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Feasibility of a stratified blended physiotherapy intervention for patients with non-specific low back pain: a mixed methods study

Mark L. van Tilburg[a,b], Corelien J.J. Kloek[a,b,c], J. Bart Staal[d,e], Daniël Bossen[f], Cindy Veenhof,[a,b,c]

[a] Department of Rehabilitation, Physiotherapy Science & Sports, UMC Utrecht Brain Center, University Medical Center Utrecht, Utrecht University, Utrecht, The Netherlands;
[b] Innovation of Human Movement Care Research Group, HU University of Applied Sciences, Utrecht, The Netherlands;
[c] Netherlands Institute for Health Services Research (NIVEL), Utrecht, The Netherlands;
[d] Research Group Musculoskeletal Rehabilitation, HAN University of Applied Sciences, Nijmegen, The Netherlands;
[e] Radboud Institute for Health Sciences, Radboud University Medical Centre, IQ Healthcare, Nijmegen, The Netherlands;
[f] Achieve Center of Expertise, Faculty of Health, Amsterdam University of Applied Sciences, Amsterdam, The Netherlands

ABSTRACT

Introduction: Integrating web-based or mobile components and face-to-face components within a treatment process is called blended care. As part of the participatory development of a blended physiotherapeutic intervention for patients with low back pain (e-Exercise LBP), a proof of concept study was carried out and showed promising results.

Objective: To investigate the feasibility of the e-Exercise LBP prototype for patients and physiotherapists to improve the intervention.

Methods: A mixed methods study was executed, embedded in the development phase of e-Exercise LBP. 21 physiotherapists treated 41 patients with e-Exercise LBP. Quantitative data consisted of: patients' satisfaction on a five-point Likert Scale; patients' and physiotherapists' experienced usability of the web-based application (System Usability Scale) and; patients' experiences with e-Exercise LBP (closed-ended

questions and statements related to the elements and goals of e-Exercise LBP). Semi-structured interviews about experiences with e-Exercise LBP were conducted with seven patients and seven physiotherapists. Qualitative data were analyzed by a phenomenological approach. Quantitative data were analyzed with descriptive statistics.

Results: Patients were satisfied with e-Exercise LBP (mean: 4.0; SD:0.8; range: extreme dissatisfaction (1)-extreme satisfaction (5)). Usability of the web-based application was acceptable (patients: mean: 73.2 (SD:16.3); physiotherapists: mean: 63.3 (SD:12.0); range: 0–100). Interviews revealed that physiotherapists' training is essential to successfully integrate the web-based application and face-to-face sessions within physiotherapy treatment. Also, patients addressed the need of reminder messages to support long-term (exercise) adherence.

Conclusion: e-Exercise LBP appeared to be feasible. However, various prerequisites and points of improvement were mentioned to improve physiotherapists' training and the prototype.

Introduction

Low back pain (LBP) is amajor health problem and creates a substantial personal and financial burden worldwide (March et al., 2014; Vos et al., 2016). Besides pain, a primary complaint of LBP is disability (Deyo and Weinstein, 2001). The cause of LBP can be either specific or nonspecific (Hill et al., 2011; Staal et al., 2017; Wong et al., 2017). Nonspecific LBP (approximately 90% of the patients with LBP) is defined as pain in the lumbosacral area without specific underlying pathology (Hill et al., 2011; Staal et al., 2017; Wong et al., 2017). Nonspecific LBP is mostly treated in primary health care settings, for example by physiotherapists (Koes et al., 2010). Physiotherapy, consisting of patient education, gradual physical activation and exercise therapy, has been shown to be effective in improving physical functioning and decreasing pain (Hayden, van Tulder, and Tomlinson, 2005; Staal et al., 2017; Wong et al., 2017). Also, early identification of psychosocial risk factors for chronification of nonspecific LBP is recommended. A higher number of physiotherapy sessions and gradually increasing physical activation might be necessary if patients with nonspecific LBP are at higher risk for chronicity (Hill et al., 2011).

An upcoming field within physiotherapy is the integration of digital components and professional guidance within a treatment process to create an optimal combination, called blended care (Wentzel, van der Vaart, Bohlmeijer, and van Gemert-pijnen, 2016). The digital components of blended care can offer support via online guidance or self-help modules and provide patients with automated feedback and support (Kelders, Bohlmeijer, Pots, and van Gemert-pijnen, 2015). Professional guidance must be interconnected with digital components and should not be separate treatment pathways (van der Vaart et al., 2014). Feedback from digital components can provide valuable information for the professional to tailor the professional guidance to individual needs. Blended care has the potential to increase adherence to exercise recommendations, enhance patients' self-management and partially replace face-to-face contact, which may lead to improved cost-effectiveness of healthcare interventions (Du et al., 2017; van der Vaart et al., 2014; Wentzel, van der Vaart, Bohlmeijer, and van Gemert-pijnen, 2016). Despite this added value of blended care, not many blended physiotherapeutic interventions have been developed and evaluated yet. Existing blended interventions are often poorly adopted in physiotherapeutic care (Kloek et al., 2018). One of the reasons is that developed interventions do not meet the needs and requirements of endusers (Christensen, Griffiths, and Farrer, 2009; Neve, Collins, and Morgan, 2010). To solve this problem, participatory development in which patients and physiotherapists are involved is highly recommended (van Gemert-Pijnen et al, 2011; Riet, Crutzen, and Vries, 2010).

The prototype of a 12-week blended physiotherapeutic intervention, called 'e-Exercise Low Back Pain' was developed with participation of both patients and physiotherapists (Kloek et al., 2019). During this process, the Center for eHealth Research & Disease Management (CeHRes) Roadmap was used to plan, coordinate and execute the participatory development of e-Exercise LBP to better match the values and requirements of end-users (van Gemert-pijnen et al., 2011). The first part of the participatory development process and proof of concept of this prototype are described elsewhere and show promising results (Kloek et al., 2019). In summary, the e-Exercise LBP intervention is an example of a blended intervention in which we integrated a web-based application and face-to-face physiotherapy sessions. The webbased application consisted of twelve weekly-varying modules with information texts and videos related to LBP, exercises and personalized physical activity assignments. Further insight into the feasibility of e-Exercise LBP for patients and physiotherapists is essential to improve the e-Exercise LBP prototype. Therefore, the aim of this mixed methods study was to investigate the feasibility of the e-Exercise LBP prototype for patients and physiotherapists.

Materials and methods

Study design

A convergent parallel mixed methods feasibility study was executed, embedded in the participatory development phase of the e-Exercise LBP prototype (Kloek et al., 2019). Quantitative and qualitative analyses were used to investigate the feasibility of the e-Exercise LBP prototype for patients and physiotherapists. Both quantitative and qualitative data were collected independently and analyzed during the same time span. Quantitative and qualitative results were compared to look for patterns or contradictions. An overview of the study is provided in Figure 1.

Participants

Initially, fifty physiotherapists working in primary care in the Netherlands were asked to participate (Kloek et al., 2019). These physiotherapists were part of the authors' networks. Physiotherapists were eligible if they treated at least ten patients with nonspecific LBP per year. Eventually, 21 primary care physiotherapists were willing to participate in the multicenter, single-group feasibility study (Kloek et al., 2019). Prior to the feasibility study, all participating physiotherapists received a three-hour training about the study procedures and the e-Exercise LBP intervention. All physiotherapists gave verbal consent to use their data anonymously.

Patients were eligible to participate in the feasibility study if they had nonspecific LBP and were aged between 18 and 65 years. Patients were not eligible if they were diagnosed with lumbosacral radiculopathy; had contraindications for physical activity without supervision, according to the Physical Activity Readiness Questionnaire (PAR-Q) (Thomas, Reading, and Shephard, 1992); had been treated by a physiotherapist for LBP in the last six months; had no internet access; or did not understand the Dutch language. Physiotherapists informed eligible patients about the study and provided interested patients with an information letter. All patients were asked to sign informed consent.

[Figure 1]

Intervention

The prototype of e-Exercise LBP studied in this feasibility study is a stratified blended intervention, whereby a prognostic stratification tool, a web-based application and face-to-face physiotherapy sessions are integrated within physiotherapy treatment to create an optimal combination (Kloek et al., 2019). During the first face-to-face session, the physiotherapist identifies the patient's risk (i.e.

low, medium or high) for persistent disabling symptoms using the Dutch Keele STarT (Subgroup Targeted Treatment) Back Screening Tool (SBT) (Hill et al., 2011; Robinson and Dagfinrud, 2017). By stratifying on this risk profile and the patient's physical capacity, the physiotherapist can tailor e-Exercise LBP to meet each patient's specific needs (Foster, Hill, Doyle, and Young, 2014). As recommended by experts, patients at low risk for disabling symptoms receive four face-to-face physiotherapy sessions, patients at medium risk twelve sessions and patients at high risk receive twenty sessions over a 12-week period (Kloek et al., 2019). However, according to the physiotherapist's clinical knowledge, physiotherapists are free to deviate from these recommendations. The web-based application consists of three modules. The first module consists of information texts and videos about the etiology of LBP, physical activity, patient experiences, pain management and psychosocial factors related to LBP. The second module consists of exercises to improve muscle strength, joint mobility and overall/muscle relaxation. The third module consists of a physical activity assignment for an activity related to the patient's treatment goal, whether or not gradually increased. Patients receive weekly reminders to visit the web-based application. Physiotherapists can monitor patients' usage of the web-based application, monitor evaluated assignments, select other types of exercises, and communicate with patients using a messenger service. Patients' usage and monitoring of evaluated assignments can be used to tailor the face-to-face sessions to patients' individual needs. Additionally, difficulties with the web-based application can be discussed during the face-to-face sessions. The content of e-Exercise LBP is based on recommendations described in the Dutch Physiotherapeutic Clinical Guideline for nonspecific Low Back Pain and focus groups with patients, physiotherapists and experts (Kloek et al., 2019; Staal et al., 2017). A schematic overview of the e-Exercise LBP intervention is provided in Figure 2. A print screen of the online e-Exercise LBP application is shown in Appendix 1.

[Figure 2]

Data collection and analyses

During the recruitment period, which lasted from May until October 2016, 16 physiotherapists recruited 46 eligible patients. Of these patients, 41 signed informed consent and were enrolled in the study.

Quantitative data

Quantitative data collection consisted of three feasibility measurements: (1) Patients' overall satisfaction with e-Exercise LBP, measured with a five-point Likert scale (1 = extreme dissatisfaction; 5 = extreme satisfaction); (2) Patients' and physiotherapists' experienced usability of the web-based application, measured with the System Usability Scale (SUS) (Brooke, 1996; Sauro and Lewis, 2012) and; (3) Patients' experiences with the web-based application, face-to-face sessions and integration of the web-based application and face-to-face sessions within physiotherapy treatment, assessed with a set of closed-ended questions and statements related to the elements and goals of e-Exercise LBP. The set of questions and statements was developed in two previous studies and adjusted by MvT and CK to fit with the elements and goals of e-Exercise LBP (Bossen et al., 2016, 2013). All other authors provided feedback on the readability and completeness. The set of questions and statements is shown in Table 3, along with the outcomes. The SUS is highly robust and flexible enough to assess a wide range of eHealth technologies (Bangor, Kortum, and Miller, 2008). The total SUS score ranges from 0–100. A SUS score of at least 62.7 is considered acceptable usability (Brooke, 1996; Sauro and Lewis, 2012). Patients were asked to complete the feasibility measurements three months after baseline. Physiotherapists were asked to fill out the SUS after the last patient finished the intervention. Patient characteristics (i.e. age, sex, height, weight, educational level, comorbidities and risk group) and physiotherapist characteristics (i.e. age, sex and specialization) were assessed at

baseline. Descriptive statistics were used to describe both quantitative data and participant characteristics.

Qualitative data

To gain more in-depth understanding of end-users' experiences with e-Exercise LBP, a subsample of 25 patients and 13 physiotherapists were consecutively invited by e-mail for a semi-structured interview, based on their study ID number. Participants were included until data saturation in two consecutive interviews was reached. Semi-structured interviews were undertaken while patients were at least in their 7th week of the e-Exercise LBP intervention, or fully completed the intervention. An exploratory, descriptive phenomenological approach was used, with thematic analyses (Braun and Clarke, 2006; Kahlke, 2014). The first interview was conducted by MvT in the presence of DB as an observer. All other interviews were individually conducted by MvT or CK in participants' homes and lasted approximately 30 minutes. Besides one researcher and the participant, no one else was present during the interview. Both researchers who conducted interviews were trained in performing interviews. The researchers who conducted the interviews were not known to participants prior to the interview. Topic lists consisted of three main themes based on the determinants of innovation described in other literature (Fleuren, Paulussen, Dommelen, and van Buuren, 2014): characteristics of the participant, intervention and organization. Interview topic lists were pilot tested between researchers and are provided in Appendix 2. Interviews were audio-recorded and subsequently transcribed. Transcripts and findings were not returned to participants for comments or corrections and field notes were not made, because data on feasibility was straight forward and unlikely to be misinterpreted. Two authors (MvT and CK) independently identified themes, coded them in meaningful sections and subsequently categorized them into main themes using Microsoft Excel 2016®. Codes and main themes were discussed between MvT and CK until consensus was reached. Descriptive statistics were used to describe participant characteristics.

Results

After 12 weeks, 37 patients and 18 physiotherapists completed the follow-up questionnaire. Four patients were lost to follow-up due to non-response and 3 physiotherapists were excluded due to self-reported lack of experience with e-Exercise LBP. Patient and physiotherapist characteristics are presented in Tables 1 and 2.

[Table 1] [Table 2]

Quantitative results

Patients' overall satisfaction with e-Exercise LBP was 4.0 (SD:0.8). Usability of the web-based application was scored 73.2 (SD:16.3) by patients and 63.3 (SD:12.0) by physiotherapists. Outcomes of the set of closed-ended questions and statements related to the elements and goals of e-Exercise LBP are provided in Table 3. In this set of questions and statements, 81% of patients agreed that the physical activity assignment was well tailored to their needs, and 83% agreed that exercises were well tailored to their needs. Also, 87% agreed that exercise instruction videos were of added value. Most patients considered the physical activity assignment (78%), exercises (83%) and information module (62%) as useful. The majority of patients (73%) stated that videos with the information themes were of added value to the written themes. All participants agreed that the language was comprehensible (100%) and that information modules were not contradictory (100%) and complete (97%). Most patients agreed that the face-to-face guidance of the physiotherapist alongside to the web-based application was good (87%). With respect to the integration of the web-based and offline

components, 68% of patients experienced that the face-to-face physiotherapy sessions and the web-based application felt as one integrated intervention.

[Table 3]

Qualitative results

After seven interviews with patients and seven interviews with physiotherapists, data saturation was reached. Table 4 shows for various participant-, intervention- and environmental factors whether they were beneficial (i.e. experienced positively) or disadvantageous (i.e. experienced negatively). Additionally, these codes could be divided into prerequisites for using e-Exercise, added values of e-Exercise and points of development to further improve the e-Exercise LBP intervention. Prerequisites According to patients, physical examination at the start of physiotherapy treatment was important to adequately tailor the web-based application to patients' needs. As one patient explained: 'One time she examined where I had stiffness, based on that, she told me which exercises suited me best [patient 18]'. Physiotherapists had some troubles with assessing patients' suitability for blended care (i.e. e-Exercise LBP) and wanted to know patient characteristics related to this suitability. According to patients, these patient characteristics could be: sufficient internet skills and a younger age. Physiotherapists thought the three-hour training prior to the feasibility study was an important prerequisite for working with the e-Exercise LBP intervention: 'Without training it would have been hard to work with the web-based application, but with training I knew exactly where to find something [physiotherapist 4]'. Other important prerequisites were that physiotherapists supported the content and that their professional autonomy was maintained. As one physiotherapist explained: 'I had the idea that I was in charge of the treatment [physiotherapist 16]'. Physiotherapists also underlined that positive experiences with e-Exercise were related to an intrinsic motivation for using blended care. An extrinsic motivation to use e-Exercise was the attitude of the employer and colleagues. For patients, this extrinsic motivation could be the attitude of relatives. Additionally, physiotherapists commented on the time needed to set up and tailor the web-based application that: 'Time investment of caregivers will have to be compensated, otherwise it simply will not work [physiotherapist 14]'.

[Table 4]

Added values

Patients experienced positive treatment effects of e-Exercise LBP: being more active, less stiff, having more energy and less pain. Patients experienced the web-based application as user-friendly, because monitoring treatment progress was clearly structured and because of the possibility of re-reading and re-watching previous information modules and exercises. Both physiotherapists and patients described the content of the web-based application as complete and all information themes were thought to be of added value. For physiotherapists, the ability to monitor patients' treatment progress and the stimulation of (exercise) adherence and empowerment were evaluated as most positively. As one physiotherapist explained: 'I have the feeling that patients have become more independent [physiotherapist 14]'. Patients also noticed that e-Exercise LBP stimulated their empowerment. As one patient mentioned: 'After a few weeks of e-Exercise LBP, I experienced that walking positively influenced my back pain [patient 18]'. The persuasive design of the web-based application was experienced as added value by both patients and physiotherapists. For example, options such as ticking off assignments and knowledge that the physiotherapist had insight in the progress were experienced by patients as 'something that serves as a carrot [patient 17]'. However, patients noticed that the web-based application was not always completely tailored to their individual needs. For example, exercises were sometimes too difficult or, in one case, even painful.

Therefore, patients valued the integration of face-to-face physiotherapy sessions with the web-based application. In the face-to-face sessions patients could discuss these difficulties, so that physiotherapists could adjust the web-based application or inform patients that painful exercises could be left out. However, most physiotherapists did not make any adjustments to the web-based application. Most physiotherapists did not use the functionality where they could gradually increase the physical activity assignment. Physiotherapists explained that that they would have applied the graded activity module more frequent if a patient-specific activity could be chosen, instead of choosing between standardized activities. It would also have helped if the working of the functionality was explained more thoroughly during the training. Some physiotherapists thought of the web-based application of e-Exercise as an addition to their usual care instead of one integrated intervention. Statements about time investment by physiotherapists were conflicting. Some physiotherapists stated that using e-Exercise costs time and another physiotherapist mentioned: 'There is no barrier, it costs time to enter patient data, but thereafter it saves a lot of time and explanation [patient 20]'. Additionally, patients with low insurance coverage or little time can now be offered a treatment, where it previously was not always possible. As one physiotherapist explained: 'In these cases, some people stop their treatment themselves, because it is going well, but with e-Exercise they have the possibility to continue at home [physiotherapist 11]'. Some patients mentioned that due to e-Exercise, less hands-on treatment was necessary.

Points of improvement

Physiotherapists evaluated the SBT as a useful tool to classify patients into risk groups. Opinions about the recommended number of face-to-face sessions were divided. Some physiotherapists stated that low-risk patients did not want and mostly did not need to follow the complete twelve-week program. Physiotherapists advised to create one platform where low-risk patients could choose which information themes they find useful. However improvements are necessary, physiotherapists were generally positive about the possibilities to tailor e-Exercise LBP. Mentioned points of improvements were creating pre-selections in exercises for both people with joint mobility problems and people who physically overload themselves. Physiotherapists currently could not easily tailor e-Exercise to these subgroups of patients. Both patients and physiotherapists explained that the persuasiveness of e-Exercise could be improved by sending messages to people with low adherence to the web-based application. Additionally, after completing the twelve-week intervention, patients would have liked to receive a reminder message to continue their physically active lifestyle. Patients and physiotherapists suggested to integrate an activity tracking device with a display to stimulate patients' physical activity. Regarding the user-interface of the web-based application, physiotherapists were unconvinced about the user-friendliness. As one physiotherapist explained: 'It could be less complex in appearance [physiotherapist 16]'. Also, both patients and physiotherapists addressed the need of an e-Exercise mobile device application, because the current web interface was experienced too small on a mobile device. Comparison of qualitative and quantitative data Overall satisfaction and usability of the web-based application of e-Exercise LBP Quantitative results showed that on average, patients were satisfied with e-Exercise LBP and usability of the web-based application. This is consistent with qualitative findings. In the interviews, various factors influenced patients' overall satisfaction and usability. Factors such as positive treatment effects, stimulation of empowerment, extensive content, user-friendliness, integration of face-to-face sessions and the web-based application positively influenced overall satisfaction and usability. Overall satisfaction and usability were negatively influenced by factors such as the presentation form and stratification of treatment. For example, patients would have preferred a smartphone app over a web-based application. Quantitative data showed that both patients and physiotherapists considered the web-based application of e-Exercise to have acceptable usability, but physiotherapists' average score was lower. This corresponded with qualitative findings. Factors such as time investment, customization

limitations, user-friendliness and the presentation form influenced usability of the web-based application negatively for physiotherapists.

Outcomes related to the elements and goals of e-Exercise LBP

Quantitative and qualitative data about tailoring of the intervention were conflicting. Quantitative findings showed that patients were positive about tailoring of the physical activity recommendations and exercises. However, patients mentioned in the interviews that the web-based application was not always completely tailored to their needs. For example, patients at low risk would have preferred a directly available platform instead of a 12-week program, where they could choose themselves which information themes they consider useful. Additionally, some physiotherapists mentioned in the interviews that they did not take the effort to adjust type and frequency of exercises. Most patients considered the physical activity recommendations, exercises and information modules of the web-based application as useful. Both quantitative and qualitative results showed that patients were more enthusiastic about the physical activity recommendations and exercises than the information modules. Especially patients with low risk of persistent disabling complaints sometimes thought the information module with twelve weekly information themes was too extensive and some themes did not apply to them. All participants agreed that the language usage of the web-based application was comprehensible, that information modules were not contradictory and were complete, in both quantitative and qualitative data.

Discussion

As part of the participatory development of the blended intervention e-Exercise LBP, this study described the feasibility of e-Exercise LBP, based on quantitative and qualitative data about both patients' and physiotherapists' experiences with the first prototype. Interviews with both patients and physiotherapists revealed important prerequisites for using e-Exercise, the added values and points of improvements for this first prototype. Results of this study provided recommendations to improve e-Exercise or other blended interventions for patients with LBP. Although patients were more satisfied, both patients and physiotherapists considered e-Exercise LBP to have acceptable feasibility. Prerequisites to successfully integrate e-Exercise LBP within physiotherapeutic care were the three-hour instruction prior to e-Exercise LBP, support of the content, that e-Exercise allowed physiotherapists to maintain their professional autonomy and getting to know patient characteristics related to suitability for e-Exercise LBP. To support physiotherapists in getting to know these characteristics, it is suggested to develop a tool to assess factors that influence patients' suitability for blended care, similar to a decision-making instrument created for mental health care (Wentzel, van der Vaart, Bohlmeijer, and van Gemert-pijnen, 2016). Important added values of e-Exercise LBP were monitoring of treatment progression and stimulation of adherence to exercise recommendations. As described in the e-Exercise LBP development and proof of concept paper, the average total number of patient logins to the web-based application was 28 (SD:27) over 12 weeks (Kloek et al., 2019). Another main added value for patients compared to face-to-face physiotherapy was the possibility of re-viewing (exercise) instructions at home. A recent study found that reviewing exercise instructions improves patient performance and therefore increases exercise adherence (Palazzo et al., 2016). e-Exercise is a substantially different way of delivering physiotherapy. As physiotherapists endorsed in the interviews, an extensive training to get used to integrating a web-based application within physiotherapy treatment is highly recommended. Our findings suggest that physiotherapists must get used to integrating the web-based application and face-to-face sessions within physiotherapy treatment, and must be willing to invest the needed time and effort to benefit from the added values.

E-Exercise LBP aims to provide personalized care through various stratification possibilities. Physiotherapists considered the SBT in combination with stratification recommendations for the

number of face-to-face sessions as useful. However, opinions about the number of recommended face-to-face sessions were divided. This corresponds with findings from the e-Exercise LBP development and proof of concept paper, in which it was described that patients in the low-risk group visited the physiotherapist more often than the e-Exercise LBP protocol recommended, while the medium and high-risk groups visited the physiotherapist less often than the protocol recommended (Kloek et al., 2019). Over-treating low-risk patients and under-treating medium- and high-risk patients was also found in other literature about stratified care in LBP patients (Bier et al., 2018). Additionally, most physiotherapists did not take the effort to adjust type and frequency of exercises. Stratification of the web-based application might be improved by creating one platform for patients with low risk for chronicity, in which information is directly available, instead of providing 12 weekly varying information themes. This is consistent with stratified care as suggested in another paper, in which only one high quality consultation is recommended, with reassurance, education and advice that should focus on positive self-management messages about avoiding bed rest, keeping active and returning to usual activities as soon as possible (Sowden et al., 2018). Stratifying the web-based application to the high-risk subgroup was possible by applying the graded activity functionality. However, as described in the e-Exercise LBP development and proof of concept paper, this functionality was only applied in one out of eight high-risk patients (Kloek et al., 2019). In the current study, physiotherapists explained that they would have applied the graded activity module more frequently if a patient-specific activity could be chosen, instead of choosing between standardized activities, and if the functionality was more thoroughly explained in the physiotherapists' training.

Another point of development for e-Exercise was a less complex appearance of the web-based application. Both patients and physiotherapists addressed the need for a smartphone application to increase e-Exercise's attractiveness. Increasing the attractiveness of exercise programs is found to be a strategy to enhance adherence (Palazzo et al., 2016). Additionally, the integration of an activity tracking device with a display was recommended by both patients and physiotherapists. In other research, integrating an activity tracking device with a display is found to significantly improve physical activity and thereby stimulate recovery (Bravata et al., 2007).

Although extensive insights in end-users' experiences were gathered, a limitation of the study is that some of the patients participating in the interviews had not yet finished the complete 12 week intervention. Although every interviewed patient had already completed at least six weeks of the e-Exercise intervention, it is possible that their perceptions differed to those who already completed the intervention. Another possible limitation of the study is that two different researchers conducted the interviews. Both interviewer's styles might have been different, which could possibly have influenced the collected data. However, both researchers used the same topic-guide for the semi-structured interviews and data saturation was reached.

Overall, patients and physiotherapists were satisfied with the e-Exercise LBP intervention. However, various prerequisites and points of improvement for the physiotherapists' training and the prototype were mentioned. The results of this mixed-methods study will be used to further adapt the e-Exercise LBP intervention to the needs of patients and physiotherapists. Hereafter, a randomized controlled trial will be conducted to compare the (cost-) effectiveness of the improved e-Exercise LBP intervention to usual physiotherapy.

Ethics approval and consent to participate

The Medical Research Ethics Committee Utrecht declared that the e-Exercise LBP project is not covered by the Dutch Medical Research Involving Human Subjects Act (WMO), because patients were not subjected to actions and no rules of behavior were imposed on them. The main reason was that patients were not exposed to any new interventions, but existing and recommended

interventions were offered in a new way. All patients signed informed consent to participate in the e-Exercise LBP study. All physiotherapists gave verbal consent to use their data anonymously.

Disclosure Statement

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ORCID

Mark L. van Tilburg http://orcid.org/0000-0002-3474-0950
Corelien J. J. Kloek http://orcid.org/0000-0002-7426-7141
J. Bart Staal http://orcid.org/0000-0002-0083-6380
Daniël Bossen http://orcid.org/0000-0003-3894-4245
Cindy Veenhof http://orcid.org/0000-0003-0970-2896

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Appendices

Appendix 1. Screenshot of the web-application of e-Exercise LBP

Appendix 2. Topic lists

Main theme	Sub theme
Patients' topic list	
Patient characteristics	(1) Status praesens
	(2) Duration of complaints
	(3) Motivation for participation
	(4) eHealth experience
Intervention characteristics	(1) General impression
	(2) Degree of use
	(3) Added value of e-Exercise
	(4) Logging in
	(5) Physical activity assignment
	(6) Content of information themes
	(7) Feedback of the web-based application
	(8) Current lifestyle
	(9) Time investment
	(10) Depth of the program
	(11) Used language
Organizational characteristics	(1) Integration of the web-based application within face-to-face sessions
	(2) Quality and used interventions in face-to-face sessions
Physiotherapists' topic list	
Physiotherapist' characteristics	(1) Motivation for participation
	(2) eHealth experience
	(3) Study recruitment
Intervention characteristics	(1) General impression
	(2) Degree of use
	(3) Keele STarT Back Screening Tool
	(4) Ratio web-based/offline
	(5) Account creation
	(6) Content information texts
	(7) Information- and instruction videos
	(8) Completeness
	(9) Added value
	(10) Integration of the web-based application
	(11) Time investment
Environmental characteristics	(1) Colleagues
	(2) Leadership or partnership

Tables and figures

Figure 1. Study flowchart.

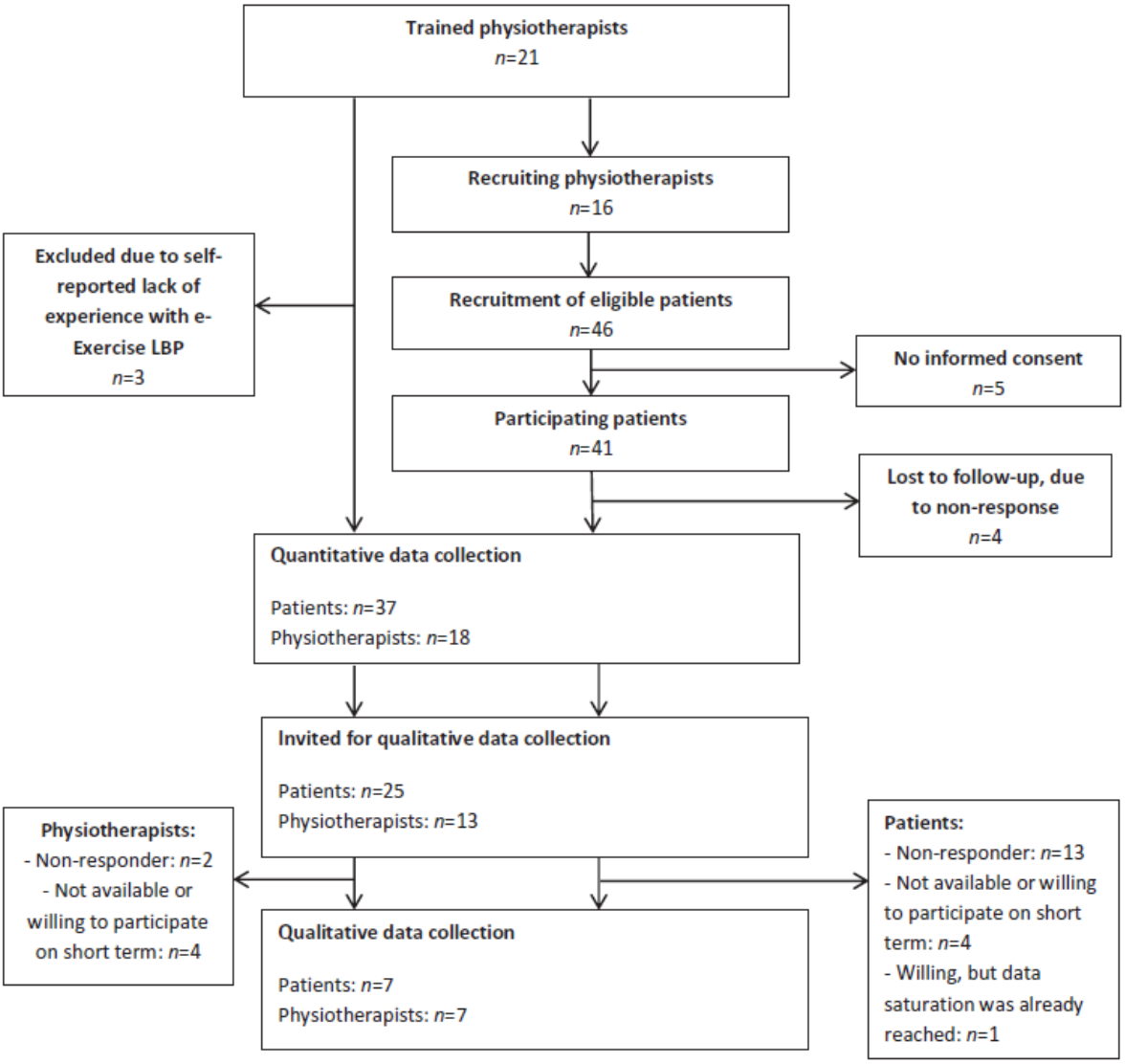

Figure 2. Overview of the blended intervention e-Exercise LBP.

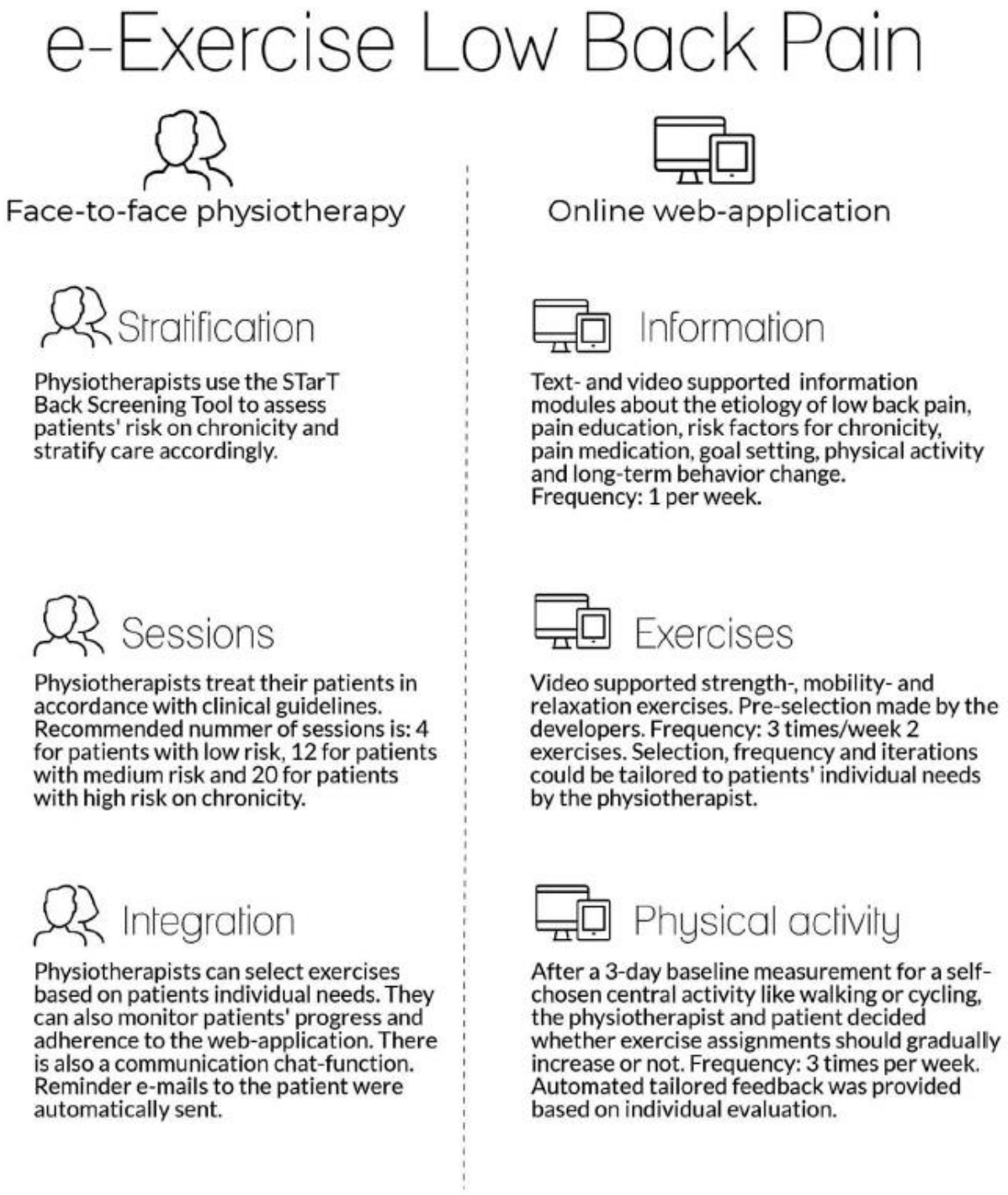

Table 1. Participant characteristics, entire group and sub-groups.

	Patients				Physiotherapists
	Entire group	*Low risk group*	*Medium risk group*	*High risk group*	*Entire group*
Number of respondents	*n*=41	*n*=18	*n*=15	*n*=8	*n*=21
Gender, *n* (%)					
Male	18 (44)	10 (56)	7 (47)	1 (13)	10 (48)
Female	23 (56)	8 (44)	8 (53)	7 (88)	11 (52)
Age in years, mean (SD)	44.3 (10.4)	44.9 (10.5)	42.0 (12.0)	47.5 (5.8)	41.2 (11.5)
BMI, mean (SD)	25.9 (4.7)	25.7 (3.8)	27.0 (6.4)	24.4 (2.8)	
Education level, *n* (%)					
Low	4 (10)	1 (6)	1 (7)	2 (25)	
Middle	17 (42)	9 (50)	5 (33)	3 (38)	
High	20 (49)	8 (44)	9 (60)	3 (38)	
Disease duration, *n* (%)					
0-6 weeks	5 (12)	2 (11)	2 (13)	1 (13)	
6-12 weeks	6 (15)	3 (17)	2 (13)	1 (13)	
12 weeks-12 months	9 (22)	4 (22)	4 (27)	1 (13)	
	21 (51)	9 (50)	77 (47)	5 (63)	
Comorbidities, *n* (%)					
None	18 (44)	8 (44)	77 (47)	3 (38)	
One	15 (37)	7 (39)	6 (40)	2 (25)	
> One	8 (20)	3 (17)	2 (13)	3 (38)	
Specialization, *n* (%)					
Manual therapy					12 (57)
Psychosomatic physiotherapy					1 (5)
Sports physiotherapy					2 (10)
No relevant master					7 (33)

SD: Standard deviation, BMI: Body Mass Index (Kg/m^2)

Table 2. Participant characteristics, qualitative analysis.

	Patients	Physiotherapists
Number of participants	*n*=7	*n*=7
Gender, *n* (%)		
Male	3 (43)	3 (43)
Female	4 (57)	4 (57)
Age in years, mean (SD)	45.3 (10.8)	37.3 (11.5)
Risk group, *n* (%)		
Low risk	3 (43)	
Medium risk	3 (43)	
High risk	1 (14)	
Specialization, *n* (%)		
Manual therapy		4 (57)
No relevant master		3 (43)

Table 3. Outcomes of the set of questions and statements related to e-Exercise LBP.

n=37	n (%)
The web-application of e-Exercise contained a physical activity assignment. How did you feel about the intensity (frequency and number of minutes) of the physical activity assignment?	
Way too intensive	2 (5)
Intensive	13 (35)
Exactly right	16 (43)
Easy	6 (16)
Way too easy	0 (0)
To what extent do you agree with the following statement: I thought the physical activity assignment was well tailored to my needs.	
Completely agree	4 (11)
Agree	26 (70)
Disagree	6 (16)
Completely disagree	1 (3)
Was the formulation of the physical activity assignment clear to you?	
Yes	36 (97)
No	1 (3)
The web-application of e-Exercise contained exercises. How did you feel about the intensity (frequency and number of repetitions) of the exercises?	
Way too intensive	3 (8)
Intensive	11 (30)
Exactly right	18 (49)
Easy	5 (14)
Way too easy	0 (0)
I thought the exercises were well tailored to my needs.	
Completely agree	2 (5)
Agree	29 (78)
Disagree	5 (14)
Completely disagree	1 (3)
Did you think that the exercise instruction videos were of added value?	
Yes	32 (87)
No	5 (14)
Which components of the e-Exercise web application did you consider as useful?	
The physical activity assignment	
Yes	29 (78)
The exercises	
Yes	31 (84)
The information module	
Yes	23 (62)
Did you think that the videos with information themes were of added value to the written information themes?	
Yes	27 (73)
No	10 (27)
I thought the language usage on the e-Exercise web-application was comprehensible.	
Yes	36 (97)
No	1 (3)
I thought the language usage and terms used on the e-Exercise web-application were recognizable to me. I use these in my daily life too.	
Completely agree	7 (19)
Agree	30 (81)
Disagree	0 (0)
Completely disagree	0 (0)
I thought that the information modules were contradictory.	
Yes	0 (0)
No	37 (100)
The information on the e-Exercise web-application was too much.	
Yes	5 (14)
No	32 (87)
Did you miss any information on the e-Exercise web-application?	
Yes	1 (3)
No	36 (97)
I fully trust that the information on the e-Exercise web-application is correct	
Completely agree	9 (24)

Table 3. (Continued)

n=37	n (%)
Agree	28 (76)
Disagree	0 (0)
Completely disagree	0 (0)
I thought that the face-to-face guidance of the physiotherapist was good.	
Completely agree	12 (32)
Agree	20 (54)
Disagree	4 (11)
Completely disagree	1 (3)
In general, I thought that the number of face-to-face visits:	
Much too few	1 (3)
Too few	5 (14)
Exactly right	27 (73)
Too many	2 (5)
Far too many	0 (0)
Does not apply	2 (5)
Did you experience the physiotherapy treatment and the e-Exercise web-application as one integrated intervention?	
Yes	25 (68)
No	12 (32)

Table 4. Qualitative analysis.

Patients' user satisfaction		
Main themes	Codes	Experience*
Patient characteristics	(1) Blended care suitability	-
	(2) expectations of physiotherapy treatment	+
	(3) Treatment effect	+
	(4) Empowerment	+
Characteristics of the web-based part of the intervention	(1) Content	+
	(2) User-friendliness	+
	(3) Presentation form	-
	(4) Tailored care	+
	(5) Persuasive design	+
	(6) Integration within the face-to-face part.	+
Characteristics of the face-to-face part of the intervention	(1) Stratification	-
	(2) Feedback	+
	(3) Motivation	+
	(4) Hands-on treatment	+
	(5) Integration within the web-based part	+
Environmental characteristics	(1) Activity tracking device	+
	(2) Attitude of relatives	+
Physiotherapists' user satisfaction		
Physiotherapist' characteristics	(1) Training in advance	+
	(2) Assessing suitability	-
	(3) Support the content	+
	(4) Professional autonomy	+
	(5) Customization	+ / -
	(6) Intrinsic motivation	+
	(7) Time investment	+ / -
Intervention characteristics	(1) Stratification	+ / -
	(3) Persuasive design	+ / -
	(4) User-friendliness	+ / -
	(5) Content	+
	(6) Monitoring	+
	(7) Adherence	+
	(8) Empowerment	+
	(9) Activity tracking device	+
	(10) Presentation form	-
	(11) Integration web-based and face-to-face.	-
Environmental characteristics	(1) Attitude of employer	+
	(2) Attitude of colleagues	+
	(3) Financial consequences	-
	(4) Patient expectations	-
	(5) Possibility to offer something for a patient with low insurance coverage and/or little time	+

*: '+' = beneficial/positive experience; '-' = disadvantageous/negative experience; ± both, beneficial/positive experience and disadvantageous/negative experience.