Toward a Digital Physiotherapy Support System for Home Training: Survey Insights into Expectations and Requirements of Patients and Therapists

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Abstract

Physical therapy plays an important role in restoring and maintaining physical health. However, due to time, cost, and personnel constraints, physiotherapy sessions are limited and exercises must also be performed at home in order to achieve long-term success. Yet, the consequence is a lack of feedback due to the missing supervision in the home environment, leading to incorrect exercise execution and a decrease in motivation. This can, in the long run, reduce the effectiveness of recovery. Digital systems utilizing everyday technologies, such as smartphone cameras, automatic motion analysis, and feedback mechanisms, are promising for bridging this gap. This study aims to reveal user expectations and requirements for the design of such a physical therapy support system for home training, encompassing both patients' and therapists' perspectives. Our findings demonstrate that users particularly value immediate corrective feedback during exercise execution, adaptable and personalized training experiences, and motivational support that enables goal setting, progress tracking, and self-monitoring, rather than relying on external rewards. By identifying user requirements and deriving concrete design implications, we lay the foundation for the realization of future applications that are closely aligned with users' needs.

Keywords

Digital Physical Therapy, Survey Research, Interactive Health Systems, User-Centered Design, Human Computer Interaction (HCI)

1. Introduction

The effectiveness of physical therapy is well documented: It is effective in rehabilitation and therapy after injuries, as well as in the treatment of chronic neuromusculoskeletal diseases [1], and accounts for more than a third of therapeutic services in medical rehabilitation facilities throughout Germany [2]. Furthermore, training therapy measures are highly effective in improving strength, balance, and stability [3]. Besides these benefits, only a very limited number of therapy sessions is common in physiotherapy practice due to time, cost, and personnel constraints. This contrasts with the need for longer, more frequent exercise sessions in order to achieve an optimal recovery process [4, 5]. As a result, patients are required to perform a substantial part of their exercises independently and without supervision, typically at home. In doing so, direct feedback about exercise execution or training intensity is omitted, despite being crucial parameters of an evidence-based therapy. This holds especially when using small therapeutic equipment, essential for achieving the necessary intensity in certain exercises [5]. A lack of feedback carries the risk of incorrect execution, a decrease in patient adherence as a result of missing motivation, while complicating the monitoring of the recovery process. To address this, a variety of digital rehabilitation systems have emerged [6]. Yet, they lack automated, everyday-technology-based

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motion analysis that can capture patients' movements and therapeutic equipment to provide meaningful feedback on exercise execution. The effectiveness of such a system and digital systems in general, depends strongly on how well it aligns with the expectations, needs, and concerns of both primary user groups: patients and therapists. To ground the design of future digital physiotherapy support systems in real-world needs, this paper aims to reveal user expectations and requirements. More specifically, we contribute the following:

- We conduct two complementary online surveys designed to reveal user expectations on digital support systems for physiotherapeutic home training from patients and therapists.
- We report and summarize the findings of our surveys and identify shared and differing opinions.
- We derive implications for the design of feedback systems and digital rehabilitation systems.

2. Related Work

As part of digital rehabilitation there are a variety of applications designed to support patients in performing exercises at home. These include online physiotherapy courses, as well as smartphone apps and sensor-based technologies that record and evaluate individual exercises performed by patients [7]. A recent review of digital rehabilitation detected six different clusters of systems [6]. Next to sensor technology, robotics, gamification, virtual reality, and augmented reality, the authors identify mobile apps and Artificial Intelligence (AI) as key trends for further development. They note that, while there is still a lack of verification for AI, aspects of social justice and patients' technical competence must be taken into account for mobile applications. Additionally, digital applications should only expand the existing range of services instead of replacing them. In Germany, for example, there are so-called *"Digitale Gesundheitsanwendungen (DiGA)"* (digital health applications) which are paid for by most insurance companies [8]. Currently (November 2025), there are 73 different DiGA [9], seven of which are applications for musculoskeletal exercises using the smartphone or a web interface as a platform. However, out of these seven, only one captures the actual motion [10]. Consequently, feedback on the actual movement performed is rare or of generic nature. To position our work within existing research addressing the challenges of supporting patients during home exercises, we review related approaches focusing on automatically assessing patient exercise performance (Section 2.1) and how to provide feedback (Section 2.2). Additionally, we review related user studies and surveys to better understand the acceptance and requirements of digital, mobile applications by physical therapists and patients (Section 2.3).

2.1. Automatic Motion Analysis

High-precision movement data, such as joint trajectories, are the foundation for effective motion analysis to provide automatic feedback on exercises. To generate such high-precision movement data, external sensors like IMUs (Inertial Measurement Units) or marker-based camera systems, such as Vicon [11] or Qualisys [12], consisting of several infrared cameras and reflective markers attached to the subject, as well as specialized software, are required. Such systems are currently employed in the fields of rehabilitation research, injury prevention, and performance enhancement [13, 14, 15]. However, these systems incur immense acquisition costs, entail complex data evaluation, and are confined to laboratory settings, making them unfeasible to use at home or even in smaller physical therapy practices. Recent advances in deep learning-based computer vision methods enable markerless motion tracking and offer a promising alternative as they are portable, cost-effective, and user-friendly. Since they only require a video recording to extract the human pose estimation data, they are a potential solution for applications in clinical practices or in home environments. Current studies have demonstrated the high reliability and validity of markerless 3D motion capture, for example, in gait analysis when employing multiple cameras [16] or even with only a single camera [17]. Using only a single smartphone camera, one recent approach has been developed that utilizes 2D motion capture to analyze exercises and provide feedback for patients with back pain [18]. Beyond movement data, current markerless

motion tracking systems provide only limited support for assessing individual exercise execution. They allow for repetition counting but do not yet allow for the quantification and, thus, assessment of exercise quantity and intensity, especially when considering physiotherapy training equipment, which is necessary for numerous exercises.

2.2. Feedback

In addition to assessing the movement quality of persons, a digital physiotherapy support system must provide meaningful feedback to compensate for the missing supervision in home environments, to ensure that exercises are performed correctly and to keep users motivated. Here, we distinguish between indirect and direct feedback. We classify feedback as *indirect* if it is not provided immediately while using an application to monitor an exercise. For example, a notification that a planned workout has not yet been completed. A recent meta-analysis discussing designs for habit formation to keep users motivated and engaged shows that the most used techniques were self-monitoring of behavior, goal setting, and prompts and cues [19]. A total of 41 research articles were included in the review, which highlighted that the predominant behavior change techniques used in digital health applications are automatic monitoring, general training guidelines, self-defined goals, time-based reminders, and virtual rewards. *Direct* feedback, on the other hand, is given to the users in real-time and immediately when assessing the performance of an exercise. This includes audio-visual cues [20, 21], such a repetition counters, visual cues showing a performance measurement, or text-to-speech messages providing posture correction or motivating feedback. However, which feedback method is chosen often seems arbitrary, as highlighted in a meta-survey on feedback design in targeted exercise digital biofeedback systems [22]. Their study suggests that systems should combine evidence-based feedback interventions with high-quality, user-centered design to ensure that the feedback is effective and meaningful. Another important factor is that none of these feedback mechanisms takes the quality of the performed exercises into account. Patients can report whether exercises are too difficult or too easy and how often they have done the exercises, but there are no established criteria for what automated feedback on exercise quality should look like [23, 24]. Hence, our survey investigates the preferences of patients and therapists regarding feedback features to aid in the design of a potential future digital physical therapy support system.

2.3. Related User Studies and Surveys

Finally, we review related studies that examine the opinions and requirements of patients and therapists regarding digital applications that support home-based exercises. Chew et al. [25] conclude, for an Asian context, that patients undergoing post-total knee arthroplasty rehabilitation prefer a streamlined, non-overloaded app that provides information in a time-appropriate manner. They also identified the importance of education features and motivation-enhancing elements. Both patients ($n = 6$) and physiotherapists ($n = 4$) emphasized the need for outcome tracking, progress monitoring, and feedback loops, which support patient motivation while offering reassurance to both groups. Notably, the study showed that self-tracking can be positively received even without gamification aspects. Gell et al. [26] investigate the perspective of physical therapists ($n = 18$) and patients ($n = 17$) on three commercially available mobile apps to support home exercise for people with osteoarthritis. Both groups see the advantage of using mobile apps to improve accountability and enhance the therapeutic relationship. Additionally, the option to also give feedback about the difficulty of exercises and reasons for not completing an exercise, such as pain or difficulty, was considered an advantage by both groups, as this information can help therapists to streamline the training routine of their patients. From the patient side, all participants preferred a video exercise prescription over traditional methods. Although both groups acknowledge the technological challenges when using mobile applications, patients perceive that the benefits outweigh the challenges. Arensman et al. [27] investigate the perspective of Dutch patients ($n = 9$) on a given smartphone app that supports them during home-based exercises as part of their physical therapy treatment for low back pain. Patients agree that the app could be easily integrated

into their daily life and that the visual examples appear to increase their self-efficacy. However, the acceptance of the app might have partly been caused by the close interaction with their physical therapists, since the patients relied on them for support. Nevertheless, apps appear to be a useful tool to complement physical therapists' face-to-face treatment. Finally, a study of Estel et al. [28] surveying physiotherapists ($n = 488$) in Germany about the potential of digitalization within physiotherapy identified that most participants see high potential for digitalization in the physiotherapy sector. An interesting finding is that physiotherapists in the outpatient sector see more potential for digitalization, perhaps because their patients would benefit more from digital support systems.

While there are a number of similar studies on this topic, virtually none of them address digital applications that can provide direct feedback on the quality of exercise. In addition, many applications specialize in either the perspective of patients or therapists, or focus on a specific physical condition or application. Our survey, in contrast to existing ones, targets both user groups (in Germany), patients and therapists, is not limited to a specific physical condition or application, and explicitly involves feedback mechanisms and automatic motion analysis in the questionnaires.

3. Survey Design

Objective: The objective of this study was to identify expectations and requirements, as well as potential concerns and opportunities related to digital, smartphone-assisted physiotherapy support. The study targeted both relevant user groups: (a) patients performing training exercises at home, and (b) therapists accompanying patients' training and recovery progress. Adopting an early-stage design perspective, the study aimed to capture general, tool-independent requirements. The overall goal was to derive design implications for an interactive user interface that supports physiotherapeutic home training, including mechanisms to provide patients with direct feedback on their exercise execution.

Methods: We designed two surveys that were conducted between August 15th and October 15th 2025 using Google Forms. A total of 84 participants took part in the surveys, comprising members of the general public representing potential patients ($n = 50$) and physiotherapy domain experts ($n = 34$). The potential patient group was not restricted to individuals with prior physiotherapy experience and included participants with and without previous exposure to physiotherapeutic treatment to capture a broad range of expectations, including those of first-time users and individuals at risk of requiring physiotherapy. The therapist group consisted of practicing physiotherapists or comparable experts who reported regularly supervising patients. The participants were recruited by digital communication channels and personal outreach via mailing lists, instant messaging platforms, and direct invitations. The surveys were carried out in German and required less than 15 minutes for completion. Participants did not receive any compensation, so no contrasting incentives for answering were present. The questionnaires were developed collaboratively by consortium members of the *THERESA* [29] project (funded by the *German Federal Ministry of Research, Technology and Space*), involving researchers and domain experts from physical therapy, kinesiology, computer science, and applied movement analysis. The questionnaires employed a combination of question types, including single- or multiple-choice items, Likert-type rating scales, and open-ended free-text fields. Questions using rating scales applied a 5-point Likert scale, where the number "5" represented the highest positive level of agreement or importance, "1" the lowest negative level, and "3" a neutral position. Predefined-answer questions were generally extended with a free-text option ("Other: . . .") to capture additional opinions beyond the predefined categories and to mitigate potential selection bias. Except for a few free-text input fields, all questions were mandatory to ensure completeness of the responses.

Ethical considerations and consent: Participation in the surveys was voluntary and anonymous. All participants received a brief description explaining the aim of the survey and the processing of their data in the introductory section preceding the questionnaire (see Appendix A). By answering the questionnaire, participants gave their consent to the use of the provided data. Since the study

involved only anonymized self-reported data without any intervention, identifiable health information, or associated risk to participants, formal ethical approval was not required.

3.1. Questionnaires

Each questionnaire consisted of up to 27 items and was divided into the following five main sections.

Patient Perspective:

i. Demographics, experience with physiotherapy and exercise habits
ii. Experience with digital training or health applications
iii. Expectations on the User Interface (UI)
iv. Personalization, interaction and motivation
v. Concerns and opportunities

Therapist Perspective:

i. Demographics and therapeutic work experience
ii. Dealing with home training
iii. Experience with digital training or health applications
iv. Expectations on the training analysis
v. System integration into professional practice

The order of sections and individual questions was maintained constant, with no randomization or alternation but the section "Experience with digital training or health applications" in both surveys was conditionally displayed. If participants indicated prior experience in the preceding question, the respective follow-up items were shown; otherwise, they were automatically skipped, and participants were directed to the next section. All other sections were presented to all participants. Participants were able to review and modify their responses any time using a "Back" button. The full questionnaires and their translations are provided in Appendix A.

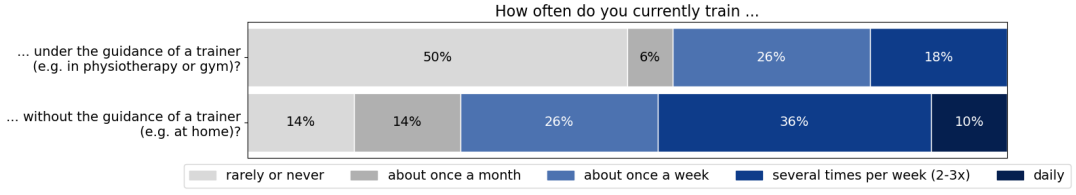
4. Results

We report the findings from our patient (Section 4.1) and therapist questionnaire (Section 4.2), organized along the five main sections, with additional figures and explicit answers to individual questions provided in Appendix B. We also provide a comparative analysis that highlights shared and differing views of the user groups, and compares our findings to those of previous surveys in digital physiotherapy and home-based exercise support (Section 4.3).

4.1. Patient Perspective

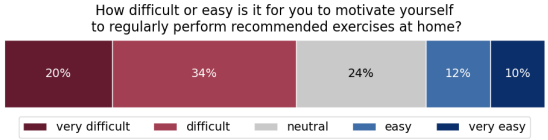
i. Demographics, experience with physiotherapy and exercise habits: A total of 50 participants took part in the survey (Table B.1), consisting of 33 females, 16 males, and 1 participant with unknown gender, aged 19 to 68 years, with an average age of 42.5 (std 16.7). Participants varied in experience with therapeutic exercises. 16 of them (32%) had experience with therapeutic exercises and were currently in therapy at the time of the study, 28 (56%) had experience in the past, and 6 participants (12%) had no direct experience so far. The results in Figure 1 show a strong tendency to perform training exercises

Figure 1: Training frequency with and without guidance.



without guidance, for instance, in the home environment, with 72% of participants training at least once a week unsupervised. Notably, half of the participants rarely or never train with supervision. On a given scale from 1 (very difficult) to 5 (very easy), more than half of the participants (combined 54%) stated that they find it (very) difficult to motivate themselves to perform recommended exercises at home (Figure 2). When asked what could help them train more regularly and with greater motivation, participants mentioned five main categories of aspects: (1) visible progress and feedback, (2) structure, routine, and scheduling, (3) external motivation and social support, (4) guidance and instruction, and (5) internal motivation and personal factors (Table B.2). While social support, guaranteed progress, and some personal factors like pain can likely not be substituted or fully achieved by a digital application, many of the mentioned factors could be supported with a well-designed user interface. Some responses already mention digital tools as a helpful solution to overcome a lack of motivation.

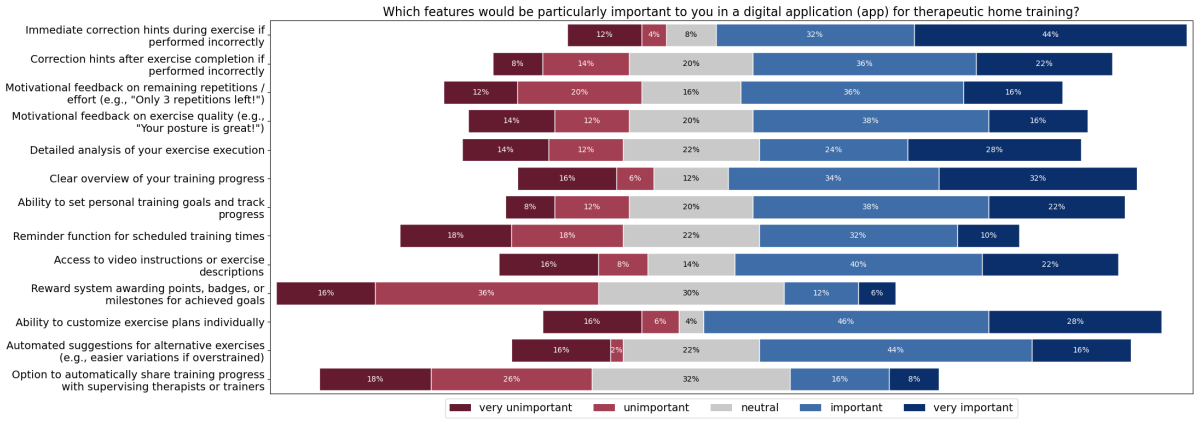
Figure 2: Perceived difficulty of self-motivation for home exercises.



ii. Experience with digital training or health applications: 42% of participants ($n = 21$) reported that they had experience with digital training or health applications, including smart watches, video-based exercise programs, or general fitness apps (Table B.3). Those using digital tools tend to be satisfied with the application, indicating acceptance and successful integration of digital applications. Yet, their potential is not fully exploited. Suggested improvements focused on error correction during training, more functionalities and details with respect to exercise variety and difficulty progression, and user-friendlier interfaces with less advertising.

iii. Expectations on the User Interface: To reveal detailed expectations and requirements for future applications, independent of prior experience, we asked participants to rate the importance of hypothetical interface features (Figure 3). A Friedman test [30] indicated significant differences in

Figure 3: Perceived importance of user interface features.

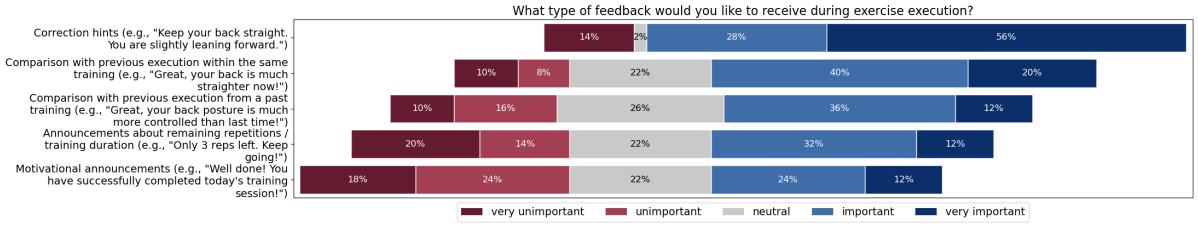


the perceived importance among the features ($\chi^2 = 73.9, p < 0.001$). The most important feature, rated "very important" by 44% on a scale from 1 (very unimportant) to 5 (very important), is providing immediate correction hints during exercise execution. Additional highly valued features included, among others, the ability to customize exercise plans and providing a clear overview of the training process. A reward system was considered least important (combined 52% rating as "very unimportant" or "unimportant"), followed by automatic sharing of training data with a supervising therapist and a reminder function for scheduled training times. Setting and tracking personal training goals was rated

more important on average, also compared to receiving motivational feedback. This hints towards customizable features as a more effective approach to increasing patients' motivation. Apart from the given answer possibilities, participants requested detailed information on the exercises (e.g., muscle engagement, therapeutic purpose, and equipment) and exercise recordings (Table B.4).

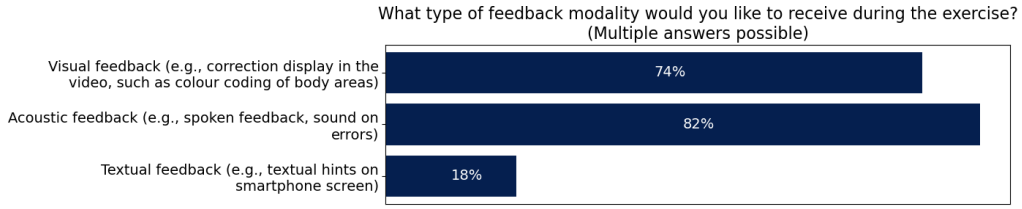
In line with being identified as a very important UI feature, most participants highly value error correction hints as feedback type (Figure 4), with a combined 84% rating it as "very important" or "important". This is followed by feedback comparing exercise execution within a training cycle (combined 60%) and comparing current with previous execution of past training sessions (combined 48%). Announcements regarding remaining repetitions and motivational feedback are considered somewhat less important. These differences are also statistically significant (Friedman $\chi^2 = 47.6, p < 0.001$).

Figure 4: Perceived importance of different feedback types.



In addition to the predefined answers, participants desired feedback on therapy progress and training frequency (Table B.5). One participant mentioned that there should be the option to turn the announcements off. This aligns with our next question, which asked about individual preferences regarding the desired frequency of provided feedback. Here, the majority (56%) voted that feedback should be given occasionally as needed (Figure B.11). However, what users consider *necessary* feedback likely varies considerably, making the optimal frequency inherently subjective. Such individual preferences demonstrate the need for personalization and system adaptation to user settings. The next section of the survey addressed this in greater detail. Regarding preferred feedback modalities, textual feedback was the least selected answer with only 18% (Figure 5). Acoustic feedback was selected most often (82%), closely followed by visual feedback (74%), suggesting a combination of both.

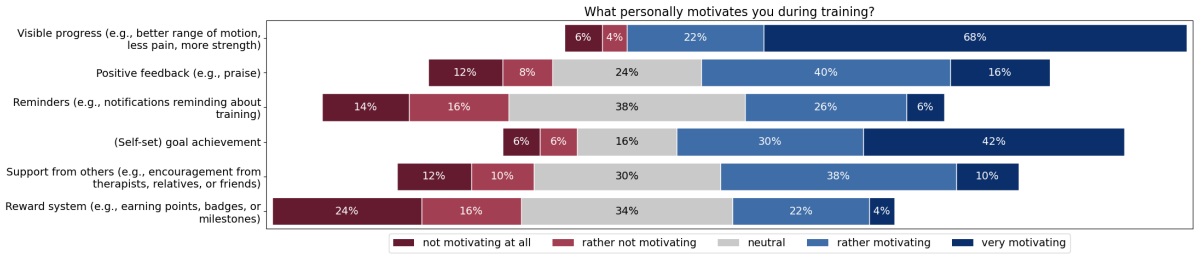
Figure 5: Desired feedback modalities.



iv. Personalization, interaction and motivation: To gain insights into how training applications should adapt to individual needs, we asked participants about desired personalization options, preferred forms of interaction, and motivation-supporting features. A majority of 56% would like to provide their own assessment of exercise difficulty after training, 14% preferred to give feedback directly during training after each completed exercise, while 30% did not wish to provide difficulty ratings at all (Figure B.12). We also asked participants if they would agree that the application uses the training data and assessment of perceived exercise difficulty to automatically suggest adjustments for future training sessions (e.g., more or fewer repetitions, heavier or lighter exercises). Only 2 participants (4%) rejected the idea of automated adaptation of training difficulty (Figure B.13). Most participants either agreed with granted permission (60%) or liked the idea of automatic adjustments without further confirmation (36%). Participants commented that the option to manually discard system suggestions should be included

and that the application must pay attention to day-to-day variability in condition and ensure exercise adjustments make functional sense, also, since exercises may require a period of adjustment. Our next questions targeted user preferences regarding personal adjustments to the application. With respect to the training plan (Figure B.14), adjusting the difficulty of exercises was chosen by the vast majority of participants (92%) as an essential feature. This is followed by adjusting the duration or amount of exercises (66%) and in- or excluding exercises from a planned training (62%). Less demanded are adjustments to the execution order of exercises (48%) and automatically suggested adjustments by the application (36%). With respect to interaction during exercise execution (Figure B.15), participants favored the option to enable or disable the display of videos or exercise instructions (84%), adjusting the type and amount of feedback (70%), and to pause and skip exercises (66%). Less than half of the participants (40%) wanted the option to see themselves during exercises by video recording. At the end of this part, we asked which factors personally motivate participants during training (Figure 6). Visible

Figure 6: Motivational factors.



progress is perceived as the most motivating factor (68% "very motivating"), followed by achieving goals, getting positive feedback, and receiving social support. Reminders and reward systems were associated with less motivational power. The differences in the ratings are statistically significant (Friedman $\chi^2 = 96.1, p < 0.001$). The factors participants reported as most motivating during training largely align with the answers in part **i.** on what could help them train more regularly, so anticipated and experienced motivators appear consistent. Additionally, the comparably low ratings for the reward system and reminders reflect their perceived low importance as UI features (Figure 3).

v. Concerns and opportunities: Key concerns of patients included data protection, privacy, and security, with participants emphasizing the need for secure anonymity and handling of sensitive data (Table B.7). Technical ability and access were also highlighted, along with worries about the system's effect on the quality of physiotherapy. On the other hand, participants identified several opportunities offered by digital systems (Table B.8). Many noted that such systems could improve exercise execution and rehabilitation, helping them avoid mistakes and perform exercises correctly. Additionally, they recognize the potential to enhance motivation and adherence through features such as progress tracking, as well as offering greater accessibility and flexibility, especially for individuals with limited mobility. Lastly, participants stated that a digital system could support physiotherapists and the healthcare system by relieving therapists, reducing costs, and providing broader coverage with objective feedback.

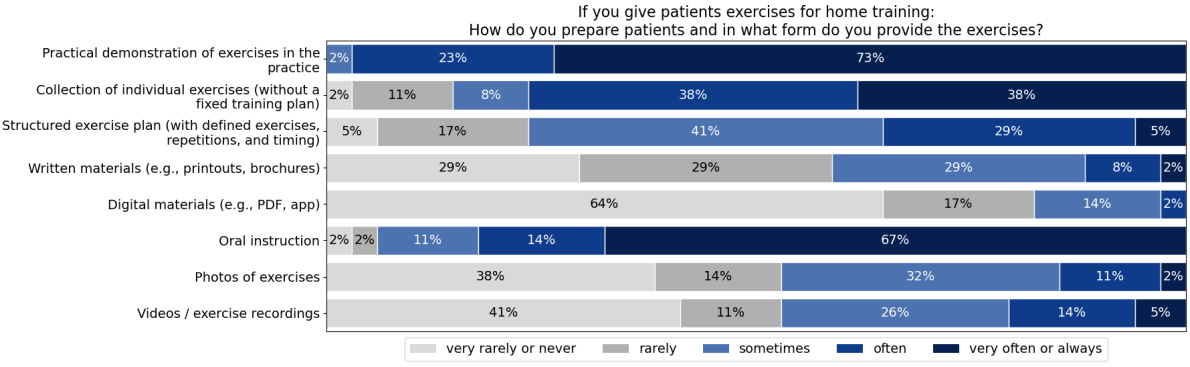
4.2. Therapist Perspective

i. Demographics and therapeutic work experience: A total of 34 participants completed the domain-expert questionnaire (Table B.9). Of these, 26 were female and 8 male, with ages ranging from 22 to 68 years (mean 32.6, std 12.3). Regarding professional background, the vast majority (91.2%) identified as physiotherapists. In addition, participants stated that they were sports scientists, sports therapists, medical doctors, fitness trainers, or osteopaths. In terms of professional experience, 44.1% reported having more than five years of work experience in the therapeutic field, 14.7% at least two years, and 41.2% less than two years. Yet, all participants regularly supervised patients who perform

physiotherapeutic exercises at home. Most participants (71%) reported supervising these patients on a daily basis, 26% several times per week, and 3% occasionally on a less regular basis. All respondents can thus be considered valid domain experts, and no responses had to be excluded due to a lack of expertise.

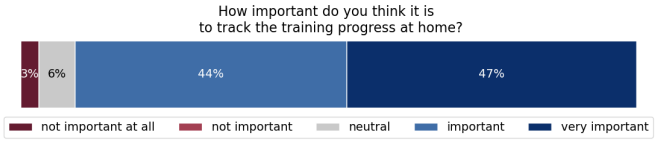
ii. Dealing with home training: In the following, we asked our domain experts about current practices regarding home training. Figure 7 shows that the most commonly used approach for preparing and providing exercises to patients is a practical demonstration (73% "very often or always"), along with oral instructions (67% "very often or always"). The handover also tends to be a collection of individual exercises rather than a more structured format. Even less common are written exercise materials as well as photos or video recordings of exercises. Digital materials are very rarely or never used by the majority of therapists (64%). These findings indicate that while therapists place high value on in-person

Figure 7: Methods used to prepare and provide exercises to patients.



explanation and demonstration, the additional integration of standardized or digital preparation tools is still limited in practice. When being asked about the importance of tracking training progress at home, participants expressed a strong belief in the value of tracking. A combined 91% rated it as 'important" or "very important" (Figure 8). However, current practice shows that the vast majority (97%) relies on self-reports by patients to track the progress at home (Figure B.16). Yet, self-reports may be subject to incompleteness, bias, or inconsistency. Only a small minority already uses analog training logs or documentation sheets (18%), apps (6%), or digital documentation (6%), and 12% of therapists use no systematic tracking at all. Two participants (6%) added that they let the patients demonstrate the exercises to evaluate their development. Regarding the content of the tracking (Figure B.17), all participants (100%) stated that they ask their patients whether the exercise was performed at all, often complemented by questions about potential problems encountered (85%) and the frequency of execution (82%). More than half also reported asking for the effort or perceived difficulty (68%) and the type of exercises performed (56%). In addition to these predefined answers, the therapists stated that they also assess pain, the impact on the patient's problem, special circumstances, alternative exercises, and progressive load increases. The most frequent challenge mentioned by therapists for home exercises concerns patient motivation and personal factors (Table B.10). Many responses referred to a general lack of motivation or self-discipline, pointing out that exercises are often deprioritized in everyday life, especially when symptoms decrease. Long-term adherence and integration into daily routines were described as particularly difficult. This is accompanied by problems with time management and a lack of routine, resulting in irregular training with insufficient intensity. Apart from insufficient quantity, therapists also mentioned the quality of exercise execution as a main challenge due to the missing supervision and error correction in the home environment. A

Figure 8: Perceived importance of progress tracking.

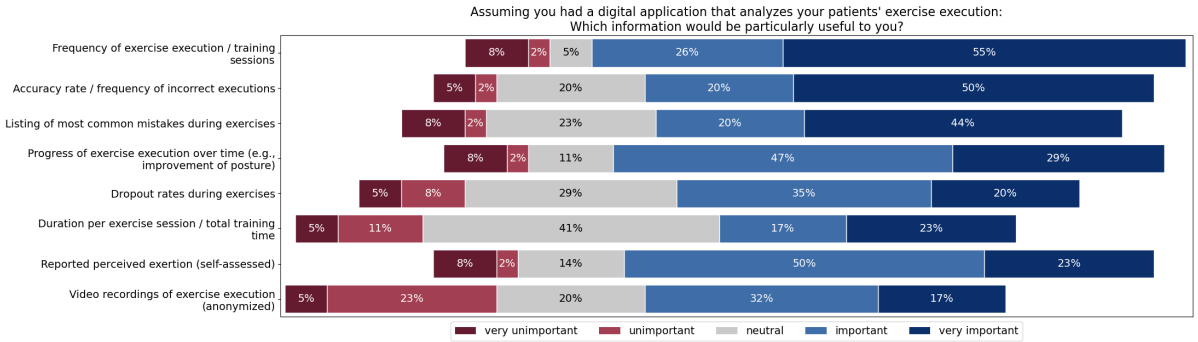


well-designed digital tool has the potential to support these areas by providing structure, reminders, guided instructions, motivational features and direct feedback for correct exercise execution.

iii. Experience with digital training or health applications: To assess whether digital applications are already integrated into the work of therapists, we asked them about their existing experience. Only 27% of participants ($n = 9$) stated to have experience with digital training or health applications such as apps or wearables (Table B.11). While therapists tend to be satisfied with these applications, their feedback also highlights existing shortcomings, including insufficient data protection, unclear or overly complex interfaces, and insufficient measurement accuracy. Additional wishes include clearer exercise descriptions, integration of training diaries, progression options for exercises, enhanced automatic detection of exercises, and (improved) patient supervision capabilities.

iv. Expectations on the training analysis: We next asked the domain experts which information would be particularly useful in a digital application to track and analyze patients' exercise execution (Figure 9). The perceived importance of different information is statistically different (Friedman $\chi^2 = 24.9, p < 0.001$). With 55% rating for "very important" and 26% for "important", the frequency of exercise execution and training sessions was perceived as most important information for therapists. Further, they highly value information about exercise quality and progress over time, coupled with self-assessed information of patients like their perceived exertion. Among the least demanded information are training duration and video recordings of exercises. The low relevance of training duration reflects that while time serves as a performance indicator in many fitness contexts, physiotherapy focuses primarily on precise and controlled execution rather than completing exercises within a specific timeframe or at high speed. In addition, therapists indicated that they require more individualized information on

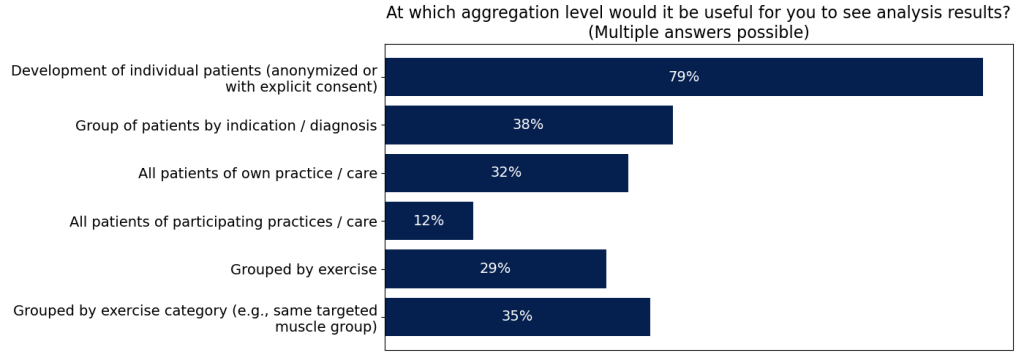
Figure 9: Perceived importance of training information.



the perceived pain of patients, the impact on the patient's problem, difficulties in exercise execution, and motivation levels for future training (Table B.12). They also suggested providing a free-text field for such comments. Viewing the development of individual patients proved to be the most favored level for receiving analytical insights, selected by 79% of participants (Figure 10). Some participants also expressed interest in aggregated views, such as groups of patients by diagnosis (38%), categories of exercises (35%), the entire patients under their care (32%), or insights grouped by exercise (29%).

v. System integration into professional practice: Finally, to understand whether and how a digital rehabilitation system can be integrated into therapeutic practice, we examined the perceived challenges and prerequisites. From the predefined answers, a lack of technical knowledge was the most frequently selected challenge (85%) for integrating a digital application into the daily work of therapists, closely followed by patient acceptance (76%) (Figure B.18). Over half of the participants also see data protection or legal issues (62%) and time effort (56%) as challenges. Perceived as less challenging are the tracability and accuracy of analysis (35%) and conflicts with existing work processes (18%). Apart from

Figure 10: Desired aggregation levels of analysis results.



Other:

- individual patients, not anonymized

these, our domain experts reported challenges with respect to cost coverage, lack of technical resources, missing interest from employers or colleagues and the uncertainty of exercise execution of patients with respect to their motivation even with an application. Assuming that these challenges could be solved, 19 participants (55.9%) would incorporate a digital application for their patients' home training regularly into their therapeutic work, and 14 (41.2%) occasionally (Figure B.19). Only 1 participant (2.9%) would not incorporate it, arguing that she works very individually and is not proficient in the digital world. When being asked about the potential added value of a digital application in their current practice (Figure B.21), most agreed that it would enable better tracking of therapy outcomes (79%) and objective assessment of home training (76%). 68% also believe in higher therapy adherence through close monitoring and 50% argue for a relief in documentation and evaluation. In addition to these, it was stated that a digital application could benefit patients in terms of safety during exercise execution. Similar to the question in the patients' survey, we also asked our physiotherapeutic domain experts if they have general concerns about using a digital system to support physiotherapy in the home environment (Table B.13). Most concerns target technical ability and access. Additionally, therapists raised concerns about data protection, privacy, and security, as well as patient motivation, and time effort.

4.3. Comparative Analysis

Patients' current exercise habits demonstrate a clear trend toward performing training without supervision (Figure 1), coupled with difficulties in maintaining motivation (Figure 2). Participants identified several factors that could help increase adherence and engagement, including (1) visible progress and feedback, (2) structure, routine, and scheduling, (3) external motivation and social support, (4) guidance and instruction, and (5) internal motivation and personal factors (Table B.2). Missing feedback, progress reporting, structure, scheduling, guidance, and motivation could be addressed by utilizing appropriate digital applications. Among desired UI features and feedback, real-time error correction of exercise execution was rated as most important (Figures 3 and 4). Participants also expressed interest in providing self-assessments, with most welcoming automatic suggestions for adjusting future training sessions (Figures B.12 and B.13). The findings demonstrate the need for personalization in digital applications, such as adjustable exercise difficulty and controlling feedback type and frequency (Figures B.11, B.14, B.15 and 3). Participants also favored acoustic and visual feedback over textual information (Figure 5), likely due to limitations in smartphone screen size and restricted accessibility during training. Patients' main concerns were related to (1) data protection, privacy, and security, (2) technical ability and access, and (3) quality of physiotherapy (Table B.7). At the same time, they perceived clear opportunities, including (1) improved exercise execution and rehabilitation, (2) increased motivation and adherence, (3) enhanced accessibility and flexibility, and (4) support for physiotherapists and the broader healthcare system (Table B.8). Therapists reported

that current practice for home training typically involves a practical exercise demonstration and oral instructions, without providing more structured training materials (Figure 7). The vast majority considers tracking patients' training progress at home as highly important (Figure 8). Yet, there currently exists no systematic way to track and analyze exercise execution, so most rely on patient self-reports (Figure B.16). (1) Motivation and personal factors, coupled with (2) time management and routine, and (3) correct exercise execution were identified by therapists as the greatest barriers and challenges for patients' home training (Table B.10). When tracking is performed by a digital application, frequency of exercise execution is the most emphasized parameter, alongside exercise quality, progress, and common mistakes (Figure 9). Furthermore, individual information such as self-assessed pain, difficulties, and other contextual factors, possibly captured in free-text notes, is requested, mirroring current practices of patients' self-reports. Less than one third of the surveyed therapists had prior experience with digital training or health applications (Table B.11). Nonetheless, the majority expressed a strong interest in integrating a digital tool into their practice, provided that challenges such as limited technical knowledge, patient acceptance, and data protection can be addressed (Figure B.19). Potential added value of a digital application in their current practice includes better tracking of therapy outcomes, objective assessment of home training, higher therapy adherence, and relief in documentation and evaluation (Figure B.21). In addition to these, it could benefit patients in terms of safety during exercise execution.

Both groups emphasize the importance of correct exercise execution in the home environment, as well as adherence and motivation to perform them. Patients reported difficulties in maintaining motivation, performing exercises without guidance, and obtaining qualitative live feedback on performed exercises. Similarly, therapists highlighted challenges related to patient adherence, motivation, and the quality of unsupervised exercise execution. This indicates a shared interest in improving supervision and progress tracking during home training supported by digital applications. Yet, patients did not perceive the sharing of their training progress with their therapist as an important UI feature. While therapists expressed a preference for accessing identifiable, patient-specific data to support clinical decision-making, patients indicated a desire to remain anonymous. Enabling therapists to acquire data-driven insights into home exercise progress thus requires a well-defined concept of data sharing to target concerns of data security and privacy. Both patients and therapists value individualized adjustments and personalization features. Patients expressed a strong preference for, e.g., adjustable exercise difficulty, feedback, goal setting, and training plan customization, while therapists emphasized the need for self-assessed insights into patient performance mirroring patients' self-reports, coupled with high-level aggregated performance metrics. Therapists' wishes for improving existing training applications also align with the requirements of patients with respect to clear descriptions and progression options for exercises, as well as automatic detection of exercises and feedback on the execution quality.

A major difference between our study and previous ones (Section 2.3) is that we survey participants' opinions on factors such as direct feedback mechanisms about the quality and intensity of exercises. This aspect has often been left out of previous studies, making it challenging to provide a comparison. However, most other findings from previous studies are consistent with our results. Both participants and therapists agree that self-monitoring and motivation-enhancing elements can improve adherence to the training routine. Additionally, an important factor identified in our survey and, for instance, in the survey of Gell et al. [26], was the ability of users to provide feedback regarding the difficulty of exercises or if they experience pain during the training. This information is crucial for the therapists to adjust the training routine and an optimized and personalized training routine keeps patients motivated. Finally, both patients and therapists agree that there are challenges regarding usability and data privacy when integrating mobile apps into the training routines. These concerns are consistently reported across our survey and related studies. Nevertheless, both groups agree that besides those addressable challenges, there are a multitude of positive aspects to digital support systems, such as improved efficacy and motivation as well as better adherence to the training routine.

5. Discussion and Future Work

To the best of our knowledge, this is the first work to present survey insights into user expectations for digital-assisted home training applications for physical therapy exercises that explicitly includes direct feedback mechanisms and is not limited to specific physical conditions or applications. By integrating both patient and therapist perspectives, our work contributes an essential step towards a user-centered development of such systems. Our study showed that participants have similar expectations regarding the requirement for feedback on error correction and motivation enhancements. Further, both groups emphasized the need for individualized adjustments and personalization features. However, the patients' and therapists' views differ with respect to data sharing. Our findings have important **implications for the design of UIs**. While patients report a lack of motivation for home training, they rated features such as reward systems, reminders, and motivational feedback as rather unimportant, suggesting that patients do not value attempts to externally incentivize them. Instead, setting personal training goals, monitoring progress, and receiving immediate correction hints were perceived as most valuable. Thus, UI designs should prioritize features supporting *self-regulation*, particularly receiving immediate correction hints and setting and tracking personal training goals and progress, over externally driven motivational mechanisms, as these are more promising to increase patients' motivation and adherence. The results further demonstrate that *personalization* is a central design requirement for digital tools targeting home physiotherapy, enabling adaptation to individual preferences and conditions. We recommend providing the patients *acoustic* and *visual* feedback with a strong focus on *live* feedback for *error correction.* Qualitative feedback on exercise execution is still missing in existing applications, coupled with insufficient exercise variety, especially with respect to difficulty progression. Attention must be paid to establish real-time cues that are suitable for small-screen devices such as smartphones. Further, our results showed that patients do not value the option to automatically share their progress with a supervising therapist and prefer to remain anonymous. While this might be mainly due to data protection and privacy concerns, it also contrasts with the results of our domain expert study. Here, we revealed that therapists clearly want insights into home training but lack the tools to obtain them reliably. Well-designed digital systems offer the possibility to support them as well by tracking patients' exercise execution and complementing patient self-reports. We recommend providing therapists *high-level* analysis metrics, such as exercise frequency and accuracy of execution, alongside detailed *patient-specific* information captured, for instance, by free-text boxes.

The development of digital applications for physical therapy home training also poses several **challenges** that need to be addressed. First, technical ability and access, especially with respect to older generations, need to be considered, including some time effort to establish the system. Simultaneously, accessibility is also perceived as an opportunity, e.g., for patients with limited mobility. Both user groups also mentioned data protection, privacy, and security as major concerns, requiring a well-defined and secure data storage and sharing concept. Besides, the lack of motivation and adherence among patients is a remaining barrier that needs to be conquered; yet, a digital application is perceived as promising to support this. To address concerns about reduced physiotherapy quality and the absence of social components, we highlight the importance of the application's intended role as a *supplement*, rather than a replacement, to conventional physical therapy. Then, the main **opportunity** of a digital system for physiotherapeutic home training is the possibility to improve exercise execution and rehabilitation outcome by closer supervision. This can be combined with improved motivation, easier time management and routine; thus, overcoming the greatest barriers perceived by domain experts.

While providing essential insights into patients' and therapists' expectations, our survey also has some **limitations**. The questionnaires were conducted in Germany, so caution must be exercised when attempting to extrapolate the results to other countries. The study is also limited by the number of participants compared to the number of active patients and physiotherapists in Germany. The findings could be further validated in multi-center studies with an even larger sample size. Additionally, the

survey questions were not derived from a standardized or validated questionnaire, which may affect the generalizability of the findings. Many questions had predefined answer options with a non-randomized fixed order, meaning that the entire range of answers was probably not fully covered. We addressed this by adding a free-text comment option. However, there may still be a bias towards the predefined responses and their order. Lastly, the questionnaires relied exclusively on text-based descriptions of potential system features. Although examples were provided, participants may have interpreted the questions differently depending on their individual experience and technical background. At the same time, this abstract framing supported a broader and technology-independent perspective on digital physiotherapy tools. **Future work** could complement this approach by incorporating interactive prototypes, visual interface mock-ups, or audio samples in subsequent empirical evaluations. Subsequent work should focus on translating the derived survey insights and UI recommendations into actionable systems, including the development of user interfaces that effectively support physiotherapeutic home training. These require a high degree of personalization, should enable individual goal setting and progress tracking, and provide live feedback on error correction. Follow-up studies could also systematically compare the expectations and requirements of participants with prior physiotherapy experience to those without such experience. Furthermore, additional research should assess the long-term effects of digital-assisted home training on clinical outcomes.

6. Conclusion

To develop a digital physiotherapy support system, it is necessary to understand the expectations, needs, and concerns of both patients and therapists. Our two surveys were designed to reveal complementary insights into the current practice of home physiotherapy training and the potential role of digital applications to address present challenges. The results showed that both user groups see clear potential for digital tools to improve the quality and consistency of home training. Patients particularly emphasized the need for real-time error correction, setting personal goals, and tracking training progress. Therapists similarly identified correct exercise execution and adherence as the core challenges. Despite this shared vision, the surveys also revealed differing priorities regarding data sharing, underlining the importance of secure data sharing and management concepts. Our findings indicate that digital physiotherapy support systems are promising to complement traditional therapy, provided they offer reliable live feedback on exercise execution to patients, a high level of personalization, and focus on self-regulating motivational features rather than external incentives. Future work should translate these insights and our derived design implications into concrete system prototypes, investigate the long-term clinical effects, and further explore design strategies that jointly meet the requirements of both patients and therapists. With our work, we set the foundation for user-centered digital systems that effectively support physiotherapy exercises at home.

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Declaration on Generative AI

During the preparation of this work, the author(s) used DeepL and ChatGPT (OpenAI, GPT-5) in order to: Grammar and spelling check, translation, as well as paraphrase and reword. After using these tool(s)/service(s), the author(s) reviewed and edited the content as needed and take(s) full responsibility for the publication's content.

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A. Questionnaires

A.1. Patient Perspective - Original (German)

Fragebogen zur Gestaltung einer interaktiven Benutzeroberfläche für trainingstherapeutische Übungen im häuslichen Umfeld - Patient:innenperspektive

Im Rahmen des Forschungsprojekts THERESA entwickeln wir, die Subsequent GmbH, die Universität Konstanz, sowie die Hochschule Trier, derzeit eine **interaktive Benutzeroberfläche**, die Patient:innen bei der Durchführung trainingstherapeutischer Übungen mit Kleingeräten (z. B. elastisches Band) im häuslichen Umfeld unterstützen soll.

Da physiotherapeutische Behandlungseinheiten in der Praxis oft zeitlich und finanziell begrenzt sind, ist eine eigenständige, regelmäßige Durchführung von Übungen zu Hause für langfristige Erfolge wichtig. Um dabei eine korrekte und effektive Ausführung zu gewährleisten, soll unsere Anwendung mithilfe von **Videoaufnahmen** der Smartphone-Kamera **Feedback** geben. Ziel ist es, die Übungsausführung durch qualifiziertes Feedback zu verbessern, individuelle Fortschritte sichtbar zu machen, die Trainingshistorie nachvollziehbar darzustellen und die langfristige Motivation der Anwender:innen zu stärken. Die Anwendung versteht sich als unterstützendes Hilfsmittel und soll die physiotherapeutische Betreuung sinnvoll ergänzen – nicht ersetzen.

Ihre Meinung hilft uns dabei, eine praxisnahe, benutzerfreundliche und wirksame Anwendung zu gestalten.
Vielen Dank für Ihre Unterstützung!

Erklärung zum Datenschutz

Ihre Teilnahme an der Studie ist freiwillig. Bei Nichtteilnahme entstehen Ihnen keine Nachteile. Die erhobenen Daten dienen ausschließlich der wissenschaftlichen Auswertung im Rahmen des Projekts THERESA. Ziel ist es, die Bedürfnisse und Erwartungen potenzieller Nutzer:innen besser zu verstehen und die Anwendung entsprechend zu gestalten. Es gibt keine Weitergabe Ihrer Daten, die Rückschlüsse auf Ihre Person zulassen. Die Daten und Ergebnisse der Befragung werden ausschließlich in anonymisierter Form genutzt. Die Daten werden für die Dauer des Projekts gespeichert und anschließend gelöscht oder vollständig anonymisiert. Die Verarbeitung erfolgt auf Grundlage Ihrer freiwilligen Einwilligung gemäß Art. 6 Abs. 1 lit. a) DSGVO. Sie haben das Recht auf Auskunft über Ihre gespeicherten Daten, deren Berichtigung, Löschung, Einschränkung der Verarbeitung und das Recht auf Widerruf Ihrer Einwilligung. Zudem können Sie sich bei einer Datenschutzaufsichtsbehörde beschweren.

Mit dem Klick auf „Weiter" bestätigen Sie, dass Sie die obenstehenden Informationen zur Datenverarbeitung gelesen haben und in die Teilnahme an der Umfrage sowie die Verarbeitung Ihrer Angaben einwilligen. Bei Fragen wenden Sie sich bitte an Daniela Blumberg (daniela.blumberg@uni-konstanz.de).

* Kennzeichnet Pflichtfelder.

Demografische Angaben

1. Alter *

_____

2. Geschlecht *

- ◯ Weiblich
- ◯ Männlich
- ◯ Divers
- ◯ Keine Angabe

3. Haben Sie Erfahrung mit trainingstherapeutischen Übungen (z. B. Dehn-, Kräftigungs- oder Mobilisationsübungen)? *

- ◯ Ja, aktuell in Therapie
- ◯ Ja, in der Vergangenheit
- ◯ Nein

4. Wie häufig trainieren Sie derzeit unter Anleitung von Trainer:innen (z. B. im Physiotherapie- oder Fitnessstudio)? *

- ◯ Täglich
- ◯ Mehrmals pro Woche (2–3x)
- ◯ Etwa einmal pro Woche
- ◯ Etwa einmal pro Monat
- ◯ Seltener oder nie

5. Wie häufig trainieren Sie derzeit ohne Anleitung von Trainer:innen (z. B. zu Hause)? *

- ◯ Täglich
- ◯ Mehrmals pro Woche (2–3x)
- ◯ Etwa einmal pro Woche
- ◯ Etwa einmal pro Monat
- ◯ Seltener oder nie

6. Wie schwer oder leicht fällt es Ihnen, sich regelmäßig zur Durchführung empfohlener Übungen zuhause zu motivieren? *

	1	2	3	4	5	
sehr schwer	◯	◯	◯	◯	◯	sehr leicht

7. Was glauben Sie könnte Ihnen helfen Übungen noch regelmäßiger und mit mehr Motivation durchzuführen?

_____

_____

8. Haben Sie Erfahrung mit digitalen Trainings- oder Gesundheitsanwendungen? (z. B. Apps, Wearables) *

◯ Ja
◯ Nein SPRINGE ZU FRAGE 13

Erfahrung mit digitalen Trainings- oder Gesundheitsanwendungen

9. Mit welchen digitalen Trainings- oder Gesundheitsanwendungen haben Sie Erfahrung? (z. B. Apps, Wearables) *

_____

_____

10. Falls mehrere: Welche dieser Anwendungen benutzen Sie am häufigsten / gefällt Ihnen am besten?

_____

11. Wie zufrieden sind Sie mit dieser Anwendung? *

	1	2	3	4	5	
sehr unzufrieden	◯	◯	◯	◯	◯	sehr zufrieden

12. Welche konkreten Verbesserungen würden Sie sich bei dieser Anwendung wünschen?

_____

_____

Erwartungen an die Benutzeroberfläche

13. Welche Funktionen wären für Sie besonders wichtig bei einer digitalen Anwendung (App) für therapeutisches Heimtraining? *

	sehr unwichtig (1)	unwichtig (2)	neutral (3)	wichtig (4)	sehr wichtig (5)
Korrekturhinweise bei fehlerhafter Ausführung einer Übung umgehend während der Übungsausführung	◯	◯	◯	◯	◯
Korrekturhinweise bei fehlerhafter Ausführung einer Übung nach vollendeter Übungsausführung	◯	◯	◯	◯	◯
Motivierendes Feedback zur verbleibenden Übungsanzahl / aufgebrachten Leistung (z. B. „Nur noch 3 Wiederholungen!“)	◯	◯	◯	◯	◯
Motivierendes Feedback zur Qualität der Übungsausführung (z. B. „Deine Haltung ist super!“)	◯	◯	◯	◯	◯
Detaillierte Analyse Ihrer Übungsausführung	◯	◯	◯	◯	◯
Übersichtliche Darstellung Ihres Trainingsverlaufs und Fortschritts	◯	◯	◯	◯	◯
Funktion, persönliche Trainingsziele festzulegen und den Fortschritt sichtbar zu machen	◯	◯	◯	◯	◯
Erinnerungsfunktion für Ihre geplanten Trainingszeiten	◯	◯	◯	◯	◯
Zugang zu Videoanleitungen oder Übungsbeschreibungen	◯	◯	◯	◯	◯
Belohnungssystem, das z. B. Punkte, Abzeichen oder Meilensteine für erreichte Ziele vergibt	◯	◯	◯	◯	◯
Möglichkeit, Übungspläne individuell anzupassen	◯	◯	◯	◯	◯
Automatisierte Vorschläge für alternative Übungen (z. B. leichtere Variante der Übung bei Überforderung)	◯	◯	◯	◯	◯
Option, Ihre Trainingsfortschritte automatisch mit betreuenden Therapeut:innen oder Trainer:innen zu teilen	◯	◯	◯	◯	◯

14. Welche zusätzlichen Funktionen würden Sie sich wünschen?

_____

_____

15. Welche Art von Feedback wünschen Sie sich während der Übungsdurchführung? *

	sehr unwichtig (1)	unwichtig (2)	neutral (3)	wichtig (4)	sehr wichtig (5)
Hinweise zur Fehlerkorrektur (z. B. "Achte darauf, deinen Rücken gerade zu halten. Du bist leicht nach vorne gebeugt.")	◯	◯	◯	◯	◯
Vergleich mit vorheriger Ausführung innerhalb des selben Trainings (z. B. "Super, jetzt ist dein Rücken viel gerader!")	◯	◯	◯	◯	◯
Vergleich mit vorheriger Ausführung eines vergangenen Trainings (z. B. "Super, deine Rückenhaltung ist viel kontrollierter als im letzten Training!")	◯	◯	◯	◯	◯
Ansagen zur verbleibenden Repetitionsanzahl / Dauer des Trainings (z. B. "Nur noch 3 Wiederholungen. Bleib dran!")	◯	◯	◯	◯	◯
Motivationssteigernde Ansagen (z. B. "Stark! Du hast die heutige Trainingseinheit erfolgreich abgeschlossen!")	◯	◯	◯	◯	◯

16. Welche Art von Feedback würden Sie sich zusätzlich wünschen?

_____

_____

17. Wie häufig möchten Sie motivierende Kommentare während des Trainings erhalten (z. B. verbleibende Übungsanzahl, Qualität der Übungsausführung)? *

- ◯ Gerne regelmäßig bei jeder Übung
- ◯ Mehrmals pro Training
- ◯ Ab und zu bei Bedarf
- ◯ Selten oder nie

18. Welche Feedbackmodalität würden Sie sich während der Übungsdurchführung wünschen? (Mehrfachauswahl möglich)

- ☐ Visuelles Feedback (z. B. Korrekturanzeige im Video wie farbliche Markierung von Körperregionen)
- ☐ Akustisches Feedback (z. B. Feedback in natürlicher Sprache, Ton bei Fehlern)
- ☐ Textbasiertes Feedback (z. B. textuelle Hinweise am Smartphonebildschirm)
- ☐ Sonstiges: _____

Personalisierung, Interaktion und Motivationssteigerung

19. Möchten Sie während oder nach dem Training die Möglichkeit haben, Ihre eigene Einschätzung zur Schwierigkeit der Übungen abzugeben? *

- ◯ Ja, während dem Training (z. B. nach jeder abgeschlossenen Übung)
- ◯ Ja, nach dem Training
- ◯ Nein

20. Wären Sie einverstanden, dass die Anwendung Ihre Trainingsdaten und Einschätzung zur Schwierigkeit der Übung nutzt, um automatisiert Anpassungen für zukünftige Trainingseinheiten vorzuschlagen (z. B. mehr oder weniger Wiederholungen, schwerere oder leichtere Übung)? *

- ◯ Ja, gerne automatisch
- ◯ Ja, aber nur nach vorheriger Zustimmung
- ◯ Nein

21. Falls Nein: Gibt es einen speziellen Grund, warum Sie das nicht möchten?

_____

22. Welche Anpassungsmöglichkeiten wünschen Sie sich beim Trainingsplan? (Mehrfachauswahl möglich)

- ☐ Schwierigkeitsgrad einzelner Übungen anpassen (bei selber Übungsart mit unterschiedlichen Schwierigkeitsstufen)
- ☐ Reihenfolge der Übungen anpassen
- ☐ Übungen aus geplantem Training ein/ausschließen
- ☐ Dauer / Umfang der einzelnen Übungen anpassen
- ☐ Automatisierte Anpassungsvorschläge der Anwendung
- ☐ Sonstiges: _____

23. Welche Anpassungsmöglichkeiten wünschen Sie sich bei der Übungsdurchführung? (Mehrfachauswahl möglich)

- ☐ Übungen pausieren/überspringen
- ☐ Videos und Anleitungen zur Übung ein-/ausblenden
- ☐ Umfang und Art des Feedbacks anpassen (z. B. nur schwerwiegende Fehler, Rückmeldung zur Repetitionsanzahl)
- ☐ Möglichkeit sich selbst bei der Übungsdurchführung zu sehen (Videoaufnahme)
- ☐ Sonstiges: _____

24. Was motiviert Sie persönlich beim Training? *

	gar nicht motivierend (1)	eher nicht motivierend (2)	neutral (3)	eher motivierend (4)	sehr motivierend (5)
Sichtbare Fortschritte (z. B. besseres Bewegungsausmaß, weniger Schmerzen, mehr Kraft)	◯	◯	◯	◯	◯
Positives Feedback (z. B. Lob)	◯	◯	◯	◯	◯
Erinnerungen (z. B. Benachrichtigungen, die ans Training erinnern)	◯	◯	◯	◯	◯
(selbst gesetzte) Ziele erreichenn	◯	◯	◯	◯	◯
Unterstützung durch Dritte (z. B. Ermutigung durch Therapeut:innen, Angehörige oder Freund:innen)	◯	◯	◯	◯	◯
Belohnungssystem (z. B. Erwerben von Punkten, Abzeichen oder Meilensteinen)	◯	◯	◯	◯	◯

25. Haben Sie Bedenken beim Einsatz eines digitalen Systems zur Unterstützung der Physiotherapie im häuslichen Umfeld? Wenn ja, welche?

_____

_____

26. Sehen Sie Chancen beim Einsatz eines digitalen Systems zur Unterstützung der Physiotherapie im häuslichen Umfeld? Wenn ja, welche?

_____

_____

27. Wären Sie bereit an weiteren Entwicklungen (z. B. durch Testen einer ersten Version der Anwendung) teilzunehmen? *

◯ Ja
◯ Nein

A.2. Patient Perspective - Translation

Questionnaire on the design of an interactive user interface for therapeutic training exercises in the home environment – Patient Perspective

As part of the THERESA research project, we at Subsequent GmbH, the University of Konstanz, and Trier University of Applied Sciences are currently developing an **interactive user interface** designed to support patients in performing **therapeutic exercises** with small equipment (e.g., elastic bands) in their **home environment**.

Since physiotherapy treatment sessions are often limited in terms of time and money, it is important for patients to perform exercises independently and regularly at home in order to achieve long-term success. To ensure that the exercises are performed correctly and effectively, our application shall provide feedback using **video recordings** from the smartphone camera. The aim is to improve exercise performance through qualified feedback, make individual progress visible, present training history in a comprehensible way, and strengthen the long-term motivation of users.
Your opinion helps us to design a practical, user-friendly, and effective app.
Thank you for your support!

Privacy Policy

Your participation in the study is voluntary. You will not suffer any disadvantages if you choose not to participate. The data collected will be used exclusively for scientific evaluation within the framework of the THERESA project. The aim is to better understand the needs and expectations of potential users and to design the application accordingly. No data that could be used to identify you will be passed on. The data and results of the survey will be used exclusively in anonymized form. The data will be stored for the duration of the project and then deleted or completely anonymized. The processing is based on your voluntary consent in accordance with Art. 6 (1) (a) GDPR. You have the right to information about your stored data, its correction, deletion, restriction of processing, and the right to revoke your consent. You can also lodge a complaint with a data protection supervisory authority.

By clicking on "Next," you confirm that you have read the above information on data processing and consent to participate in the survey and to the processing of your data. If you have any questions, please contact Daniela Blumberg (daniela.blumberg@uni-konstanz.de).

* Indicates required responses.

Demographics

1. Age *

_____

2. Gender *

- ◯ Female
- ◯ Male
- ◯ Diverse
- ◯ Prefer not to say

3. Do you have experience with therapeutic exercises (e.g. stretching, mobility or resistance training)? *

- ◯ Yes, currently in therapy
- ◯ Yes, therapy in the past
- ◯ No

4. How often do you currently train under the guidance of a trainer (e.g. in physiotherapy or gym)? *

- ◯ daily
- ◯ several times per week (2–3x)
- ◯ about once a week
- ◯ about once a month
- ◯ rarely or never

5. How often do you currently train without the guidance of a trainer (e.g. at home)? *

- ◯ daily
- ◯ several times per week (2–3x)
- ◯ about once a week
- ◯ about once a month
- ◯ rarely or never

6. How difficult or easy is it for you to motivate yourself to regularly perform recommended exercises at home? *

	1	2	3	4	5	
very difficult	◯	◯	◯	◯	◯	very easy

7. What do you think could help you perform exercises more regularly and with greater motivation?

_____

_____

8. Do you have experience with digital training or health applications (e.g. apps, wearables)? *

◯ Yes
◯ No SKIP TO QUESTION 13

Experience with Digital Training or Health Applications

9. Which digital training or health applications have you used (e.g. apps, wearables)? *

_____

_____

10. If several: Which of these do you use most / like best?

_____

11. How satisfied are you with this application? *

	1	2	3	4	5	
very dissatisfied	◯	◯	◯	◯	◯	very satisfied

12. Which concrete improvements would you like to see?

_____

_____

Expectations on the User Interface

13. Which features would be particularly important to you in a digital application (app) for therapeutic home training? *

	very unimportant (1)	unimportant (2)	neutral (3)	important (4)	very important (5)
Immediate correction hints during exercise if performed incorrectly	◯	◯	◯	◯	◯
Correction hints after exercise completion if performed incorrectly	◯	◯	◯	◯	◯
Motivational feedback on remaining repetitions / effort (e.g., "Only 3 repetitions left!")	◯	◯	◯	◯	◯
Motivational feedback on exercise quality (e.g., "Your posture is great!")	◯	◯	◯	◯	◯
Detailed analysis of your exercise execution	◯	◯	◯	◯	◯
Clear overview of your training progress	◯	◯	◯	◯	◯
Ability to set personal training goals and track progress	◯	◯	◯	◯	◯
Reminder function for scheduled training times	◯	◯	◯	◯	◯
Access to video instructions or exercise descriptions	◯	◯	◯	◯	◯
Reward system awarding points, badges, or milestones for achieved goals	◯	◯	◯	◯	◯
Ability to customize exercise plans individually	◯	◯	◯	◯	◯
Automated suggestions for alternative exercises (e.g., easier variations if overstrained)	◯	◯	◯	◯	◯
Option to automatically share training progress with supervising therapists or trainers	◯	◯	◯	◯	◯

14. What additional features would you like to have?

_____

_____

15. What type of feedback would you like to receive during exercise execution? *

	very unimportant (1)	unimportant (2)	neutral (3)	important (4)	very important (5)
Correction hints (e.g., "Keep your back straight. You are slightly leaning forward.")	◯	◯	◯	◯	◯
Comparison with previous execution within the same training (e.g., "Great, your back is much straighter now!")	◯	◯	◯	◯	◯
Comparison with previous execution from the past training (e.g., "Great your back posture is much more controlled than last time!"	◯	◯	◯	◯	◯
Announcements about remaining repetitions / training duration (e.g., "Only 3 reps left. Keep going!")	◯	◯	◯	◯	◯
Motivational announcements (e.g., "Well done! You have successfully completed today's training session!")	◯	◯	◯	◯	◯

16. What kind of additional feedback would you like to receive?

_____

_____

17. How often would you like to receive motivational comments during training (e.g., remaining repetitions, quality of exercise execution)? *

- ◯ regularly for each exercise
- ◯ several times per training
- ◯ occasionally as needed
- ◯ rarely or never

18. What type of feedback modality would you like to receive during the exercise? (Multiple answers possible)

- ☐ Visual feedback (e.g., correction display in the video, such as colour coding of body areas)
- ☐ Acoustic feedback (e.g., spoken feedback, sound on errors)
- ☐ Textual feedback (e.g., textual hints on smartphone screen)
- ☐ Other: _____

Personalization, Interaction and Motivation

19. Would you like to provide your own assessment of the difficulty of the exercises during or after training? *

- ◯ Yes, during training (e.g., after each completed exercise)
- ◯ Yes, after training
- ◯ No

20. Would you agree to the application using your training data and assessment of the perceived difficulty of the exercise to automatically suggest adjustments for future training sessions (e.g., more or fewer repetitions, heavier or lighter exercises)? *

- ◯ Yes, automatically
- ◯ Yes, with prior consent
- ◯ No

21. If not: Is there a specific reason why you don't want to?

_____

22. What adjustment options would you like to have for the training plan? (Multiple answers possible)

- ☐ Adjust difficulty of individual exercises (same exercise type with different difficulty levels)
- ☐ Adjust order of exercises
- ☐ Include / exclude exercises from planned training
- ☐ Adjust duration / amount of individual exercises
- ☐ Automatically suggested adjustments by the application
- ☐ Other: _____

23. What adjustment options would you like to have during exercise execution? (Multiple answers possible)

- ☐ Pause / skip exercises
- ☐ Show / hide videos and exercise instructions
- ☐ Adjust amount and type of feedback (e.g., just major mistakes, feedback on repetition count)
- ☐ Option to see yourself during exercise execution (video recording)
- ☐ Other: _____

24. What personally motivates you during training? *

	not at all motivating (1)	rather not motivating (2)	neutral (3)	rather motivating (4)	very motivating (5)
Visible progress (e.g., better range of motion, less pain, more strength)	◯	◯	◯	◯	◯
Positive feedback (e.g., praise)	◯	◯	◯	◯	◯
Reminders (e.g., notifications reminding about training)	◯	◯	◯	◯	◯
(self-set) goal achievement	◯	◯	◯	◯	◯
Support from others (e.g., encouragement from therapists, relatives, or friends)	◯	◯	◯	◯	◯
Reward system (e.g., earning points, badges, or milestones)	◯	◯	◯	◯	◯

25. Do you have any concerns about using a digital system to support physical therapy in the home environment? If so, what are they?

_____

_____

26. Do you see opportunities in the use of a digital system to support physical therapy in the home environment? If so, what are they?

_____

_____

27. Would you be willing to participate in further developments (e.g., by testing an initial version of the application)? *

◯ Yes
◯ No

A.3. Therapist Perspective - Original (German)

Fragebogen zur Gestaltung einer interaktiven Benutzeroberfläche für trainingstherapeutische Übungen im häuslichen Umfeld - Therapeut:innenperspektive

Im Rahmen des Forschungsprojekts THERESA entwickeln wir, die Subsequent GmbH, die Universität Konstanz, sowie die Hochschule Trier, derzeit eine **interaktive Benutzeroberfläche**, die Patient:innen bei der Durchführung trainingstherapeutischer Übungen mit Kleingeräten (z. B. elastisches Band) im häuslichen Umfeld unterstützen soll.

Da physiotherapeutische Behandlungseinheiten in der Praxis oft zeitlich und finanziell begrenzt sind, ist eine eigenständige, regelmäßige Durchführung von Übungen zu Hause für langfristige Erfolge wichtig. Um dabei eine korrekte und effektive Ausführung zu gewährleisten, soll unsere Anwendung mithilfe von **Videoaufnahmen** der Smartphone-Kamera **Feedback** geben. Ziel ist es, die Übungsausführung durch qualifiziertes Feedback zu verbessern, individuelle Fortschritte sichtbar zu machen, die Trainingshistorie nachvollziehbar darzustellen und die langfristige Motivation der Anwender:innen zu stärken. Darüber hinaus soll die Anwendung auch eine **patientenübergreifende Analysefunktion für Therapeut:innen** bereitstellen, basierend auf anonymisierten und aggregierten Daten, die bei der Heimanwendung erfasst werden.
Die Anwendung versteht sich als unterstützendes Hilfsmittel und soll die physiotherapeutische Betreuung sinnvoll ergänzen – nicht ersetzen.

Ihre Meinung hilft uns dabei, eine praxisnahe, benutzerfreundliche und wirksame Anwendung zu gestalten.
Vielen Dank für Ihre Unterstützung!

Erklärung zum Datenschutz

Ihre Teilnahme an der Studie ist freiwillig. Bei Nichtteilnahme entstehen Ihnen keine Nachteile. Die erhobenen Daten dienen ausschließlich der wissenschaftlichen Auswertung im Rahmen des Projekts THERESA. Ziel ist es, die Bedürfnisse und Erwartungen potenzieller Nutzer:innen besser zu verstehen und die Anwendung entsprechend zu gestalten. Es gibt keine Weitergabe Ihrer Daten, die Rückschlüsse auf Ihre Person zulassen. Die Daten und Ergebnisse der Befragung werden ausschließlich in anonymisierter Form genutzt. Die Daten werden für die Dauer des Projekts gespeichert und anschließend gelöscht oder vollständig anonymisiert. Die Verarbeitung erfolgt auf Grundlage Ihrer freiwilligen Einwilligung gemäß Art. 6 Abs. 1 lit. a) DSGVO. Sie haben das Recht auf Auskunft über Ihre gespeicherten Daten, deren Berichtigung, Löschung, Einschränkung der Verarbeitung und das Recht auf Widerruf Ihrer Einwilligung. Zudem können Sie sich bei einer Datenschutzaufsichtsbehörde beschweren.

Mit dem Klick auf „Weiter" bestätigen Sie, dass Sie die obenstehenden Informationen zur Datenverarbeitung gelesen haben und in die Teilnahme an der Umfrage sowie die Verarbeitung Ihrer Angaben einwilligen. Bei Fragen wenden Sie sich bitte an Daniela Blumberg (daniela.blumberg@uni-konstanz.de).

* Kennzeichnet Pflichtfelder.

Demografische Angaben

1. Alter *

_____

2. Geschlecht *

- ◯ Weiblich
- ◯ Männlich
- ◯ Divers
- ◯ Keine Angabe

3. Beruflicher Hintergrund (Mehrfachauswahl möglich) *

- ☐ Physiotherapeut:in
- ☐ Sportwissenschaftler:in
- ☐ Sporttherapeut:in
- ☐ Mediziner:in
- ☐ Gesundheits-/Krankenpfleger:in
- ☐ Fitnesstrainer:in
- ☐ Sonstiges: _____

4. Seit wie vielen Jahren arbeiten Sie im therapeutischen Bereich? *

- ◯ < 2 Jahre
- ◯ 2–5 Jahre
- ◯ > 5 Jahre

Umgang mit Heimtraining

5. Wie häufig betreuen Sie Patient:innen? *
(Mit „Patient:innen" sind hier ausschließlich Personen gemeint, die sich in physiotherapeutischer Behandlung befinden und zusätzlich zu den Terminen in der Praxis einen häuslichen Übungsanteil haben – nicht z. B. stationäre Fälle oder Personen, die lediglich aus eigenem Antrieb Sport treiben.)

- ◯ Täglich
- ◯ Mehrmals pro Woche
- ◯ Etwa einmal pro Woche
- ◯ Etwa einmal im Monat
- ◯ Gelegentlich
- ◯ Nie

6. Falls Sie Ihren Patient:innen Übungen für das Heimtraining mitgeben: Wie bereiten Sie die Patient:innen darauf vor und in welcher Form stellen Sie die Übungen zur Verfügung? *

	sehr selten oder nie	selten	manchmal	häufig	sehr häufig oder immer
Praktische Demonstration der Übungen in der Praxis	◯	◯	◯	◯	◯
Sammlung einzelner Übungen (ohne festen Trainingsplan)	◯	◯	◯	◯	◯
Strukturierter Übungsplan (mit festgelegten Übungen, Wiederholungen und zeitlichem Ablauf)	◯	◯	◯	◯	◯
Schriftliche Unterlagen (z. B. Ausdrucke, Broschüren)	◯	◯	◯	◯	◯
Digitale Unterlagen (z. B. PDF, App)	◯	◯	◯	◯	◯
Mündliche Anleitung	◯	◯	◯	◯	◯
Fotos der Übungen	◯	◯	◯	◯	◯
Videos / Übungsaufnahmen	◯	◯	◯	◯	◯

7. Für wie wichtig ist es Ihrer Einschätzung nach den Trainingsverlauf im häuslichen Umfeld nachvollziehen zu können? *

	1	2	3	4	5	
sehr unwichtig	◯	◯	◯	◯	◯	sehr wichtig

8. Wie erfassen Sie derzeit den Trainingsverlauf im häuslichen Umfeld? (Mehrfachauswahl möglich) *

- ☐ Selbstauskunft der Patient:innen
- ☐ Analoge Trainingsprotokolle / Dokumentationsbögen
- ☐ Digitale Trainingsprotokolle / Dokumentationsbögen
- ☐ Digitale Tools / Apps
- ☐ Keine systematische Erfassung
- ☐ Sonstiges: _____

9. Welche Informationen zum Trainingsverlauf im häuslichen Umfeld fragen Sie ab? (Mehrfachauswahl möglich) *

- ☐ Keine Erfassung
- ☐ Absolvieren der Übung im allgemeinen (ja oder nein)
- ☐ Art der absolvierten Übungen
- ☐ Häufigkeit der Übungsausführung
- ☐ Auftretende Probleme bei der Übungsausführung
- ☐ Anstrengung / empfundene Schwierigkeit
- ☐ Sonstiges: _____

10. Was sind Ihrer Meinung nach die größten Hürden und Herausforderungen bei der häuslichen Übungsausführung?

_____

_____

11. Haben Sie Erfahrung mit digitalen Trainings- oder Gesundheitsanwendungen? (z. B. Apps, Wearables) *

◯ Ja
◯ Nein SPRINGE ZU FRAGE 16

Erfahrung mit digitalen Trainings- oder Gesundheitsanwendungen

12. Mit welchen digitalen Trainings- oder Gesundheitsanwendungen haben Sie Erfahrung? (z. B. Apps, Wearables) *

_____

_____

13. Falls mehrere: Welche dieser Anwendungen benutzen Sie am häufigsten/gefällt Ihnen am besten?

_____

14. Wie zufrieden sind Sie mit dieser Anwendung? *

	1	2	3	4	5	
sehr unzufrieden	◯	◯	◯	◯	◯	sehr zufrieden

15. Welche konkreten Verbesserungen würden Sie sich bei dieser Anwendung wünschen?

_____

_____

Erwartungen an die Trainingsauswertung

16. Angenommen, Sie hätten eine digitale Anwendung, die die Übungsausführung Ihrer Patient:innen analysiert: Welche Informationen wären für Sie besonders hilfreich? *

	sehr unwichtig (1)	unwichtig (2)	neutral (3)	wichtig (4)	sehr wichtig (5)
Häufigkeit der Übungsausführung / Trainingseinheiten	◯	◯	◯	◯	◯
Korrektheitsquote / Häufigkeit fehlerhafter Ausführungen	◯	◯	◯	◯	◯
Auflistung häufigster Fehler bei der Übungsausführung	◯	◯	◯	◯	◯
Entwicklung der Übungsausführung im Zeitverlauf (z. B. Verbesserung der Haltung)	◯	◯	◯	◯	◯
Abbruchraten bei Übungen	◯	◯	◯	◯	◯
Dauer pro Übungseinheit / Gesamtzeit des Trainings	◯	◯	◯	◯	◯
Angaben zur empfundenen Belastung (selbsteingeschätzt)	◯	◯	◯	◯	◯
Videoaufnahmen der Übungsausführungen (anonymisiert)	◯	◯	◯	◯	◯

17. Welche zusätzlichen Informationen würden Sie sich wünschen?

_____

_____

18. Auf welchem Aggregationslevel wäre es für Sie sinnvoll, Analyseergebnisse sehen zu können? (Mehrfachauswahl möglich) *

- ☐ Entwicklung einzelner Patient:innen (anonymisiert oder mit expliziter Zustimmung der Person)
- ☐ Gruppe von Patient:innen nach Indikation / Diagnose gruppiert
- ☐ Gesamte Patient:innen der eigenen Praxis / Betreuung
- ☐ Gesamte Patient:innen aller teilnehmenden Praxen/Betreuungen
- ☐ Je Übung gruppiert
- ☐ Nach Übungskategorie gruppiert (z. B. gleiche beanspruchte Muskelpartie)
- ☐ Sonstiges: _____

Integration in den Arbeitsalltag

19. Welche Herausforderungen sehen Sie bei der Integration einer digitalen Anwendung für physiotherapeutisches Heimtraining in Ihren Arbeitsalltag? (Mehrfachauswahl möglich) *

- ☐ Zeitaufwand
- ☐ Datenschutz / rechtliche Fragen
- ☐ Fehlende technische Kenntnisse (bei Therapeut:innen oder Patient:innen)
- ☐ Nachvollziehbarkeit und Genauigkeit der Analyse
- ☐ Akzeptanz der Patient:innen
- ☐ Konflikte mit bestehenden Arbeitsprozessen
- ☐ Sonstiges: _____

20. Vorausgesetzt, die genannten Herausforderungen könnten gelöst werden – würden Sie eine digitale Anwendung für das Heimtraining Ihrer Patient:innen in Ihre therapeutische Arbeit einbinden? *

- ◯ Ja, regelmäßig
- ◯ Ja, gelegentlich
- ◯ Nein

21. Falls Nein: Könnten Sie uns den Grund nennen?

_____

22. Wie häufig würden Sie patientenübergreifende Analysen nutzen wollen? *

- ◯ Täglich
- ◯ Wöchentlich
- ◯ Monatlich
- ◯ Nach Bedarf (z. B. Therapieanpassung)
- ◯ Vermutlich gar nicht

23. Was wäre für Sie ein Mehrwert gegenüber der aktuellen Praxis? (Mehrfachauswahl möglich) *

- ☐ Objektivierte Einschätzung des Heimtrainings
- ☐ Höhere Therapieadhärenz durch engmaschige Begleitung
- ☐ Besseres Nachvollziehen von Therapieerfolgen
- ☐ Entlastung bei Dokumentation / Auswertung
- ☐ Sonstiges: _____

24. Haben Sie Bedenken beim Einsatz eines digitalen Systems zur Unterstützung der Physiotherapie im häuslichen Umfeld? Wenn ja, welche?

_____

_____

25. Wären Sie bereit an weiteren Entwicklungen (z. B. durch Testen einer ersten Version der Anwendung) teilzunehmen? *

- ◯ Ja
- ◯ Nein

A.4. Therapist Perspective - Translation

Questionnaire on the design of an interactive user interface for therapeutic training exercises in the home environment – Therapist Perspective

As part of the THERESA research project, we at Subsequent GmbH, the University of Konstanz, and Trier University of Applied Sciences are currently developing an **interactive user interface** designed to support patients in performing **therapeutic exercises** with small equipment (e.g., elastic bands) in their **home environment**.

Since physiotherapy treatment sessions are often limited in terms of time and money, it is important for patients to perform exercises independently and regularly at home in order to achieve long-term success. To ensure that the exercises are performed correctly and effectively, our application shall provide feedback using **video recordings** from the smartphone camera. The aim is to improve exercise performance through qualified feedback, make individual progress visible, present training history in a comprehensible way, and strengthen the long-term motivation of users. In addition, the application will also provide **therapists** with a **cross-patient analysis function** based on anonymized and aggregated data collected during home use.
The app is intended as a supportive tool and is designed to complement physiotherapy care in a meaningful way—not replace it.

Your opinion helps us to design a practical, user-friendly, and effective app.
Thank you for your support!

Privacy Policy

Your participation in the study is voluntary. You will not suffer any disadvantages if you choose not to participate. The data collected will be used exclusively for scientific evaluation within the framework of the THERESA project. The aim is to better understand the needs and expectations of potential users and to design the application accordingly. No data that could be used to identify you will be passed on. The data and results of the survey will be used exclusively in anonymized form. The data will be stored for the duration of the project and then deleted or completely anonymized. The processing is based on your voluntary consent in accordance with Art. 6 (1) (a) GDPR. You have the right to information about your stored data, its correction, deletion, restriction of processing, and the right to revoke your consent. You can also lodge a complaint with a data protection supervisory authority.

By clicking on "Next," you confirm that you have read the above information on data processing and consent to participate in the survey and to the processing of your data. If you have any questions, please contact Daniela Blumberg (daniela.blumberg@uni-konstanz.de).

* Indicates required responses.

Demographics

1. Age *

_____

2. Gender *

- ◯ Female
- ◯ Male
- ◯ Diverse
- ◯ Prefer not to say

3. Professional background (Multiple answers possible) *

- ☐ Physiotherapist
- ☐ Sport Scientist
- ☐ Sport Therapist
- ☐ Physician
- ☐ Nurse
- ☐ Fitness Trainer
- ☐ Other: _____

4. How many years have you been working in the therapeutic field? *

- ◯ < 2 years
- ◯ 2–5 years
- ◯ > 5 years

Dealing with Home Training

5. How often do you supervise patients? *
(The term "patients" here refers exclusively to individuals who are undergoing physiotherapy treatment and who, in addition to their appointments at the practice, also have a home exercise program—it does not refer to, for example, inpatients or individuals who exercise solely on their own initiative.)

- ◯ Daily
- ◯ Several times per week
- ◯ About once a week
- ◯ About once a month
- ◯ Occasionally
- ◯ Never

6. If you give patients exercises for home training: How do you prepare patients and in what form do you provide the exercises? *

	very rarely or never	rarely	sometimes	often	very often or always
Practical demonstration of exercises in the practice	◯	◯	◯	◯	◯
Collection of individual exercises (without a fixed training plan)	◯	◯	◯	◯	◯
Structured exercise plan (with defined exercises, repetitions, and timing)	◯	◯	◯	◯	◯
Written materials (e.g., printouts, brochures)	◯	◯	◯	◯	◯
Digital materials (e.g., PDF, app)	◯	◯	◯	◯	◯
Oral instruction	◯	◯	◯	◯	◯
Photos of exercises	◯	◯	◯	◯	◯
Videos / exercise recordings	◯	◯	◯	◯	◯

7. How important do you think it is to track the training progress at home? *

	1	2	3	4	5	
not important at all	◯	◯	◯	◯	◯	very important

8. How do you currently track training progress at home? (Multiple answers possible) *

- ☐ Self-report by patients
- ☐ Analog training logs / documentation sheets
- ☐ Digital training logs / documentation sheets
- ☐ Digital tools / apps
- ☐ No systematic tracking
- ☐ Other: _____

9. What information about home training progress do you ask for? (Multiple answers possible) *

- ☐ No tracking
- ☐ Whether the exercise was performed at all (yes or no)
- ☐ Type of exercises performed
- ☐ Frequency of exercise execution
- ☐ Problems encountered during exercise
- ☐ Effort / perceived difficulty
- ☐ Other: _____

10. What do you think are the greatest barriers and challenges for performing exercises at home?

_____

_____

11. Do you have experience with digital training or health applications? (e.g., apps, wearables) *

- ◯ Yes
- ◯ No Skip to question 16

Experience with Digital Training or Health Applications

12. Which digital training or health applications have you used? (e.g., apps, wearables) *

_____

_____

13. If several: Which of these do you use most / like best?

_____

14. How satisfied are you with this application? *

	1	2	3	4	5	
very dissatisfied	◯	◯	◯	◯	◯	very satisfied

15. Which concrete improvements would you like to see?

_____

_____

Expectations on the Training Analysis

16. Assuming you had a digital application that analyzes your patients' exercise execution: Which information would be particularly useful to you? *

	very unimportant (1)	unimportant (2)	neutral (3)	important (4)	very important (5)
Frequency of exercise execution / training sessions	◯	◯	◯	◯	◯
Accuracy rate / frequency of incorrect executions	◯	◯	◯	◯	◯
Listing of most common mistakes during exercises	◯	◯	◯	◯	◯
Progress of exercise execution over time (e.g., improvement of posture)	◯	◯	◯	◯	◯
Dropout rates during exercises	◯	◯	◯	◯	◯
Duration per exercise session / total training time	◯	◯	◯	◯	◯
Reported perceived exertion (self-assessed)	◯	◯	◯	◯	◯
Video recordings of exercise execution (anonymized)	◯	◯	◯	◯	◯

17. What additional features would you like to have?

_____

_____

18. At which aggregation level would it be useful for you to see analysis results? (Multiple answers possible) *

- ☐ Development of individual patients (anonymized or with explicit consent)
- ☐ Group of patients by indication / diagnosis
- ☐ All patients of own practice / care
- ☐ All patients of participating practices / care
- ☐ Grouped by exercise
- ☐ Grouped by exercise category (e.g., same targeted muscle group)
- ☐ Other: _____

System Integration into Professional Practice

19.Which challenges do you see in integrating a digital application for physiotherapeutic home training into your daily work? (Multiple answers possible) *

- ☐ Time effort
- ☐ Data protection / legal issues
- ☐ Lack of technical knowledge (therapists or patients)
- ☐ Traceability and accuracy of analysis
- ☐ Patient acceptance
- ☐ Conflicts with existing work processes
- ☐ Other: _____

20. Assuming that the challenges mentioned could be resolved – would you incorporate a digital application for your patients' home training into your therapeutic work? *

- ◯ Yes, regularly
- ◯ Yes, occasionally
- ◯ No

21. If no: Could you tell us why?

_____

22. How often would you like to use cross-patient analyses? *

- ◯ Daily
- ◯ Weekly
- ◯ Monthly
- ◯ As needed (e.g., therapy adjustment)
- ◯ Probably not at all

23. What would be an added value for you compared to current practice? (Multiple answers possible) *

- ☐ Objective assessment of home training
- ☐ Higher therapy adherence through close monitoring
- ☐ Better tracking of therapy outcomes
- ☐ Relief in documentation / evaluation
- ☐ Other: _____

24. Do you have concerns about using a digital system to support physiotherapy in the home environment? If yes, which ones?

_____

_____

25. Would you be willing to participate in further developments (e.g., by testing an initial version of the application)? *

- ◯ Yes
- ◯ No

B. Results

B.1. Patient Perspective

	Absolute	Relative (%)
Gender		
Female	33	66.0
Male	16	32.0
Unknown	1	2.0
Experience with therapeutic exercises		
Currently in therapy	16	32.0
Past experience	28	56.0
No experience	6	12.0
Experience with digital training or health applications		
Yes	21	42.0
No	29	58.0

Table B.1
Demographics and therapeutic and digital experience of the participants in the patients questionnaire (N = 50).

Was glauben Sie könnte Ihnen helfen Übungen noch regelmäßiger und mit mehr Motivation durchzuführen?
What do you think could help you perform exercises more regularly and with greater motivation?

	Original Statement	Translation
Visible Progress and Feedback	wenn ich Fortschritte sehen würde	if I could see progress
	wenn ich den Fortschritt sehe bin ich motiviert	if I see the progress I am motivated
	Erfolgskontrolle	success monitoring
	Feedback zur richtigen Durchführung	feedback on correct execution
	Schnellerer Erfolg	faster success
	Dass die Übungen auch wirklich helfen	that the exercises really help
	Korrekte Ausführung und Grund der Ausführung	correct execution and reason for the execution
	Schnellerer Erfolg	faster success
Structure, Routine and Scheduling	Einbau in den Alltag	integration into daily life
	Feste Zeiten, max 30 Minuten	fixed times, max 30 minutes
	festgelegtes Online-Training	fixed online training
	feste Termine	fixed appointments
	Mehr Zeit	more time
	Tracking über App	tracking via app
	Ich kann mir die Reihenfolge der Übungen nicht merken	I cannot remember the order of the exercises
	mehr Zeit und schnellere Erreichbarkeit des Studios	more time and faster accessibility of the studio
	Routinen und feste Zeitfenster	routines and fixed time slots
	Ein fester Platz zum Training	a fixed place for training
	Möglichst geringer Aufwand, genaue Anleitung	as little effort as possible, precise instructions
	Regelmässigkeit am Abend und oder Morgen	regularity in the evening and/or morning
	Die richtige Ausrüstung	the right equipment

External Motivation and Social Support	Externe Motivation, gemeinsames Training	external motivation, joint training
	Soziales Umfeld bzw Unterstützung Motivation	social environment or support motivation
	Trainingspartner	training partner
	Gemeinschaft	community
	Sportgruppen	sports groups
	Sozialer Druck	social pressure
	professionelle Anleitung in realer Form	professional instruction in real form
	Gruppenzwang	peer pressure
	Belohnung	reward
	Tracking über App, positive Verstärkung, Belohnung am Ende des Trainings	tracking via app, positive reinforcement, reward at the end of training
Guidance and Instruction	Übungen, die auf DVD oder in youtube gezeigt werden	exercises shown on DVD or on youtube
	Wahrscheinlich mit einem persönlichen Coach per App	probably with a personal coach via app
	professionelle Anleitung in realer Form	professional instruction in real form
	festgelegtes Online-Training	fixed online training
	Feedback zur richtigen Durchführung	feedback on correct execution
	Erfolgskontrolle	success monitoring
	genaue Anleitung	precise instructions
Internal Motivation and Personal Factors	Ich bin mein eigener Motivator,da ich nie wieder so Schmerzen haben möchte und das Level wie es mir gerade geht unbedingt halten will und daher 3mal wöchentlich plus einmal Ausdauertraining für mich ausreichend finde:)	I am my own motivator because I never want to have such pain again and I definitely want to maintain my current level, and therefore 3 times a week plus one endurance session is sufficient for me :)
	Akute Schmerzen motivieren. Sind die Schmerzen weg vergeht leider auch die Motivation für Übungen.	acute pain motivates. once the pain is gone the motivation unfortunately also fades
	Schmerzen	pain
	Wenn die Übungen Spaß machen würden	if the exercises were fun

Table B.2
Categorization of factors that could help individuals perform exercises more regularly and with greater motivation. If a participant provided multiple factors, the original statements are split up to arrange them into the categories.

Mit welchen digitalen Trainings- oder Gesundheitsanwendungen haben Sie Erfahrung? (z. B. Apps, Wearables)
Which digital training or health applications have you used?
***Falls mehrere: Welche dieser Anwendungen benutzen Sie am häufigsten/gefällt Ihnen am besten?**
**If several: Which of these do you use most / like best?*
Welche konkreten Verbesserungen würden Sie sich wünschen?
Which concrete improvements would you like to see?

Application	Requested Improvements (Original Statement)	Requested Improvements (Translation)
Nike Training		
Garmin	Details zu Anwendungen	Details on applications
Training mit Apple Watch		
B42	Korrektur bei falscher Durchführung der Übung und bessere Übersicht in der App	Correction when performing an exercise incorrectly and better clarity/overview in the app
Trainingseinheiten über Instagram, Lisakayepilates*, Liebscher & Bracht, Zoom, TSF Ditzingen Antara und Pilates		
Samsung Health auf der Smartwatch		
Video-Guide zum Training, Smartwatch für Fitnesstracking*	Zusammenstellung des Trainingsplans am PC ermöglichen statt mit schlechter UX auf der Smartwatch	Allow training plan creation on a PC instead of through poor UX on the smartwatch
Training mit Apple Watch (Ich nutze fast ausschließlich den Schrittzähler und manchmal den Pulsmesser)		
Fitnesswatch von Garmin		
Fitbit	Vielfältigere Übungen mit unterschiedlichen Schweregraden	A greater variety of exercises with different difficulty levels
Samsung Health, Ringconn*, App Evermore*		
Amazfit		
App		
Fitbit*, miband, wii fit	Mehr als nur tracken	More than just tracking
Caspar		
Garmin, Strava		
App vom Fitnessstudio	Dass man nicht sofort aus dem Trainingsprogramm rausfliegt, wenn man versehentlich eine falsche Eingabe gemacht hat, sondern diese korrigieren kann.	That you don't get kicked out of the program immediately when entering something incorrectly, but can correct it instead
Polar flow		
Videos der Trainerin, Apps		
Workout Zuhause		
Runtastic, Strava*, YouTube Workouts*	Dynamische Anpassung an mein Level	Dynamic adaptation to my fitness level
Lauf-App	Weniger Werbung	Less advertising

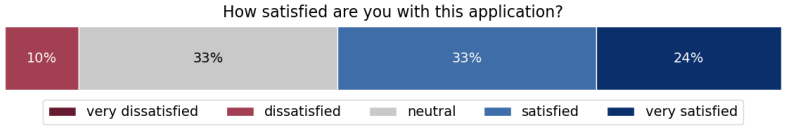


Table B.3
Experience with digital training and health applications and desired improvements.

Welche zusätzlichen Funktionen würden Sie sich wünschen?
What additional features would you like to have?

- Weckerfunktion, wann die Übung fällig ist.
  Alarm function indicating when an exercise is due.
- Anonymität der Teilnehmer, in der App soll ich eine Nummer sein.
  Anonymity of participants; in the app I want to be represented by a number.
- z. B. welche Muskeln trainiert werden, Hinweise auf Übungen bei bestimmten Beschwerden.
  For example, information on which muscles are trained, and recommendations for exercises for specific complaints.
- Ausgeübte Übungen wiederholt anschauen zu können/auszuüben zur Verinnerlichung.
  Being able to repeatedly view and perform completed exercises for reinforcement.
- Beschreibung, welche Muskelgruppen durch die Übung angesprochen werden. Beschreibung, gegen welche Art von Krankheit/Schmerz eine Übung hilfreich ist.
  Description of which muscle groups are targeted by the exercise. Description of which type of condition/pain the exercise is helpful for.
- Trainingsziele ändern bzw. anpassen können.
  Being able to change or adjust training goals.
- Hinweise, welche Übungsgeräte noch sinnvoll sind.
  Recommendations on which additional training equipment may be useful.

Table B.4
Desired additional features.

Welche Art von Feedback würden Sie sich zusätzlich wünschen?
What kind of additional feedback would you like to receive?

- Hinweis auf Fortschritt im Verlauf der Therapie.
  Indication of progress over the course of therapy.
- Ansagen müssen abschaltbar sein.
  Announcements must be able to be turned off.
- Rückmeldungen zur Häufigkeit einer Trainingseinheit (z.B. "Du wolltest doch dreimal pro Woche trainieren, wann ist Dein nächster Trainingstermin, um das zu erreichen?")
  Feedback on the frequency of a training session (e.g., "You wanted to train three times a week — when is your next session to achieve that?")
- Lächeln
  Smile
- Nachfrage wie es mir damit geht
  Asking how I am doing with it

Table B.5
Desired additional feedback.

Wären Sie einverstanden, dass die Anwendung Ihre Trainingsdaten und Einschätzung zur Schwierigkeit der Übung nutzt, um automatisiert Anpassungen für zukünftige Trainingseinheiten vorzuschlagen (z. B. mehr oder weniger Wiederholungen, schwerere oder leichtere Übung)? Falls Nein: Gibt es einen speziellen Grund, warum Sie das nicht möchten?
Would you agree that the application uses your training data and your assessment of the difficulty of the exercise to automatically suggest adjustments for future training sessions (e.g., more or fewer repetitions, harder or easier exercises)? If not: Is there a specific reason why you would not want that?

- Möglichkeit die Vorschläge der Anwendung zu verwerfen.
  Option to discard the application's suggestions.
- Vielleicht fällt einem eine Übung zu Beginn schwer, nach einigen Trainings beherrscht man sie dann.
  Perhaps an exercise is difficult at first, but after some training sessions one masters it.
- Ich mache die Übungen nicht um mich zu steigern sondern um mein Level zu halten. Mal brauche ich weniger,mal mehr Schwierigkeit, das kann ich ganz gut abschätzen. Zu viel Beurteilen über den Schwierigkeitsgrad könnte sich eher negativ auf meine mögliche Motivation auswirken
  I do the exercises not to improve but to maintain my level. Sometimes I need less, sometimes more difficulty, I can judge that quite well myself. Too much evaluation of the difficulty could actually negatively affect my potential motivation.
- Meine Einschätzung könnte tagesformabhängig sein
  My assessment could depend on my daily condition.

Table B.6
Reasons against automatic suggestions.

Figure B.11: Desired frequency of motivational feedback.

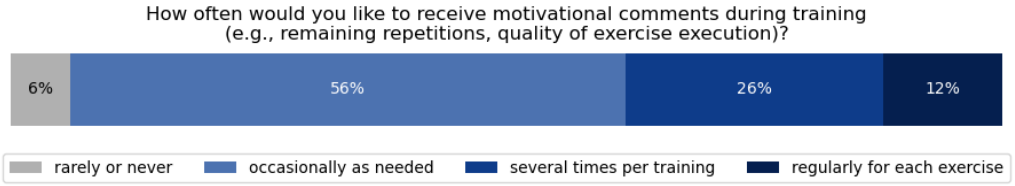


Figure B.12: Option to provide own assessment of exercise difficulty.

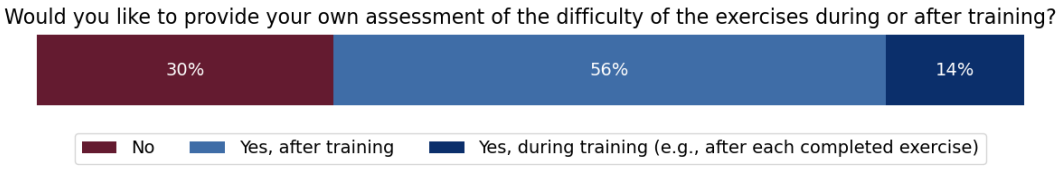


Figure B.13: Option to receive automatic suggestions for future trainings.

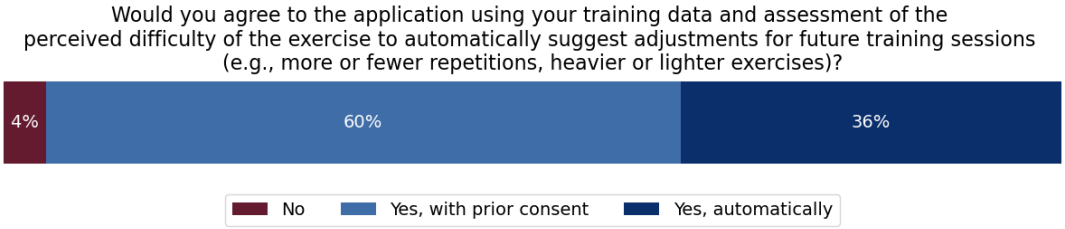


Figure B.14: Desired adjustment options for training plan.

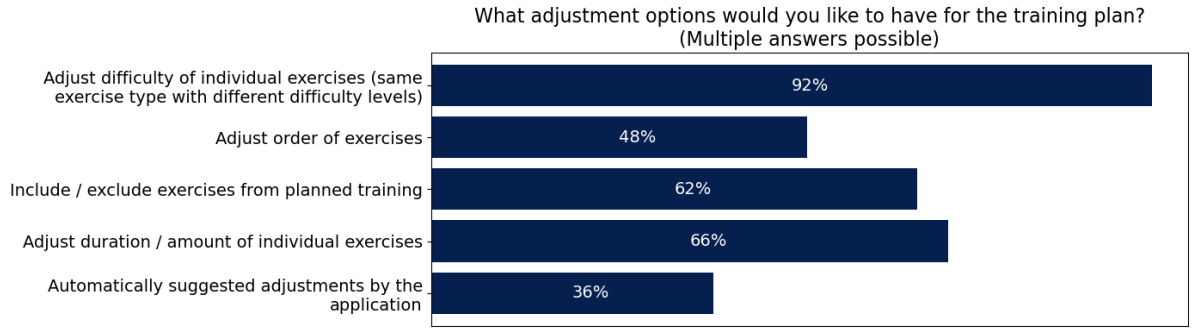
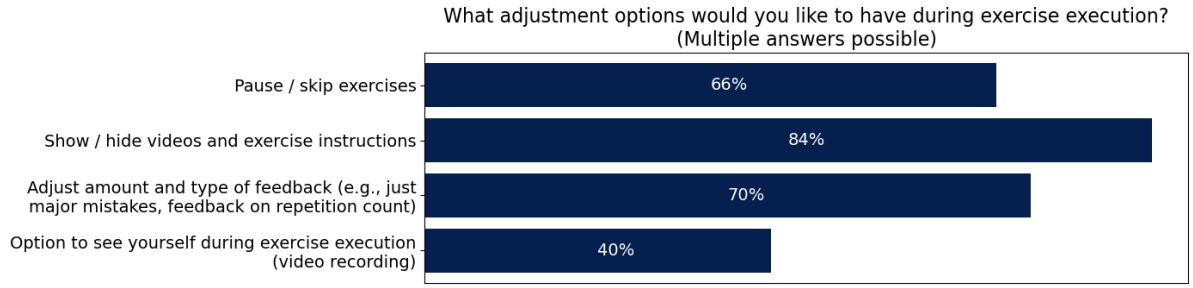


Figure B.15: Desired adjustment options during exercise execution.



Haben Sie Bedenken beim Einsatz eines digitalen Systems zur Unterstützung der Physiotherapie im häuslichen Umfeld? Wenn ja, welche?
Do you have any concerns about using a digital system to support physical therapy in the home environment? If so, what are they?

	Original Statement	Translation
Data Protection, Privacy & Security	Ja, ich möchte eine sichere Anonymität der Teilnehmer haben	Yes, I would like to have secure anonymity for the participants
	Privatsphäre der aufgezeichneten Daten	Privacy of the recorded data
	Ist der Datenschutz gewährleistet?	Is data protection ensured?
	Datenschutz	Data protection
	Ja, wegen Datenschutz	Yes, because of data protection
	Videomaterial wird gespeichert	Video material is being stored
	System könnte gehackt werden, Datensicherheit	The system could be hacked, data security
	Sensible Daten, ob und wie häufig man die Übungen macht, v.a. mit Blick auf Krankenkassenleistungen	Sensitive data, such as whether and how often one performs the exercises, especially with regard to health insurance benefits
Technical Ability & Access	technische Schwierigkeiten beim Anmelden und Gebrauch, kleiner Bildschirm	Technical difficulties when logging in and using the system, small screen
	Evt. technische Voraussetzungen sind nicht gegeben. Falsche Ausführung / Anwendung	Technical requirements may not be met. Incorrect execution/application
	Braucht wahrscheinlich eine längere Trainingsphase, um konstruktiv Rückmeldung zu geben	Probably needs a longer training phase in order to provide constructive feedback
	Ungewohnt	Unfamiliar
	Welche Hilfsmittel werden benötigt; Genügend Platz	Which aids are needed; enough space
Quality of Physiotherapy	Fehlender Gesamtblick auf den/die Patient:in	Lack of an overall view of the patient
	Dass es dann noch weniger Geld für Physiotherapie vor Ort gibt	That there will then be even less funding for in-person physiotherapy
	Ist abhängig von der Schwere der Erkrankung.	Depends on the severity of the illness

Table B.7
Categorization of concerns regarding the use of a digital system to support physiotherapy in a home setting.

Sehen Sie Chancen beim Einsatz eines digitalen Systems zur Unterstützung der Physiotherapie im häuslichen Umfeld? Wenn ja, welche?
Do you see opportunities in the use of a digital system to support physical therapy in the home environment? If so, what are they?

	Original Statement	Translation
Improved Exercise Execution & Rehabilitation	Vermeidung von Fehlern	Avoidance of mistakes
	weniger Fehler in der Ausführung	fewer execution errors
	Es passiert mir sehr oft, dass ich eine Übung nicht richtig ausführe – vielleicht, weil sie zu schwer ist oder weil ich mich nicht selbst sehen kann. Dadurch verschlimmere ich meinen Zustand unabsichtlich, sehe keinen Fortschritt und lasse es dann schließlich sein. Eine Hilfe dabei wäre super	It often happens that I do an exercise incorrectly—perhaps because it is too difficult or because I cannot see myself. As a result, I unintentionally worsen my condition, see no progress, and eventually stop. Help with this would be great
	Ja.z.B Feedback/Korrektur um Übungen so zu machen das sie die Physiotherapie unterstützen und nicht falsch ausgeführt werden und so schneller zur Genesung führen	Yes, e.g., feedback/correction to perform exercises properly so that they support physiotherapy and lead to faster recovery
	Weniger Fehler zu machen	Making fewer mistakes
	Bessere Durchführung, Fehler schleichen sich nicht ein	Better performance, fewer mistakes creep in
	richtige Ausführung der Übungen	correct execution of exercises
	Man kann sie Übungen immer wieder zeigen lassen. Wenn einem eine bestimmte Anzahl an Wiederholungen der Übung vorgegeben wird, hält man länger durch und kann die Übung konsequenter durchführen	You can have the exercises shown repeatedly. If a specific number of repetitions is given, you persevere longer and perform the exercises more consistently
	Schnellere und nachhaltigere Genesung. Probleme kehren sonst wieder zurück	Faster and more sustainable recovery. Otherwise, problems tend to return
Increased Motivation & Adherence	höhere Motivation seine Übungen regelmäßig zu machen	higher motivation to do exercises regularly
	motivierend	motivating
	Motivation	Motivation
	Es steigert die Motivation.	It increases motivation.
	Bei regelmäßiger Erinnerung bleibt man eher dran	With regular reminders, one is more likely to stay consistent
	Ja, um bessere Ergebnisse durch regelmäßigeres Training zu erreichen. Da Physiotherapie ja meist nur einmal die Woche ist, flacht gerade am Ende der Woche die Motivation oft ab	Yes, to achieve better results through more regular training. Since physiotherapy usually takes place only once a week, motivation often declines toward the end of the week
	Ja , um den inneren Schweinehund zu überwinden und die Übungen zu Hause durchzuführen .	Yes, to overcome inner resistance and carry out exercises at home.
	Erinnerung und Tracking	Reminders and tracking
	Ja, Verbesserung durch regelmäßigere Anwendung.	Yes, improvement through more regular practice.
	Patient kann die Übungen jederzeit abrufen und zur besseren Erinnerung	The patient can access the exercises at any time for better recall
	Übungen werden häufiger gemacht	Exercises are done more frequently
	Man hat das Gefühl die Übungen nicht alleine zu machen ;)	You feel like you're not doing the exercises alone ;)

Accessibility & Flexibility	Mehr Menschen können erreicht werden, Gut zu Prävention	More people can be reached, good for prevention
	Ja, für Personen die nicht mehr aus dem Haus können	Yes, for people who can no longer leave their homes
	Bei eingeschränkter Mobilität + es kann häufiger trainiert werden	For limited mobility + training can be done more frequently
	Besser als keine Betreuung	Better than no supervision at all
Support for Physiotherapists & Healthcare System	Entlastung des Therapeuten und Kostenersparnis	Relief for therapists and cost savings
	Ja, es könnte physiotherapeutische Behandlungen unterstützen	Yes, it could support physiotherapeutic treatments
	Ja, da man keinen Physiotherapeuten braucht, der teurer wäre	Yes, because no physiotherapist is needed, which would be more expensive
	Ja, könnte die Abdeckung des Bedarfs deutlich verbessern, eine objektivere Rückmeldung ermöglichen und es günstiger machen	Yes, it could significantly improve coverage, allow for more objective feedback, and make it more affordable
	Zeit und kostensparend	Time- and cost-saving

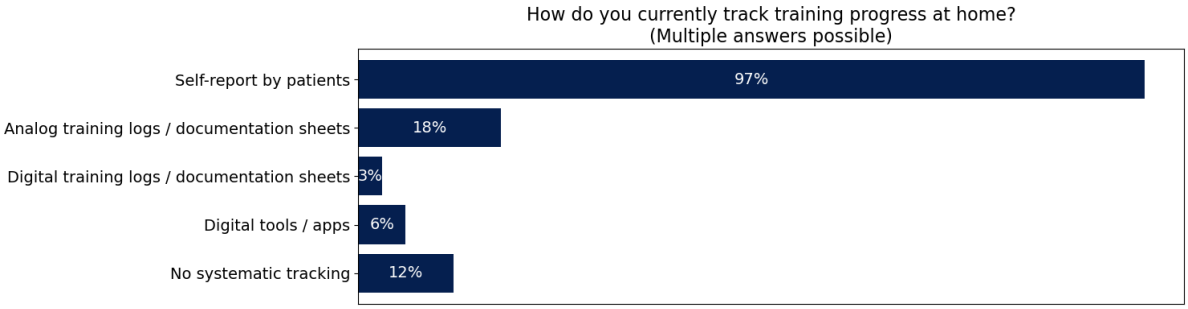
Table B.8
Categorization of perceived opportunities regarding the use of a digital system to support physiotherapy in a home setting.

B.2. Therapist Perspective

	Absolute	Relative (%)
Gender		
Female	26	76.0
Male	8	24.0
Profession		
Physiotherapist	31	91.2
Sports Scientist	2	5.9
Sports Therapist	2	5.9
Physician	1	2.9
Fitness Trainer	2	5.9
Osteopath	1	2.9
Therapeutic work experience		
$>$ 5 years	15	44.1
$\geq$ 2 years	5	14.7
$<$ 2 years	14	41.2
Supervision of patients*		
Daily	24	71.0
Several times per week	9	26.0
Occasionally	1	3.0

Table B.9
Demographic and professional characteristics of the therapeutic domain expert participants (N = 34).
*The term *patients* in this context refers exclusively to individuals who are undergoing physiotherapy treatment and who, in addition to their appointments at the practice, also have a prescribed home exercise program – excluding, for example, inpatients or individuals exercising independently.

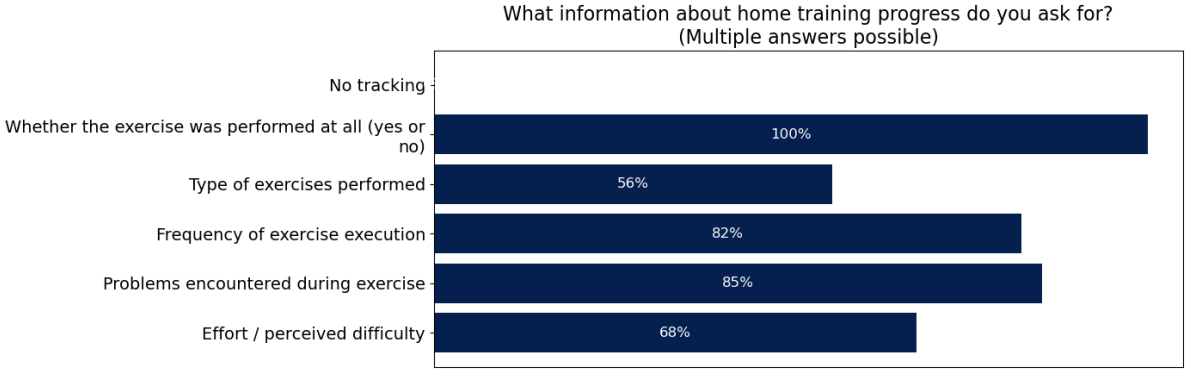
Figure B.16: Existing tracking procedure of training progress.



Other:

- Patients demonstrate how they perform the exercises at home
- Checking the exercises

Figure B.17: Information on home training requested by therapists.



Other:

- Impact on the current problem
- Specialities
- Alternvatives
- Progressive load increases
- Pain

Was sind Ihrer Meinung nach die größten Hürden und Herausforderungen bei der häuslichen Übungsausführung?
What do you think are the greatest barriers and challenges for performing exercises at home?

	Original Statement	Translation
Motivation & Personal Factors	Compliance der PatientInnen	Compliance of the patients
	Motivation des Patienten	Motivation of the patient
	Motivation die Übungen zu machen	Motivation to do the exercises
	Leistungsfortschritt bewerten, Motivation der Patienten fehlt	Assessing performance progress, motivation of the patients is missing
	Fehlende Eigenmotivation oder Disziplin der Patienten, fehlende Verbindlichkeit zur Durchführung der Übungen, langfristige Übungsausführung und Sekundärprävention schwierig d.h. wenn keine Symptome/Beschwerden als Motivatoren mehr vorliegen wird nicht mehr trainiert, Weitsicht für langfristigen Erfolg durch Training fehlt	Lack of self-motivation or discipline of the patients, lack of commitment to performing the exercises, long-term exercise execution and secondary prevention are difficult, i.e., if no symptoms/complaints remain as motivators, training is no longer performed, foresight for long-term success through training is missing
	Motivation	Motivation
	Selbstständigkeit	Independence
	mangelnde Selbstdisziplin der Patienten	Lack of self-discipline of the patients
	Motivation	Motivation
	viele müssen ihren "Inneren Schweinehund" überwinden	Many have to overcome their "inner weaker self"
	Die Compliance des Patienten.	The compliance of the patient.
	geringe Adhärenz der Patienten, Angst- Vermeidungsverhalten durch Unsicherheit	Low adherence of the patients, fear-avoidance behavior due to uncertainty
	Den Schweinehund zu überwinden.	To overcome the inner weaker self.
	Die nicht vorhandene Disziplin der Patienten	The non-existent discipline of the patients
	Adhärenz der Patient*innen	Adherence of the patients
	Mangelnde Adhärenz, mangelndes Bewusstsein und Verständnis für die Notwendigkeit von Eigenübungen/Bewegung für den Therapieerfolg, mangelndes Verantwortungsbewusstsein für seinen eigenen Körper und dessen Gesundheitszustand, motivationale / psychologische Defizite	Lack of adherence, lack of awareness and understanding of the necessity of self-exercises/movement for therapy success, lack of responsibility for one's own body and its health status, motivational/psychological deficits
	Motivation, körperliche Einschränkungen, zu niedrige Priorität	Motivation, physical limitations, too low priority
	keine Motivation	No motivation
	Unmotiviertheit, Ablenkungen, Stressempfinden, Erschöpfung	Lack of motivation, distractions, sense of stress, exhaustion
	Motivation der Patienten	Motivation of the patients
	Motivation der Patienten zur Eigenarbeit	Motivation of the patients for self-directed work
	Fehlende Motivation	Lack of motivation
	Motivation bzw Leidensdruck zu gering	Motivation or suffering is too low
	Motivation	Motivation

Time Management, Structure & Routine	zu viele Übungen	Too many exercises
	Zeitmanagement	Time management
	Übungsausführung zu kurz	Exercise execution too short
	zu kurz und zu selten tatsächlich trainiert	Actually trained too short and too rarely
	Zeitmanagement	Time management
	Ablenkungen durch andere Tätigkeiten im Alltag	Distractions from other daily activities
	Aus den Übungen Gewohnheit zu machen um sie in den Alltag zu integrieren	Making the exercises a habit to integrate them into daily life
	Dass Übungen vergessen werden	That exercises are forgotten
	Regelmäßige Ausführung	Regular execution
	Die Routine die die Patienten sich aufbauen müssen	The routine that patients have to build up
	Übungen zu finden, die der Patient gut in den Alltag integrieren kann.	Finding exercises that the patient can easily integrate into daily life
	wenig Zeit durch Alltag (laut Patienten)	Little time due to daily life (according to patients)
	Zeitmanagement der Patient*innen	Time management of the patients
	Überlastung im Alltag von seitens Beruf und sozialem Umfeld	Overload in daily life from work and social environment
	keine Regelmäßigkeit, zu kurze Durchführung	No regularity, too short execution
	Vergessen der Übungen	Forgetting the exercises
	Gewöhnung	Habit formation
	Patienten vergessen die Durchführung; führen es nicht regelmäßig durch	Patients forget to perform it; do not carry it out regularly
	Regelmäßigkeit	Regularity
Correct Exercise Execution	keine exakte Ausführung	No exact execution
	falsche Übungsausführung	Incorrect exercise execution
	Fehlerfreie Umsetzung der Übung	Error-free execution of the exercise
	korrekte Ausführung ohne Korrektur durch Therapeuten	Correct execution without correction by therapists
	Merken der Abläufe	Remembering the sequences
	Übungsausführung korrekt zu machen, um nicht mehr Schaden wie Nutzen anzurichten; Körpergefühl des Patienten	Performing the exercise correctly to do more good than harm; patient's body awareness
	Richtige Ausführung	Correct execution
	Unaufmerksamkeit bei der Übungsausführung	Inattention during exercise execution
	korrekte Ausführung	Correct execution
	Korrekte Ausführung der Übung, wenn der Patient die Übung das erste mal in der Praxis ausgeführt hat.	Correct execution of the exercise when the patient performed it for the first time in practice
	Falsche Ausführungen	Incorrect executions
	mit uneffizienter Intensität	With inefficient intensity

Table B.10
Categorization of perceived barriers and challenges for home exercise execution. If a participant provided multiple factors, the original statements are split up to arrange them into the categories.

Mit welchen digitalen Trainings- oder Gesundheitsanwendungen haben Sie Erfahrung? (z. B. Apps, Wearables)
Which digital training or health applications have you used?
***Falls mehrere: Welche dieser Anwendungen benutzen Sie am häufigsten/gefällt Ihnen am besten?**
**If several: Which of these do you use most / like best?*
Welche konkreten Verbesserungen würden Sie sich wünschen?
Which concrete improvements would you like to see?

Application	**Improvements**	
	Original Statement	**Translation**
Wearables*, Trainingsapps	Besserer Datenschutz der sensiblen Gesundheitsdaten, evtl. höheren Messgenauigkeit	Better data protection of sensitive health data, possibly higher measurement accuracy
Trainingswerk	Kunden anlegen dauert zu lange, Übungsauswahl ist zwar vielfältig aber unübersichtlich, Übungsbeschreibung nicht immer verständlich	Creating clients takes too long, exercise selection is diverse but confusing, exercise descriptions are not always clear
Apps		
App	Dass Patienten sie überhaupt anfangen zu nutzen, ohne dass der Therapeut sie 100 Mal darauf hinweisen muss.	That patients actually start using it without the therapist having to remind them 100 times
App	Einsehbarkeit für Therapeuten, ob Übungen durchgeführt wurden	Ability for therapists to see whether exercises were performed
Sportswatches; Apps, die Übungen anzeigen*; e-Gym-Training	Übersichtlichkeit; Trainingstagebuch integrieren; Videos knapp auf den Punkt; unnötige Features weglassen; Übungen mit Steigerungsformen anbieten	Clarity; integrate a training diary; make exercise videos short and to the point; remove unnecessary features; provide exercises with progression levels
Jolii Gerätetetraining		
Physiofit, Garmin Connect*, Fitbit, Adidas Training (Runtastic), Strava	Bessere automatische Erkennung der Sportart	Better automatic detection of the sport type
Gainsfire* (Trainingspläne Fitness), TK Coach, My FitnessPal	Mehr Klienten kostenfrei betreuen zu können	To be able to supervise more clients free of charge

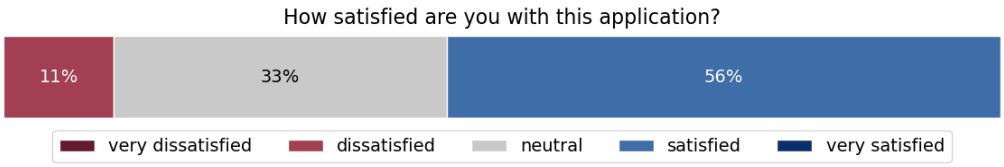


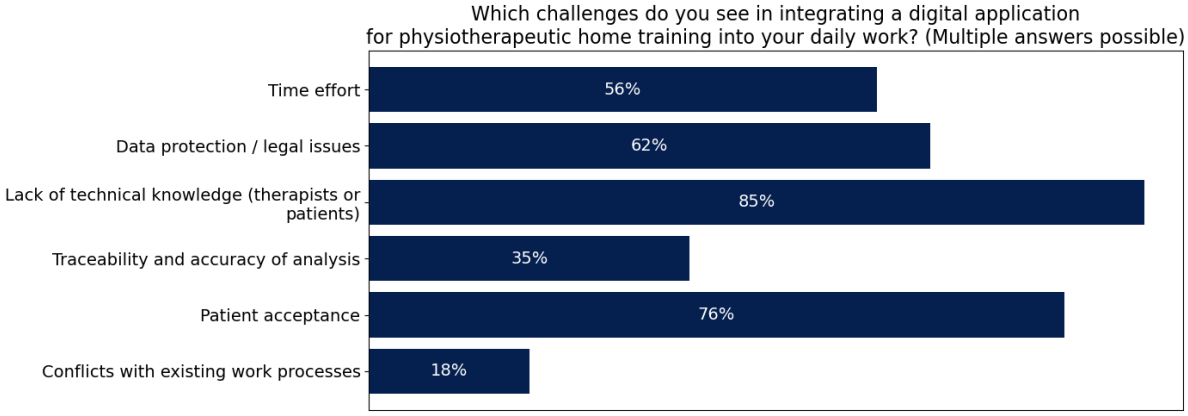
Table B.11
Experience with digital training and health applications and desired improvements.

Welche zusätzlichen Informationen würden Sie sich wünschen?
What additional information would you like to have?

- Einfluss auf das aktuelle Problem, z.B. verbessert sich der Schmerz (Skala), die Beweglichkeit, die AdLs
  Impact on the current problem, e.g., whether pain improves (scale), mobility, AdLs
- Entwicklungsmöglichkeiten der Übungen, Plan zur Steigerung, Ziel der Übungen (im Gesamten)
  Development possibilities of the exercises, plan for progression, overall goal of the exercises
- Tut mir die Übung gut
  Does the exercise do me good
- Schmerzskala
  Pain scale
- persönliche Schwierigkeiten bei den Übungen
  Personal difficulties with the exercises
- Motivationslevel, wie regelmäßig werden die Übungen auch in Zukunft durchgeführt
  Motivation level, how regularly the exercises will be performed in the future
- Feld für freie Kommentare vonseiten des Patienten, zB wenn er ungewöhnliche Schmerzen / Sensationen wahrgenommen hat während der Ausführung oder Gründe, warum er eine Übung nicht ausführen konnte/wollte
  Field for free comments from the patient, e.g., if they experienced unusual pain/sensations during execution or reasons why they could not/would not perform an exercise
- Schmerzlevel bei Ausführung (Selbsteinschätzung)
  Pain level during execution (self-assessment)

Table B.12
Desired additional information.

Figure B.18: Perceived challenges for system integration into professional practice.



Other:

- Implementation/execution of the exercises
- No interest from employers/colleagues
- Cost coverage
- Lack of technical resources/equipment
- Does an app really increase motivation to exercise?

Figure B.19: Incorporation into therapeutic work.

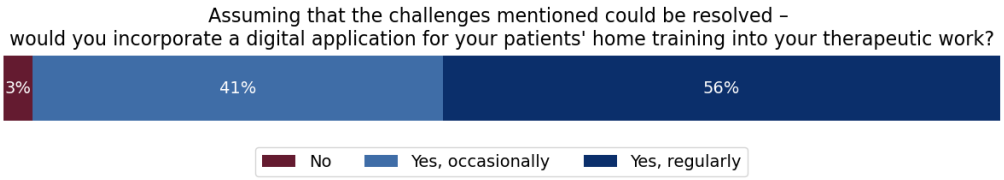


Figure B.20: Desired frequency of cross-patient analyses.

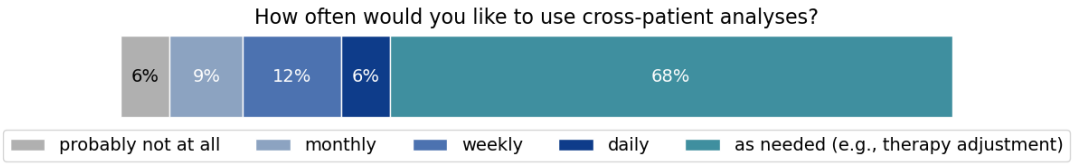
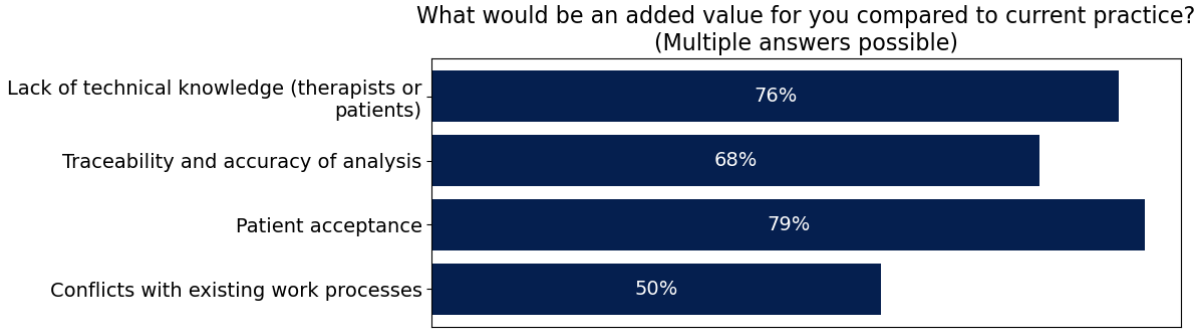


Figure B.21: Perceived added value.



Other:

- Safety of patients in exercise execution

Haben Sie Bedenken beim Einsatz eines digitalen Systems zur Unterstützung der Physiotherapie im häuslichen Umfeld? Wenn ja, welche?
Do you have concerns about using a digital system to support physiotherapy in the home environment? If yes, which ones?

	Original Statement	Translation
Data Protection, Privacy & Security	Datenschutz	data protection
	Datenschutz und Vorbehalt der Patienten, die sich nicht privat filmen möchten	data protection and patients' reluctance who do not want to film themselves privately
	Bedenken von PatientInnen beim Datenschutz	patient concerns about data protection
Technical Ability & Access	Umgang mit Technik vor allem bei älteren Patienten?	dealing with technology, especially for older patients?
	Technikaffinität der vorwiegend älteren Patienten, nicht leistbarer Zeitaufwand zum Briefing der (älteren) Patienten bzgl.der App, Installieren, Handhabung etc in Praxisalltag	technical affinity of predominantly older patients; unaffordable time required to brief (older) patients about the app, installation, handling, etc. in daily practice
	Meine Patientin sind über 70 Jahre alt	my patients are over 70 years old
	Einige Menschen haben nicht die Möglichkeit/ Ressourcen zu digitalen Systemen	some people do not have access to / resources for digital systems
	Schneller Verlust an Interesse, falls das System nicht selbsterklärend genug / zu kompliziert sein könnte	quick loss of interest if the system is not intuitive enough or could be too complicated
	Fehlendes technisches Know-How oder Akzeptanz gegenüber der Technik	Lack of technical know-how or acceptance of the technology
	Ich denke, dass viele Patienten (ich arbeite fast ausschließlich in Seniorenheimen und mit älteren Menschen) die Übungen ohne persönliche Anleitung und Korrektur falsch machen und nachher mehr Probleme haben als vorher. Bei jungen Patienten ist es sicherlich ein Mehrwert.	I think that many patients (I work almost exclusively in nursing homes with older people) would perform exercises incorrectly without personal instruction and correction, ending up with more problems than before. For younger patients, it is certainly an added value.
Motivation & Adherence	Motivation der Patienten	motivation of patients
	der Patient muss sich trotzdem noch zur Übungsusführung überwinden, was vermutlich häufig das einzige Problem ist, das im Wege steht	the patient still has to motivate themselves to perform the exercises, which is often the main barrier
Time Effort	Im durchgetakteten Praxisalltag ist keine Zeit dafür vorgesehenen Patienten individuelle Übungsprogramme zusammenzustellen.	in the tightly scheduled practice routine, there is no time to create individualized exercise programs for patients
	Je nachdem könnte es den Zeitaufwand möglicherweise noch erhöhen.	depending on circumstances, it could potentially even increase the time required
	Eher unpersönlich	rather impersonal
	Dass es nicht umgesetzt wird	that it will not be carried out

Table B.13
Categorization of concerns regarding the use of a digital system for home-based physiotherapy.