phase of exercises (jumping and hopping exercises) on one occasion.

Table 1
Age, gender and Knee Osteoarthritis Outcome Scores of patient participants in Phase 2.

Variable	TRAK Group at baseline	Reference Group at baseline
Mean Age years (SD)	48.76 (17.57)	36.07 (22.35)
Gender (frequency)	Females 29, Males 18	Females 10, Males 4
Mean KOOS pain (SD)	57.21 (21.56)	68.68 (16.32)
Mean KOOS symptoms (SD)	53.03 (19.68)	61.64 (21.38)
Mean KOOS activities of daily living (SD)	66.17 (24.22)	74.33 (20.09)
Mean KOOS sport (SD)	45.42 (30.25)	47.04 (26.27)
Mean KOOS quality of life (SD)	38.69 (19.11)	53.88 (20.83)

4. Discussion

In this study, TRAK was integrated into clinical practice in an NHS out-patient physiotherapy service alongside routine care. The findings from this research identified factors related to who used TRAK, how TRAK was used by both patients and physiotherapists, requirements and practicalities for integrating into care, the training required by physiotherapists and patients and factors that could be used to monitor intervention fidelity. These findings provide the details required to describe the TRAK intervention for a future randomised control trial, so that the trial is implementable in clinical practice.

Overall, physiotherapists identified benefits of using TRAK for patient care, found it easy to use and did change their practice as they gradually became more familiar with TRAK both conceptually and practically. Physiotherapists reported that TRAK was well received by a wider range of individuals than they anticipated. They also identified aspects of TRAK functionality that needed to be improved, such as thumbnail images alongside exercise videos, an exercise search facility and reducing the volume of text by presenting the information in alternative formats, such as video or audio (Bossen et al., 2016). Equally, patients found TRAK easy to use and identified how it effectively supported their treatment, e.g. planning, goal setting, motivating. Patients liked the personalisation of exercises and both patients and clinicians reported the therapeutic benefits of the exercise videos, which has also been reported for other digital interventions (Brooks et al., 2014). Patients reported needing assistance with selection and progression of exercises. TRAK also permitted access to rehabilitation at home and for those with time restraints on when they could attend for treatment. Patients identified the importance of using TRAK with their treating physiotherapist so that they could use TRAK independently at home to best effect.

TRAK is a complex intervention that combines information resources, exercise videos, personalised exercise plans and remote contact with a physiotherapist, which is delivered in combination with face-to-face clinic appointments. The underlying rationale to the success of TRAK is that these components are essential to empower individuals and improve their ability to self-manage (De Silva, 2011). Therefore, the findings from this study have been mapped to the 'sources of behaviour' and 'intervention functions' components of the Behaviour Change Wheel (Michie et al., 2011), to demonstrate how TRAK meets with this theoretical underpinning, which is displayed in Fig. 5. Additionally, training physiotherapists about these linkages could improve the quality of future implementation, including how they use TRAK with patients.

We found that simply providing clinicians with a web-based intervention does not mean that they will necessarily use it and usage of TRAK by the physiotherapists appeared to decline over the course of treatment, as less than half of the personal plans were progressed and the most frequently used exercises were from early rehabilitation. This is a phenomenon that has been reported by others with eHealth tools (Bossen et al., 2016) online decision aids (Elwyn et al., 2012) and other technology (Liu et al., 2015). In the current study this may have been related to environment/organizational factors such as the length and scheduling of appointments, insufficient time within the consultation to use TRAK, insufficient training on using TRAK and access to technology within the physiotherapy service. The latter of which was addressed by giving physiotherapists access to tablet computers in the clinic.

Therefore, in addition to increasing physiotherapist awareness of the linkages of TRAK to supported self-management and behaviour change, the training also needs to include general training to improve familiarity with TRAK, better guidance on how to integrate TRAK into the consultation and practical sessions on setting and updating personalised exercise plans and using all the functionality of TRAK. A more detailed description of the content of this training is in Table 2, along with methods of evaluating the success of this training.

Based on the findings of this study a detailed description of how the TRAK intervention should be described and delivered has been produced following the 'Template for intervention description and replication checklist' developed by Hoffmann et al. (2014). The completed template for TRAK intervention can be viewed in Table 3. This also includes details on aspects of monitoring intervention fidelity. This will be assessed using an approach already developed by (Quinn et al., 2016). This model combining 4 face-to-face consultations with online interactions has been found to be feasible for the knee osteoarthritis population (Bossen et al., 2016). This would allow greater spread of appointments and personalised timing of treatment focused on key points in a patient's care.

There were some limitations to this study. Firstly, only limited TRAK usage statistics have been reported, but this has been addressed so more detailed usage will be measured in the future. Secondly a larger reference group would have allowed us to generate data to inform the sample size for an RCT. This will be built into a future 2-arm randomised controlled trial with internal pilot study, to compare TRAK to usual care. A feasibility study to evaluate the use of TRAK in rehabilitation after anterior cruciate ligament surgery is underway (Dunphy et al., 2016). TRAK will be scaled up for use with all musculoskeletal conditions.

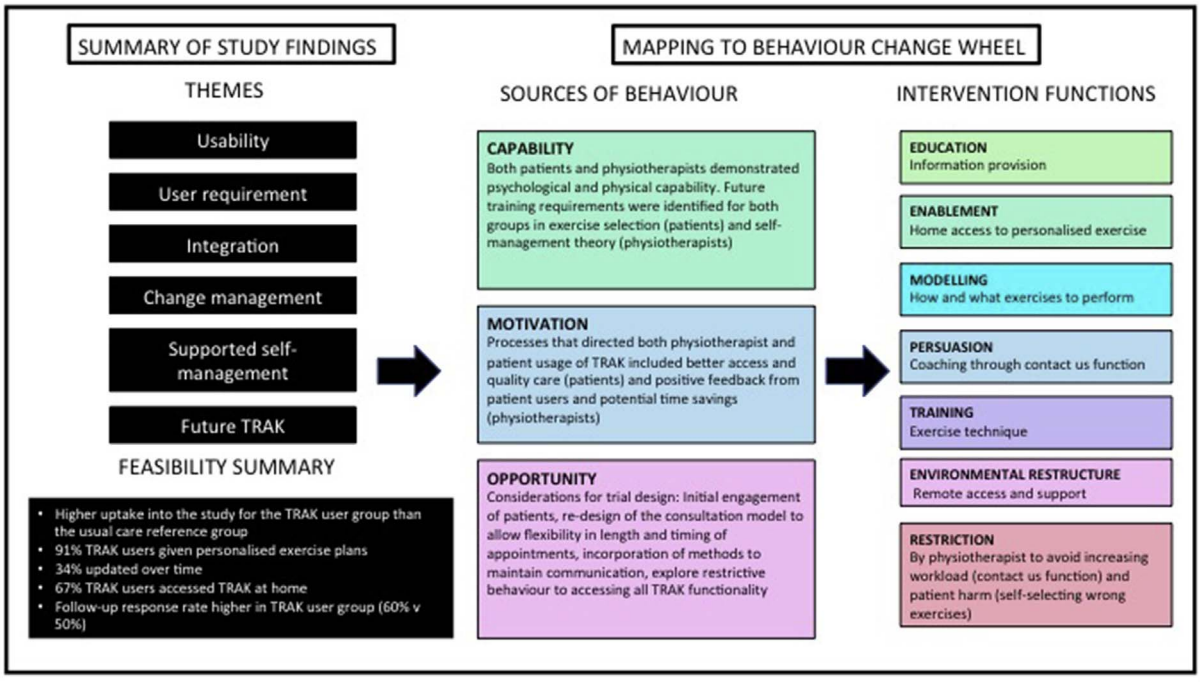

Fig. 5. Demonstration of linkages between TRAK findings and Behaviour change wheel.

Table 2
Training for Physiotherapists and patient participants in future RCT.

	Physiotherapists	Patients
Aim of training	1. Competence using all aspects of TRAK functionality 2. Application of TRAK into patient care 3. To be able to train patients how to use TRAK	1. Apply all aspects of TRAK functionality 2. To be able to select own exercises
Assessment of training success	Screen recording and audio of task completion using TRAK for mock patient treatment scenario. Monitored against checklist.	
Content of training	• Introduction to TRAK • TRAK functionality • Creating personalised exercise plans • Self-care theory • Exercise prescription theory • Training patient	• Introduction to TRAK • TRAK functionality • Using over time • Theory of exercise
Methods of delivery	Recorded presentation Face-to-face Q&A session with PI Practical tasks	• Short video presentation prior to consultation. • Face-to-face training with physiotherapist
Amount of training	Half day training	30 min

The next phase of this research will be a multi-centre pragmatic RCT with process evaluation comparing TRAK to usual care for patients with knee pain. The research sites will be recruited to reflect a diversity of urban and rural areas and areas of deprivation. The primary outcome will be the KOOS total score (Roos et al., 1998). The secondary outcome will be the cost-effectiveness of TRAK intervention. The process evaluation will evaluate key questions such as; retention, recruitment, adherence, fidelity and contamination. Future implementation will also be explored patient and physiotherapist interviews.

5. Conclusion

TRAK intervention was integrated into routine clinical practice alongside face-to-face treatment within a NHS physiotherapy setting to support self-management of knee conditions. Patients and physiotherapists identified which components of TRAK supported self-management within a behaviour change framework, such as, videos to model exercises and increase engagement, provision of health information, personalisation of exercises, goal setting, treatment planning and increasing confidence and motivation. TRAK was reported to be acceptable, easy to use and appropriate for a wide spectrum of patients. Initial engagement with TRAK was good however its usage declined over time. Physiotherapists reported lack of familiarity and time as factors reducing engagement. This study provides a detailed description of the TRAK intervention, what training is required and how it should be delivered. This will be used to ensure that the TRAK intervention is implementable in a future trial to evaluate its effectiveness.

Ethical approval and consent

Ethical approval was gained from Wales REC 7 committee, reference: 15/WA/0147 NHS Research & Development approval was granted from Cardiff and Vale University Health Board, reference: 15-OAE-6200. All participants in this study provided written informed consent.

Competing Interests

The authors declare that there are no competing interests.

Funding

This project was funded by The Health Foundation; Innovating for Improvement award. The funder had no involvement in the design of

Table 3
Description of TRAK intervention using criteria from the TIDieR checklist.

Theory	TRAK functionality is based on Framework for supported self-management (De Silva, 2011). TRAK intervention functions and participant behaviour are characterised by components of the behaviour change wheel (Michie et al., 2011) (See Fig. 5).
What intervention	TRAK is a website that supports the patient to undertake their treatment independently from the physiotherapy department. It blends face-to-face and remote contact with the physiotherapist. The TRAK website provides information, personalised exercise plans, videos, exercise logs and remote support.
Who delivers	Physiotherapists working in musculoskeletal out-patient setting. Patient participant is involved at all stages of their care.
How delivered	In a blended approach combining face-to-face consultation with remote use of TRAK website and contact with the treating physiotherapist.
Where delivered	Physiotherapy department and remotely at participant's home through the TRAK website.
When delivered	The patient participant views an online presentation prior to first consultation about TRAK. At the initial face-to-face consultation, TRAK introduced and used as an integral part of the treatment. Follow up face-to-face appointments are scheduled for 2 months, 3 months and 4 months. Remote contact through email or private chat facility will happen fortnightly, the physiotherapist will email the participant but the participant can make contact with their physiotherapist as required.
How much (number, how long, schedule)	The intervention combines 4 face-to-face treatments with fortnightly remote email/private chat contact. The initial consultation will be 1 h and all face-to-face follow-up consultations will be 30 min. The schedule for appointments will be an initial consultation, with follow-ups scheduled after 1 month, 2 months and 4 months.
Tailoring (personalisation)	Individualised exercise plans co-produced by the physiotherapist and patient participant.
Training	For both patients and physiotherapists – see details in Table 2
Assessment of fidelity	Web site usage statistics: based on our findings we would expect 65% patients to adhere and access TRAK from home. We would expect personalised exercise plans to be updated by physiotherapists at least once Monitoring updates (timing and content) of personalised exercise plans Exercise logs Number, timing and content of remote interactions Audio of the 3rd consultation, which will be rated against a checklist developed by Quinn et al. (2016). Rating will be completed by a member of the research team.

the study, data collection, analysis, interpretation of the data or writing this manuscript.

Author contributions

KB jointly wrote this manuscript with IS. KB collected and prepared the data and performed the data analysis. KN identified and reviewed relevant literature, managed the database for patient rated outcome measure data and assisted with data collection. MC implemented the TRAK web site within NHS. MB provided expert guidance on writing the manuscript. IS designed the TRAK website. All authors read and approved the final manuscript.

Acknowledgements

Robert van Deursen for his support in preparing the initial funding application. Thomas Edwards for transcribing the interviews and assisting in the preparation of the thematic analysis. Tina Gambling for her guidance on qualitative data analysis. Gareth Bulpin for facilitating implementation of TRAK into clinical practice The Physiotherapists within Cardiff and Vale UHB for supporting this research. Carl Rogers, Videographer, Cardiff and Vale University Health Board.

References

Bossen, D., et al., 2016. A Blended Intervention for Patients with Knee and Hip Osteoarthritis in the Physical Therapy Practice: Development and a Pilot Study.

Braun, V., Clarke, V., 2006. Using thematic analysis in psychology. Qual. Res. Psychol. 3 (2), 77–101. Available at: http://www.tandfonline.com/doi/abs/10.1191/1478088706qp063oa, Accessed date: 24 June 2017.

Briggs, A.M., et al., 2016. Musculoskeletal health conditions represent a global threat to healthy aging: a report for the 2015 world health organization world report on ageing and health. Gerontologist 56, S243–S255.

Brooks, M.A., et al., 2014. Web-based therapeutic exercise resource center as a treatment for knee osteoarthritis: a prospective cohort pilot study. BMC Musculoskelet. Disord. 15, 158. Available at: http://www.ncbi.nlm.nih.gov/pubmed/24884547, Accessed date: 2 January 2017.

Burd, H., Hallsworth, M., 2016. Supporting Self-management a Guide to Enabling Behaviour Change for Health and Wellbeing Using Person-and Community- Centred Approaches Guide. Available at: http://www.health.org.uk/sites/health/files/RtVSupportingSelfManagement.pdf, Accessed date: 2 January 2017.

Button, K., et al., 2012. Clinical effectiveness of knee rehabilitation techniques and implications for a self-care treatment model. Physiother. (United Kingdom) 98 (4).

Button, K., et al., 2013. TRAK ontology: defining standard care for the rehabilitation of knee conditions. J. Biomed. Inf. 46 (4).

Button, K., et al., 2015. The clinical effectiveness of self-care interventions with an exercise component to manage knee conditions: a systematic review. Knee 22 (5).

De Silva, D., 2011. Helping people help themselves identify innovate demonstrate encourage. Available at: http://www.health.org.uk/sites/health/files/HelpingPeopleHelpThemselves.pdf, Accessed date: 2 January 2017.

Dobson, F., et al., 2016. Barriers and facilitators to exercise participation in people with hip and/or knee osteoarthritis. Am. J. Phys. Med. Rehab. 95 (5), 1. Available at: http://www.ncbi.nlm.nih.gov/pubmed/26945211, Accessed date: 2 January 2017.

Dunphy, E., Hamilton, F.L., Button, K., 2016. Taxonomy for the rehabilitation of knee conditions (TRAK), a digital intervention to support the self-care components of anterior cruciate ligament rehabilitation: protocol of a feasibility study. JMIR Res. Protoc. 5 (4), e234. Available at: http://www.researchprotocols.org/2016/4/e234/, Accessed date: 11 September 2017.

Dziedzic, K.S., et al., 2016. Implementation of musculoskeletal Models of Care in primary care settings: theory, practice, evaluation and outcomes for musculoskeletal health in high-income economies. Best Pract. Res. Clin. Rheumatol. 30 (3), 375–397.

Elwyn, G., et al., 2012. Why do clinicians not refer patients to online decision support tools? Interviews with front line clinics in the NHS. BMJ open 2 (6), e001530. Available at: http://www.ncbi.nlm.nih.gov/pubmed/23204075, Accessed date: 2 January 2017.

Gordon, K., et al., 2016. Barriers to self-management of chronic pain in primary care: a qualitative focus group study. Br. J. general Pract. J. R. Coll. General Pract p.bjgpmar-2017-67-656-gordon-p. Available at: http://bjgp.org/content/early/2016/12/19/bjgp17X688825.abstract, Accessed date: 30 December 2016.

Hoffmann, Tammy, Glasziou, Paul, Boutron, I., et al., 2014. Better reporting of interventions: template for intervention description and replication (TIDieR) checklist and guide. BMJ 348 (1687).

Kroon, F.P.B., et al., 2014. Self-management education programmes for osteoarthritis. Cochrane Database Syst. Rev. 1, CD008963. Available at: http://www.ncbi.nlm.nih.gov/pubmed/24425500.

Liu, L., et al., 2015. What factors determine therapists' acceptance of new technologies for rehabilitation – a study using the Unified Theory of Acceptance and Use of Technology (UTAUT). Disabil. Rehab. 37 (5), 447–455. Available at: http://www.ncbi.nlm.nih.gov/pubmed/24901351, Accessed date: 3 January 2017.

Michie, S., van Stralen, M.M., West, R., 2011. The behaviour change wheel: a new method for characterising and designing behaviour change interventions. Implement. Sci. 6 (1), 42. Available at: https://doi.org/10.1186/1748-5908-6-42.

NICE, 2014. Osteoarthritis: Care and Management | Guidance and Guidelines. NICE, pp. CG177. Available at: https://www.nice.org.uk/guidance/cg177, Accessed date: 2 January 2017.

O'Cathain, A., Murphy, E., Nicholl, J., 2007. Why, and how, mixed methods research is undertaken in health services research in England: a mixed methods study. BMC Health Serv. Res. 7, 85. Available at: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1906856/.

Palazzo, C., et al., 2014. The burden of musculoskeletal conditions. PLOS one 9 (3), e90633.

Quinn, L., et al., 2016. Development and delivery of a physical activity intervention for people with huntington disease: facilitating translation to clinical practice. J. Neurol. Phys. Ther. JNPT 40 (2), 71–80. Available at: http://www.ncbi.nlm.nih.gov/pubmed/26863152, Accessed date: 2 January 2017.

Rees, S., Williams, A., 2009. Promoting and supporting self-management for adults living in the community with physical chronic illness: a systematic review of the effectiveness and meaningfulness of the patient-practitioner encounter. JBI Libr. Syst. Rev. 7 (13), 492–582. Available at: https://www.ncbi.nlm.nih.gov/pubmed/27819974.

Roos, E.M., et al., 1998. Knee injury and osteoarthritis outcome score (KOOS)—development of a self-administered outcome measure. J. Orthop. Sports Phys. Ther. 28 (2), 88–96. Available at: http://www.ncbi.nlm.nih.gov/pubmed/9699158, Accessed date: 2 January 2017.

Spasić, I., et al., 2015. TRAK app suite: a web-based intervention for delivering standard care for the rehabilitation of knee conditions. JMIR Res. Protoc. 4 (4), e122. Available at: http://www.researchprotocols.org/2015/4/e122/, Accessed date: 2 January 2017.

Uk, A.R, 2013. Osteoarthritis in General Practice - Data and Perspectives - Arthritis Research, vol. 222. The Medical press, UK, pp. 253–258.

Vos, T., et al., 2012. Years lived with disability (YLDs) for 1160 sequelae of 289 diseases and injuries 1990-2010: a systematic analysis for the Global Burden of Disease Study 2010. Lancet (London, Engl. 380 (9859), 2163–2196. Available at: http://www.thelancet.com/article/S0140673612617292/fulltext, Accessed date: 19 October 2016.

Walsh, L., et al., 2016. Harnessing and supporting consumer involvement in the development and implementation of Models of Care for musculoskeletal health. Best Pract. Res. Clin. Rheumatol. 30 (3), 420–444. Available at: http://www.ncbi.nlm.nih.gov/pubmed/27886940, Accessed date: 2 January 2017.