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Title

A(pp)ceptance - Increasing physicians' acceptance for chronic pain apps: A randomized controlled trial

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Abstract

Objectives

The aim of our study was to determine and enhance physicians' acceptance, performance expectancy and credibility of health apps for chronic pain patients. We further investigated predictors of acceptance.

Design

Randomized experimental trial with a parallel-group repeated measures design.

Setting and participants

248 physicians working in various, mainly outpatient settings in Germany.

Intervention and outcome

Physicians were randomly assigned to either an experimental group (short video about health apps) or a control group (short video about chronic pain). Primary outcome measure was acceptance. Performance expectancy and the credibility of health apps were secondary outcomes. In addition, we assessed 101 medical students to evaluate the effectiveness of the video intervention in young professionals.

Results

In general, physicians' acceptance of health apps for chronic pain patients was moderate (M=9.51, SD=3.53, scale ranges from 3-15). All primary and secondary outcomes were enhanced by the video intervention: A repeated-measures ANOVA yielded a significant interaction effect for acceptance ($F(1, 246)=15.28$, $p=.01$), performance expectancy ($F(1, 246)=6.10$, $p=.01$) and credibility ($F(1, 246)=25.61$, $p<.001$). The same pattern of results was evident among medical students.

Linear regression analysis revealed credibility ($\beta=.34$, $p<.001$) and performance expectancy (β .30, $p<.001$) as the two strongest factors influencing acceptance, followed by skepticism ($\beta=-.18$, $p<.001$) and intuitive appeal ($\beta=.11$, $p=.03$).

Conclusions and recommendations

Physicians' acceptance of health apps was moderate, and was strengthened by a three minutes video. Besides performance expectancy, credibility seems to be a promising factor associated with acceptance. Future research should focus on ways to implement acceptability-increasing interventions into routine care.

Trial registration: https://osf.io/x693r

Strengths and limitations of this study

- This is the first study to examine physicians´ acceptance and expectations about health apps for chronic pain.

- A strength of the study is the investigation of both practitioners and medical students as future physicians.
- Additional to the pure assessment of physicians´ attitudes, their acceptance was manipulated by a short video intervention within a pre-post design.
- A limitation is the online-only data collection, due to which a selection bias may have occurred.

INTRODUCTION

Since the Global Burden of Disease Study was first conducted in the 1990s, chronic pain has been identified as the leading cause of years lived with disability[1]. Chronic pain has various negative health consequences and adverse impacts on quality of life[2–4]. Although there are effective treatments for chronic pain[5,6], effect sizes tend to be small[7]. Further, the sustained efficacy of treatments is uncertain[8]. This is problematic, because chronic pain raises costs dramatically for health care systems[9,10] and is a significant contributor to work disability[11]. The likelihood of returning to work correlates with the duration of pain: the longer patients are out of work, the less likely they are to return to full-time employment[12,13]. Therefore, the principle for treating pain is that it should start as early as possible. However, many people, especially in rural areas, have no access to adequate pain treatment[14,15], even though it is considered a human right[16].

Electronic health (eHealth) offerings can help to alleviate these problems and provide patients with evidence-based interventions[17]. Smartphone apps, falling under the mobile health (mHealth) category, especially have great potential for both practitioners and patients[18]: First, they can help patients better manage their pain, for example as a treatment adjunct or in the absence of a pain expert[19,20]. Several studies have demonstrated the high potential of health apps for pain[21–24]. Second, because of the widespread use of smartphones, they can reach patients with chronic pain at a low threshold[25]. Despite these positive aspects, there are various barriers to implementing health apps within clinical practice. It is thus important to identify and overcome these specific barriers[26].

One barrier on the practitioners' side is that they play a gatekeeping role in electronic treatment forms[27]. Even if physicians consider health apps to be helpful[28], integration of health apps in their daily work is slow[29]. Although many patients are eager to try health apps[30] health professionals recommend them seldom[31,32]. One potential reason is their moderate acceptance of eHealth[33]. There is ample evidence that acceptance is an important prerequisite to implementing new technologies in practice[34,35]. Across studies, an important factor influencing acceptance (respective the intention to apply new technology) is performance expectancy[33,36–39].

To increase acceptance, acceptance-enhancing video interventions have proven to be effective in patients and health practitioners[34,40,41]. However, not all investigations proved able to increase practitioners' acceptance[42,43], suggesting that the educational videos' presentation and content are relevant[34].

Since previous research mainly investigated eHealth in general focusing on internet interventions, little is known about the acceptance of mobile health apps. The main aims of this study was to assess physicians' acceptance of health apps and to increase their acceptance, performance expectancy and credibility thereof via a short video intervention. Our further aim was to identify variables that influence physicians' acceptance of health apps for chronic pain. To the best of our knowledge, this is the first experimental study assessing and modifying physicians' acceptance of health apps in the context of chronic pain.

METHODS

Study Design

The present study is a web-based randomized experimental trial with a parallel-group design. Self-rating questionnaires were used to assess pre- and post-intervention outcomes. The study was preregistered with the Open Science Framework on 12/17/2020 (Trial Registration Number: https://osf.io/x693r). All study participants gave their informed consent. The survey was approved by the Ethics Committee of Philipps University of Marburg (reference 2020-72k-2). The survey took an average 14 minutes to complete. Measurements were collected online via the software platform Unipark (Enterprise Feedback Suite survey, version Fall 2020, Questback). Randomization was performed by the software used. All procedures complied with the German Psychological Society's ethical guidelines.

Participants

Data collection was between December 2020 and April 2021. The sample size was determined using an a priori power analysis with G*Power version 3.1.9.3[44]. We based our calculation on expecting a small effect between groups (expected f = .16; power = .8; alpha error probability of .05), resulting in a necessary sample size of 230. Because we assumed a 10% dropout rate, we planned to survey 253 subjects. While 354 people expressed interested to participate, 257 participants completed the questionnaires at post-intervention, yielding a completer rate of 73% (Figure 1). Inclusion criteria were being employed as a physician and sufficient knowledge of the German language. Study participants were collected online through their practices, hospitals, and medical communities. We also investigated a sample of 101 medical students.

[Please insert figure 1 about here]

Measures

Primary Outcome

Acceptance of the Unified Theory of Acceptance and Use of Technology model (UTAUT)[35] was our primary outcome. Acceptance according to the UTAUT model is conceived as the intention to use (new) technologies. The three acceptance items (table 1) were added together as a cumulative score, giving a range of 3 – 15. To make our data easier to interpret, we considered values as low (3 – 6), moderate (7 – 11) and high (12 – 15). This classification is similar to other studies[33,34].

Secondary Outcomes

Performance expectancy of the UTAUT model was our secondary outcome. It was surveyed by means of 3 items (Table 1). Performance expectancy is conceptualized as the expectation that an intervention will be beneficial.

An additional secondary outcome was the credibility of health apps, which we assessed via the credibility/expectancy questionnaire (CEQ)[45]. The credibility scale (e.g., *"How logical does the medical use of health apps for chronic pain seem to you?"*), includes 3 items and asks about treatment credibility on a 9-point response scale (ranging from 1 = not at all useful to 9 = very useful).

Primary and secondary outcomes were measured both before and after the intervention. With our medical student cohort, only the primary and secondary outcomes were assessed.

Predictors of acceptance

Predictors of acceptance were examined. For this purpose, we used the baseline variable of acceptance as dependent variable and multiple predictors as independent variables (see Statistical Analysis).

Socio-demographic variables included age, gender and field of specialization. All of the following items had to be slightly adapted for the purposes of this study.

We assessed the four main constructs of UTAUT model[35]. The UTAUT model is an established model which states that the four constructs performance expectancy; effort expectancy; facilitating conditions; and social influence have an effect on the acceptance and intention to use (new) technologies. The scales consist of statements (table 1) that can be agreed to using a 5-point response scale (answers ranging from 1 = totally disagree to 5 = totally agree). Higher values indicate a higher level of the construct. Items were adapted from different studies[40,46,47].

From the Attitudes toward Psychological Online Interventions questionnaire (APOI)[48], we used the scepticism and perception of risks scale, which contains 4 statements (e.g., *"It is difficult for patients to effectively integrate health apps into their daily lives."*) that can be agreed on a 5-point scale (ranging from 1 = totally agree to 5 = totally disagree). We excluded 1 item because its content did not fit the survey *("By using a POI [Psychological Online Interventions], I do not receive professional support.")*.

Openness (e.g., *"I would use new treatments to help my patients."*) and intuitive appeal (e.g., *"If you learned about a new health app, how likely would you be to use it if it appealed to you intuitively?"*) were assessed with the Evidence-based Practice Attitude Scale-36 (EBPAS)[49]. The EBPAS measures difficulties and supportive factors in implementing evidence-based treatment approaches with sound psychometric scores. Both scales consist of 4 statements or questions that can be agreed to on a 5-point scale (ranging from 0 = not at all to 4 = to a very great extent).

Table 1 UTAUT Items.

UTAUT Scale	**Items**
Acceptance	1. I can basically imagine prescribing a health app. 2. I would prescribe health apps regularly. 3. I would recommend health apps to colleagues.
Performance Expectancy	1. Using health apps would improve the effectiveness of my work. 2. Using health apps would help me in my work and increase my productivity. 3. Overall, health apps would help me treat my patients.
Effort Expectancy	1. Using health apps would be easy. 2. Using health apps would be easy for me. 3. The use of health apps would be clear and understandable to me.
Social Influence	1. Colleagues would advise me to use health apps. 2. My supervisors and/or experienced colleagues would recommend that I use health apps.
Facilitating Conditions	1. I would get support for technical problems with health apps. 2. I have the necessary technical skills to use health apps.

Notes. Items are adapted from[40,46,47].

Intervention

The CG watched a video providing general information about chronic pain (e.g., prevalence and costs for the health care system). The EG watched a video that discussed the content of health apps (e.g., how they can be used, and the results of recent studies). Both videos were matched in terms of length and visuals (Figure 2). Skipping the video was not possible due to the survey software. We produced the video with the commercial software Powtoon (2012–2021 Powtoon Limited). A professional narrator recorded the audio track. An English translation of the spoken text is in the supplementary material.

[Please insert figure 2 about here]

Statistical Analysis

We used the 26th version of IBM SPPS Statistics software for statistical analyses. There were no missing data due to the software (participants had to answer all questions to get to the next page). For all analyses, we used a type-1 error level of 5%.

Both Mahalanobis distance and Cook's distance were used to detect multivariate outliers[50]. According to the suggestion of Pituch and Stevens (2016), univariate outliers were calculated using standardized values[50]. We checked data for plausibility before exclusion. In addition, we checked subjects' comments at the end of the survey for possible bias.

To detect any differences between baseline values, we conducted a multivariate analysis of variance (MANOVA) for age; APOI; EBPAS; CEQ; and the UTAUT variables. Gender differences via Chi square test.

The video's influence on our primary and secondary outcomes was assessed via a 2 (condition) x 2 (time) repeated measures analysis of variance (ANOVA). Partial eta squared was used as the effect size measure, as suggested by Richardson (2011). Effect sizes were classified according to Richardson[51] based on Cohen[52]. To reduce inflation of the alpha error, we applied Bonferroni correction to secondary outcomes[53].

The variables influencing health apps' acceptance were calculated using linear regression, in which we added predictor groups blockwise: first, demographic variables (age; gender; daily smartphone time; professional smartphone use in a working context). The APOI, EBPAS, and CEQ scales were then added. Last, the four UTAUT predictors were added to the model. Acceptance from the pre-measurement was the dependent variable[33]. Because of the large number of predictors and resulting overestimation of R^2, we referred to an adjusted R^2 as the outcome[54].

Patient and public involvement

No patient involved.

RESULTS

Sample Characteristics

After inspecting the data, there was one exclusion because the subject said that he had filled in the questionnaires arbitrarily. 8 subjects were excluded because they had stated "psychological psychotherapist" as their specialist direction, which in Germany indicates that they were not physicians but psychologists. This reduced our sample to 248 (38.71%

female) (n_{EG}=124; n_{CG}=124). The average age was 49.56 years (*SD*=11.51). There were no baseline differences between conditions. The most common fields of specialization were general practitioners (89); surgeons (39); anesthesiologists (29); neurologists and psychiatrists (23). Acceptance levels at baseline across both conditions were moderate (*M*=9.51, *SD*=3.53) with 21.4% in the low range, 47.1% in the moderate range, and 31.5% in the high range. See table 2 for a complete list of specialty directions, additional demographic variables as well as pre-values of the baseline measures.

Table 2 Demographic characteristics.

Variables	**Experimental Group**	**Control Group**
Age	49.65 ± 11.57	49.47 ± 11.49
Number (% female)	124 (35.50)	124 (41.90)
Professional environment (%)		
Outpatient	89 (71.8)	77 (62.1)
Inpatient	30 (24.2)	33 (26.6)
Other	5 (4.0)	14 (11.3)
Medical Specialty (%)[a]		
General medicine	49 (39.5)	40 (32.3)
Surgery	17 (13.7)	22 (17.7)
Neurology	17 (13.7)	6 (4.8)
Anesthesiology	11 (8.9)	18 (14.5)
Orthopedics	6 (4.8)	8 (6.5)
Pediatrics	5 (4)	8 (6.5)
Other	19 (15.4)	22 (17.7)
CEQ		
Credibility	5.28 ± 1.78	5.14 ± 1.96
APOI		
Scepticism and Perception of Risks	2.66 ± 0.74	2.68 ± 0.81
EBPAS		
Openness	3.65 ± 0.87	3.66 ± 0.93
Intuitive Appeal	3.64 ± 0.88	3.57 ± 0.93
UTAUT		
Acceptance	9.73 ± 3.33	9.30 ± 3.72
Performance Expectancy	8.60 ± 3.00	8.30 ± 3.10
Effort Expectancy	11.03 ± 2.47	10.73 ± 2.42
Social Influence	5.80 ± 2.10	5.40 ± 1.95
Facilitating Conditions	7.60 ± 1.71	7.48 ± 1.95

Notes. Values represent averages (± standard deviation), frequency or percentages; CEQ=credibility/expectancy questionnaire (range: 1-9); APOI=Attitudes toward Psychological Online Interventions questionnaire (range:1-5); EBPAS=Evidence-based Practice Attitude Scale-36 (range: 0-4); UTAUT=Unified Theory of Acceptance and Use of Technology (Acceptance, Performance Expectancy, Effort Expectancy range: 3-15, Social Influence and Facilitating Conditions range 2-10); [a]Only those medical specialties are listed that were represented by more than 5% in one of the two groups.

Primary Outcome

Our subjects' acceptance was increased by means of the video (significant main effect of time (F(1, 246)=15.28, p<.001, η^2_p=.06)). Further subjects of the EG showed higher increases than those of the CG (significant time x condition interaction (F(1, 246)=15.28, p=.01, η^2_p=.02)). After the intervention, the EG (M=10.51, SD=3.28) had higher post-acceptance scores than the CG (M=9.48, SD=3.57) (t(246)=-2.37, p=.01). Figure 3 shows a comparison between the medical student sample and the physicians.

[please insert figure 3 about here]

Secondary Outcomes

Performance expectancy could also be increased by the video (main effect of time (F(1, 246)=66.85, p<.001, η^2_p=.21)). Again, the increase was higher in the EG than in the CG (significant time x condition interaction (F(1, 246)=6.10, p=.01, η^2_p=.02)). The EG (M=9.94, SD=3.16) had higher post-performance expectancy scores than the CG (M=9.02, SD=3.34) (t(246)=-2.23, p=.01).

We found the same pattern of results for credibility. It was increased by the video (significant effect of time (F(1, 246)=64.47, p<.001, η^2_p=.21), with a higher increase in the EG (significant time x condition interaction (F(1, 246)=25.61, p<.001, η^2_p=.09)). Post values of the EG (M=6.07, SD=1.87) were higher than those of the CG (M=5.31. SD=2.14) (t(246)=-2.95, p=.002). Figure 4 shows a comparison between the medical student sample and the physicians in terms of credibility.

[Please insert figure 4 about here]

The medical students' pattern of results was identical to those illustrated above (see (supplementary material for a detailed presentation of results and demographic variables). The time x condition interaction effect for acceptance had an effect size of η^2_p=.13 (Figure 2); for performance expectancy an effect size of η^2_p=.09; and for credibility an effect size of η^2_p=.21 (Figure 3).

Predictors of acceptance

Linear regression with the predictors from the first block was significant (R^2_{adj}=.14, F(4, 242)=11.01, p<.001). Age (β=-.23, p=.001), gender (β=-.04, p=.54), daily smartphone time (β=.14, p=.05), and smartphone use in a professional context (β=.20, p=.002) were related to acceptance.

The model improved when we added the second block with APOI, EBPAS as well as CEQ scales (R^2_{adj}=.70, F(9, 237)=64.14, p<.001). Credibility (β=.51, p<.001) was the strongest predictor followed by skepticism (β=-.23, p<.001) and intuitive appeal (β=.13, p=.01). None of the predictors from the first block were significant.

The model improved marginally after adding the UTAUT variables (R^2_{adj}=.73, F(13, 233)=51.95, p<.001). Again, credibility was the best predictor (β=.34, p<.001), followed by performance expectancy (β=.30, p<.001), skepticism (β=-.18, p<.001) and intuitive appeal (β=.11, p=.03). None of the other predictors were significant.

DISCUSSION

The current study is the first to explicitly investigate physicians' acceptance of health apps focusing on chronic pain. Our results complement preceding studies by adding the physicians' perspective within an outpatient setting. The main aims of this study were to survey physicians' current acceptance of health apps for patients with chronic pain and to increase their acceptance. In general, physicians' and medical students' acceptance for health apps was moderate, which indicates a higher openness than previous studies[33]. The experimental intervention successfully increased acceptance, performance expectancy and credibility of health apps among physicians and medical students. Our additional study aim was to identify variables that influence acceptance. Credibility and performance expectancy were the strongest predictors of acceptance, followed by skepticism and intuitive appeal.

We found that our physicians' moderate acceptance of health apps was higher than that reported in previous studies: A survey conducted between 2015 and 2016 among various health care professionals observed rather low acceptance rates for electronic health interventions[33]. According to a recent study, psychotherapists exhibited mixed acceptance of blended care (a combination of internet and mobile base interventions and face-to-face therapy)[34]. However, the aforementioned study was conducted several years ago and perceptions of eHealth may have changed in the meantime. In particular, the COVID-19 pandemic may have influenced opinions about electronic health interventions[55]. Also, unlike the studies mentioned above, we specifically asked about health apps in our survey.

Our results indicate that brief educational videos may be an effective acceptance-facilitating intervention for physicians. Results from acceptance-enhancing interventions in other studies were inconclusive. Some researchers demonstrated positive effects[34], while others identified no effects[42,43]. Most researchers employed video interventions to increase acceptance toward eHealth interventions in general (e.g. online interventions) but not by focusing on apps in particular. Another potential explanation of our positive findings is the specific focus on chronic pain, as the perceived usefulness of e- and mHealth interventions could be disorder-specific. In addition to the content, the presentation's format could also be important, as aesthetics contribute to the credibility of information[56]. One advantage of the current study is that we applied professional software to develop an appealing video that might be more convincing.

However, the higher effect sizes of the student sample lead us to cautiously conclude that the intervention may be more effective with students. Young professionals thus appear to be more receptive to interventions promoting the acceptance of health apps. Since high acceptance does not automatically lead to action[57], long-term studies examining the actual use of health apps among (prospective) physicians would be worthwhile.

The strong association we detected between performance expectancy and acceptance is in line with other research findings. Across studies, performance expectancy has consistently proven to be one of the most important predictors of acceptance of new technologies in the healthcare sector[33,38]. This strong association between performance expectancy and acceptance suggests that physicians' acceptance can be increased by highlighting the benefits of health apps for their patients and themselves. This is also supported by a study which found that physicians are more likely to use mobile devices with drug reference software if they believe it will help their patients[58]. In contrast to Hennemann and colleagues[33], we found no impact of social influence on acceptance, nor did we find any influence of facilitating conditions as Liu and colleagues did[38]. Note that the subjects in those two studies were surveyed in inpatient settings. We mainly surveyed physicians in an outpatient setting. Accordingly, our physicians were probably relying less on their employer's facilitation because they are often self-employed. The same might apply to social support: Medical practices employ much less staff than hospitals, a fact that may have contributed to this construct being less significant in this survey. Additionally, it is worth mentioning that the two studies above did not specifically survey acceptance towards health apps and that they were conducted a few years ago. The relevance of certain constructs like facilitating conditions may have lessened since then.

The association we found between credibility and acceptance also concurs with previous research findings. A study with college students concluded that credibility influences the perceptions of health apps positively[59]. The credibility of new technologies in the healthcare field is important[60] as it increases the likelihood that the technology will be used in the short and long term[61,62]. Accordingly, the low prescription rates (or the paucity of recommendations) of health apps by physicians could be partly attributable to their lack of credibility. One potential reason for this is the low quality of many health apps on the market[63]. Important to the credibility of information about new electronic health measures is the source of the information. Websites controlled by editors are perceived to be more credible, as is information from independent medical experts[64]. Because the source of the material appears to be more important than its design[65], independent research institutes can play an important role in disseminating evidence-based information about electronic health care interventions. By including highly visible videos on their websites, they could increase both the acceptance and awareness of health apps. Our results indicate that such an approach holds particular promise for medical students, highlighting the call for establishing eHealth curricula in education[60,66].

Technological influences will continue to make strong inroads into medicine[67], which requires that health care professionals are able to adapt new technologies flexibly. Especially considering the rapid technological progress in this area, the evidence from earlier studies and from ours provide valuable information about the importance of communicating with physicians, psychotherapists, and other professional groups in the health care sector about eHealth in general and health apps in particular. Video interventions can be an effective and cost-saving means of communicating the potential, opportunities, and limitations of these new technologies. They reach the target group at a low threshold, for example, by being included on informational websites, newsletters or at training courses. This informational material should emphasize both performance expectancy and the credibility of the intervention being addressed.

Limitations

Our study has some limitations. First, there may have been a selection bias due to the data collection method. Thus, physicians who were already open and interested in mHealth may have participated, which would restrict the generalizability of our results. Furthermore, our results relied solely on self-reporting. Most of our items were adaptations of already tested items or scales on questionnaires. This approach was necessary due to the lack of appropriate health app-specific questionnaires, but it remains a limitation. Because of the survey's brevity, we could not collect many other potentially relevant constructs like the technologization threat[48] or motivation. As acceptance due to self-regulatory deficits[68] does not guarantee that intention becomes an action in the future[57], longitudinal surveys to examine whether video interventions increase the actual recommendations or prescriptions of the respective technologies should be one of the next steps in research.

Strengths

To our knowledge, this is the first study that investigated and increased the acceptance by physicians of health apps for managing chronic pain. This professional group is of particular interest due to the gatekeeper role they play in the healthcare system.

Furthermore, we based the UTAUT questionnaires on predecessor studies, to increase comparability. In addition, we engaged a strong control group whose intervention was time-wise, visually, and audibly identical to the intervention video. Despite the brevity of the survey and our strong control group, we identified a superior effect of the intervention video. The video intervention was very short and can be integrated at a low-threshold within different platforms.

Conclusion

Our results show that physicians are open to using health apps for chronic pain patients as they demonstrated moderate to high acceptance rates. Our study also shows that performance expectancy and credibility had the strongest influence on acceptance. As low-threshold entities, brief video interventions are useful tools that can strengthen these constructs and reach a high number of health professionals. They can thus be helpful in overcoming certain barriers to implementing mobile health interventions in clinical practice. Future studies should focus on the long-term behavioral effects of such interventions.

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Disclosure of Interest

None declared.

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Author Contributions

HJH, JAG, WR, JR: Conception and design of the study; HJH: data collection, analysis, and interpretation, manuscript preparation; JAG, WR, JR: supervision, manuscript editing and reviewing; JR: project administration. All authors approved the final manuscript.

Data sharing statement

Data can be shared upon reasonable request. A request can be made to the corresponding author.

Legends of the figures

Figure 1 Flowchart.

Figure 2 Screenshots of the video interventions. Left: Experimental video; Right: Control video.

Figure 3 Level of acceptance. Left: Physicians; Right: Medical students; EG=Experimental Group; CG=Control Group; pre=Measurement before the video; post=Measurement after the video; Error bars indicate standard errors; * $p < .05$; ** $p < .005$.

Figure 4 Level of credibility. Left: Physicians; Right: Medical students; EG=Experimental Group; CG=Control Group; pre=Measurement before the video; post=Measurement after the video; Error bars indicate standard errors; ** $p < .001$.

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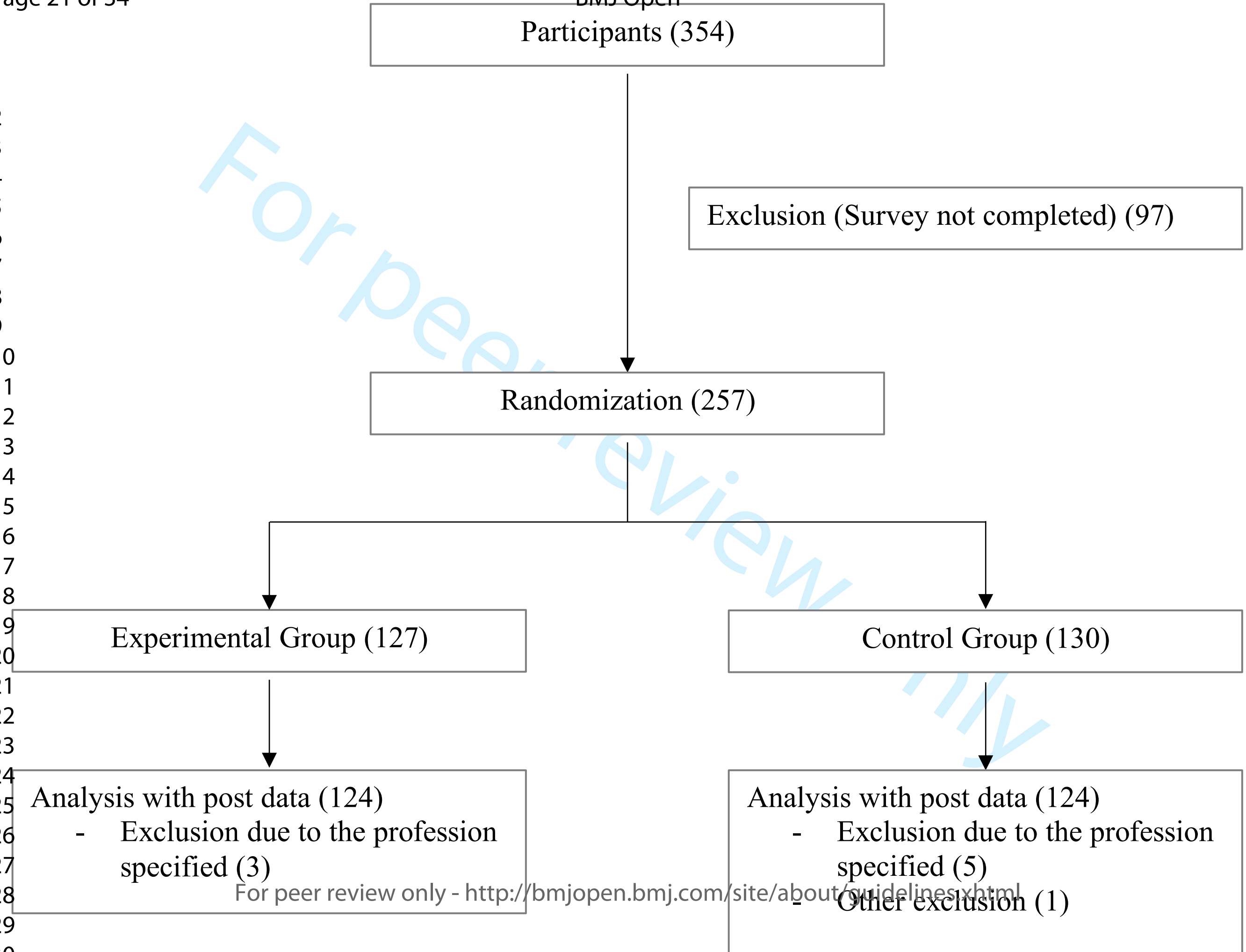
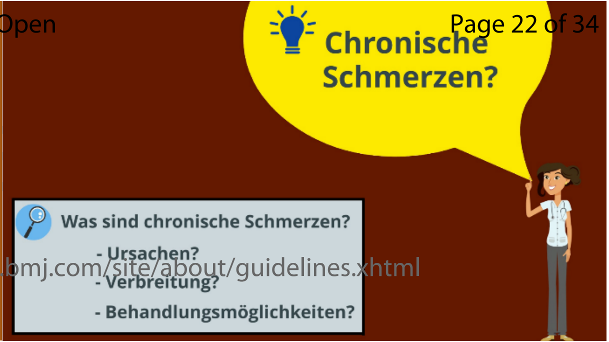
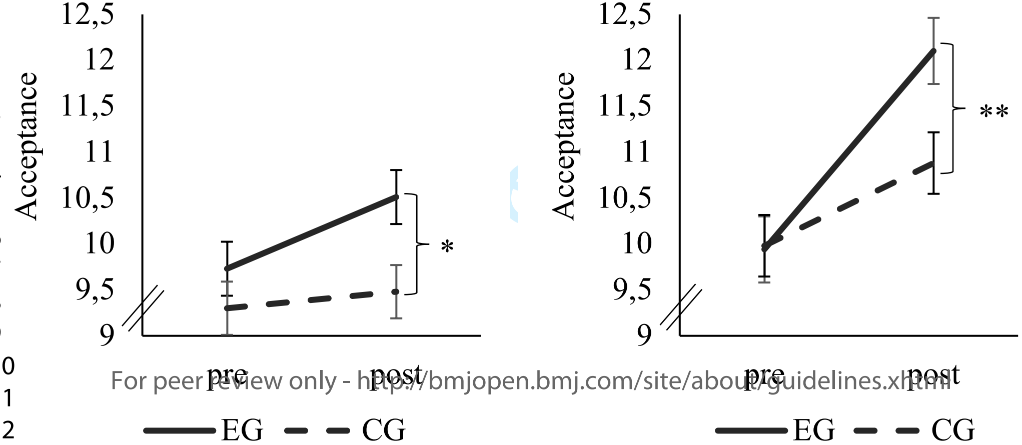

Participants (354)
Exclusion (Survey not completed) (97)
Randomization (257)
Experimental Group (127)
Control Group (130)
Analysis with post data (124)
- Exclusion due to the profession specified (3)
Analysis with post data (124)
- Exclusion due to the profession specified (5)
- Other exclusion (1)


Gesundheits-
Apps?!
Was sind Gesundheit-Apps?
Nutzen von Gesundheits-Apps?
Wissenschaftsstand zu ihnen?


Chronische
Schmerzen?
Was sind chronische Schmerzen?
- Ursachen?
- Verbreitung?
- Behandlungsmöglichkeiten?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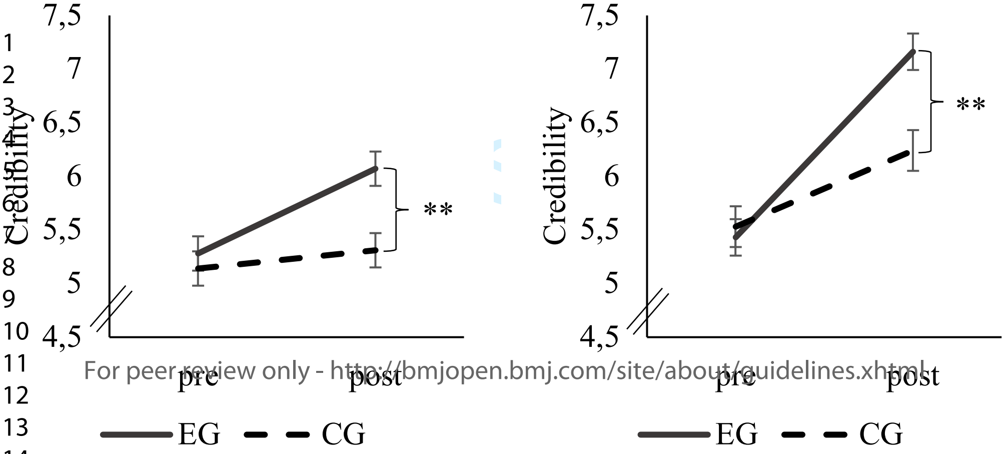
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SUPPLEMENTARY MATERIAL

Transcripts and English translations of the video interventions

German transcript of the health app-video

Seite 0
Gesundheits-Apps für chronische Schmerzpatient*innen

Seite 1

In diesem Video geht es um Gesundheits-Apps für chronische Schmerzpatient*innen. Darum, was sie sind, welchen Nutzen Patient*innen aus ihnen ziehen können und wie der aktuelle Wissenschaftsstand zu ihrer Wirksamkeit aussieht.

Seite 2
Ende des Jahres 2019 trat das „Digitale Versorgungs-Gesetz" in Kraft. Es ermöglicht Ärztinnen und Ärzten ihren Patient*innen zertifizierte Gesundheits-Apps auf Rezept zu verschreiben.

Seite 3
Das Einsatzgebiet von Gesundheits-Apps ist vielfältig.

Sie können etwa nach einem klinischen Aufenthalt zur Nachsorge oder in der ambulanten Versorgung als Therapiebegleitung eingesetzt werden.

Gerade bei chronischen Schmerzen erscheinen Gesundheits-Apps sinnvoll. Sie stehen Patient*innen jederzeit bei der Bewältigung ihrer Beschwerden zur Verfügung und können beispielsweise bei einem Schmerzschub direkt zur Hand genommen werden.

Seite 4
Ziele solcher Apps sind vor allem der Aufbau und die Aufrechterhaltung von Bewältigungsstrategien für den Umgang mit Schmerzen.

Sie können Patient*innen dabei unterstützen, hinsichtlich ihrer Gesundheitsziele am Ball zu bleiben und ihre mit ihrer Ärztin oder ihrem Arzt vereinbarten Vorsätze zu erreichen. Das kann mittels einer Erinnerungsfunktion, aufgestellten Bewegungsplänen oder ähnlichen geschehen.

Weiterhin können Schmerztagebücher geführt werden, die Patient*in und Behandler*in einen visuellen Überblick über den Schmerzverlauf geben.

Darüber hinaus helfen Gesundheits-Apps Patient*innen dabei, körperliche Übungen durchzuführen – beispielsweise mit unterstützenden Videos.

Sie können auch einen Überblick über die aktuelle Medikation geben. Ebenfalls hilfreich sind vertiefende Hintergrundinformationen, geleitete Entspannungsverfahren oder eine Schritt für Schritt durchgeführte gedankliche Neubewertung der Schmerzsymptome.

Seite 5
Mittlerweile gibt es eine ganze Reihe von Studien, die sich mit der Wirksamkeit von Gesundheits-Apps befasst haben.

Seite 6

Bereits 2013 zeigten Parker und Kollegen, dass auch ältere, technisch weniger versierte, Patient*innen an der Nutzung von Gesundheits-Apps zur Unterstützung ihrer Krankheitsbewältigung interessiert sind.

Seite 7

Eine Studie aus Norwegen zeigt, dass Patient*innen, die zusätzlich zur ärztlichen Behandlung eine Smartphone-Intervention nutzten, ihre chronischen Schmerzen eher akzeptieren können und weniger negative Gedanken ihnen gegenüber haben.

Seite 8

Toelle und Kollegen zeigten 2019, dass die Behandlung mit einer Gesundheits-App zu einer geringeren Schmerzintensität führt.

Seite 9

Weitere Studien zeigen, dass Patient*innen, die zusätzlich zu ihrer Behandlung Gesundheits-Apps nutzen, zufriedener mit ihrer Behandlung sind… ihren Alltag aktiver gestalten… und ein effektiveres Selbstmanagement haben.

Seite 10

Neben diesen Ergebnissen gibt es viele weitere Studien, die sich mit Gesundheits-Apps auseinandersetzen und unser Wissen zu diesem Thema erweitern.

Seite 11

Auch wenn es weiterer Forschung bedarf, um das Wirksamkeitspotential von Gesundheits-Apps abschließend einschätzen zu können, sind die bisherigen Studienergebnisse sehr vielversprechend.

Wichtig dabei ist, dass Apps in eine Behandlung eingebunden werden und diese nicht ersetzen sollen.

Ist das gegeben können Apps eine wertvolle Therapiebereicherung sein.

English translation

Page 0

Health apps for chronic pain patients

Page 1

This video is about health apps for chronic pain patients: what they are, how patients can benefit from them, and what the current state of science is regarding their effectiveness.

Page 2

At the end of 2019, the "Digital Care Act" came into force. It enables doctors to prescribe certified health apps to their patients.

Page 3

Health apps can be used in a variety of ways.

For example, they can be used after a clinical stay for follow-up care or in outpatient care as therapy support.

In the case of chronic pain in particular, health apps seem to be useful. They are available to patients at any time to help them cope with their symptoms and can, for example, help immediately in the event of a pain attack.

Page 4

The main aim of such apps is to establish and maintain coping strategies for dealing with pain.

They can help patients stay on track with their health goals and achieve the resolutions they have agreed on with their doctor. This can be done via a reminder function, established exercise plans, or similar.

Furthermore, pain diaries can be used to give patients and doctors a visual overview of their patient's pain course.

In addition, health apps help patients do physical exercises - for example, through supporting videos.

They can also provide an overview of current medication. Other helpful features include in-depth background information, guided relaxation procedures, or a step-by-step mental re-evaluation of pain symptoms.

Page 5

Quite a few studies have investigated the effectiveness of health apps.

Page 6

As early as 2013, Parker and colleagues showed that older, less tech-savvy patients are interested in using health apps to assist with their disease management.

Page 7

A study from Norway showed that patients who used a smartphone intervention in addition to medical treatment were more likely to accept their chronic pain and have fewer negative thoughts about it.

Page 8

Toelle and colleagues showed in 2019 that treatment with a health app led to lower pain intensity.

Page 9

Other studies show that patients who use health apps in addition to their treatment are more satisfied with their treatment... are more active in their daily lives... and have more effective self-management.

Page 10

In addition to these findings, many other studies have addressed health apps and deepened our knowledge on this topic.

Page 11

Although more research is needed to conclusively assess the potential effectiveness of health apps, the study results to date are very promising.

It is important to note that apps should be integrated within treatment and not replace it.

If that is the case, apps can be a valuable supplement to therapy.

German transcript of the control-video

Seite 0
Chronische Schmerzen

Seite 1

In diesem Video geht es um chronische Schmerzen: Was sie sind und welche Ursachen sie haben; wie stark ihre Verbreitung in der Bevölkerung ist und welche Behandlungsmöglichkeiten es gibt.

Seite 2

Von chronischen Schmerzen wird gesprochen, sobald man länger als 6 Monate anhaltende Schmerzen hat.

Chronische Schmerzen können in allen Körperregionen entstehen. Mit Abstand am häufigsten treten sie jedoch im Rücken auf. Aber auch chronische Kopf- oder Gelenkschmerzen sind keine Seltenheit.

Seite 3

In der Bevölkerung sind chronische Schmerzen weit verbreitet:

Von 900 Patient*innen in ambulanten Arztpraxen haben 327 chronische Schmerzen – das entspricht über 36% der Patient*innen. Insgesamt leiden 12 bis 15 Millionen Menschen in Deutschland an anhaltenden oder wiederkehrenden Schmerzen. Häufig führen Schmerzen zu anhaltenden Einschränkungen ihres Arbeits- oder Privatlebens.

Gerade Rückenschmerzen stellen ein zentrales Problem dar.

Seite 4

Rückenschmerzen im Allgemeinen und chronische Rückenschmerzen im Speziellen sind der häufigste Grund für Arbeitsausfälle. Über 12% der deutschen Bevölkerung sieht sich aufgrund ihrer Rückenschmerzen in ihrer Lebensführung eingeschränkt.

Diese Zahlen machen chronische Rückenschmerzen zur teuersten Krankheit der westlichen Industrieländer.

Rückenschmerzen sind also im wortwörtlichen Sinne das Volksleiden Nummer 1 – und das obwohl die körperliche Belastung der Arbeitnehmer*innen immer geringer wird.

Seite 5

Zur Diagnostik chronischer Schmerzen verwendet man unter anderem spezifische Schmerzfragebögen, die die Schmerzintensität, -qualität und -lokalisation erfassen. Weiterhin wird erhoben, wie stark die Beeinträchtigung in der alltäglichen Lebensführung durch die Schmerzen ist.

Eine gute Diagnostik ist wichtig, da chronische Schmerzen viele Ursachen haben können, wie zum Beispiel:

Nervenschädigungen; Veränderungen in der knöchernen Struktur; psychische Belastungen; Entzündungen; muskuläre Prozesse und weitere.

Seite 6

Abgesehen davon, dass chronische Schmerzen ein hohes Maß an körperlichen Unbehagen verursachen, können sie entsprechend ihrer vielseitigen Ursachen, sehr unterschiedliche psycho-soziale Folgen haben.

Diese reichen von einem andauernden Gefühl der körperlichen Unsicherheit; Einschränkungen der Bewegungsfreiheit und des Autonomiegefühls bis hin zu einem verringerten Selbstwert- oder Kontrollgefühl. Auch Schlafstörungen sind eine häufige Folge chronischer Schmerzen.

Aufgrund des hohen Leidensdruck betroffener Patient*innen, ist eine gut eingebundene Behandlung der Schmerzen von hoher Wichtigkeit.

Seite 7

Ganz allgemein wird eine multimodale Behandlung empfohlen, also eine Behandlung die von verschiedenen Gruppen von Behandler*innen durchgeführt wird.

Ärzt*innen untersuchen dabei, welche körperlichen Ursachen die Schmerzen erklären können und stehen Patient*innen für die medizinische Behandlung zur Seite.

Physiotherapeut*innen können Bewegungsübungen mit den Patient*innen einüben, die sie im Alltag z. B. mobiler machen können.

Und Psychotherapeut*innen erarbeiten Möglichkeiten, die Lebensqualität der Schmerz-Patient*innen zu verbessern.

Die Therapiekonzepte für die Behandlung chronischer Schmerzen haben sich in den letzten Jahren stetig weiterentwickelt. Die multimodale Einbindung der Patient*innen in die unterschiedlichen Behandlungsgruppen bleibt aber ein zentrales Konzept.

English translation

Page 0

Chronic pain

Page 1

This video is about chronic pain: what it is and what causes it; how prevalent it is in the population; and what treatment options are available.

Page 2

Chronic pain is defined as pain that lasts longer than 6 months.

Chronic pain can occur in all regions of the body. However, it occurs by far most frequently in the back. But chronic headaches and joint pain are not uncommon either.

Page 3

Chronic pain is widespread in the population:

Out of 900 patients* in outpatient medical practices, 327 have chronic pain - this corresponds to over 36% of patients. In total, 12 to 15 million people in Germany suffer from persistent or recurring pain. Pain often leads to persistent restrictions in their work or private life.

Back pain in particular is a major problem.

Page 4

Back pain in general and chronic back pain in particular are the most common reason for lost work days. More than 12% of the German population feels that their lifestyle is restricted because of their back pain.

These figures make chronic back pain the most expensive disease in Western industrialized countries.

Back pain is therefore literally the number one health problem among the population - despite the fact that the amount of physical strain on employees keeps dropping.

Page 5

To diagnose chronic pain, specific pain questionnaires are used that record pain intensity, quality and location. The extent to which the pain interferes with everyday life is also assessed.

A good diagnosis is important, because chronic pain can have many causes, such as:

nerve damage, anomalies in the bony structure, psychological stress, inflammation, muscular processes, etc.

Page 6

Apart from the fact that chronic pain causes such physical discomfort, it can have very different psycho-social consequences according to its multifaceted causes.

These range from a persistent feeling of physical insecurity; restrictions in freedom of movement and sense of autonomy; to a diminished sense of self-worth or control. Sleep disturbances are also a frequent consequence of chronic pain.

Due to the high level of suffering of affected patients, well-integrated pain therapy is essential.

Page 7

In general, a multimodal treatment is recommended, i.e. a treatment carried out by different groups of practitioners.

Physicians investigate the physical causes of the pain and assist patients with medical treatment.

Physiotherapists can practice movement exercises with patients that can enhance their mobility in everyday life, for example.

And psychotherapists work out ways to improve the quality of life of pain patients.

Therapy concepts for treating chronic pain continue to develop. However, the multimodal integration of patients within various treatment groups remains a central concept.

SUPPLEMENTARY MATERIAL

Student results

Student demographic characteristics

Demographic data of the students can be found in table 3.

Table 3. Demographic characteristics of the student sample

Variables	Experimental Group	Control Group
Age	23.53 (3.10)	23.37 (2.91)
Number (% female)	49 (73,47)	52 (76,92)
Study time in years	3.00 (1.69)	2.99 (1.49)

Results of the repeated-measures ANOVA among students

Acceptance

Student's acceptance could be increased as a result of the video. The 2 x 2 ANOVA revealed a significant main effect of time ($F(1, 99)=88.95$, $P<.001$, $\eta^2_p=.48$) as well as a significant time x condition interaction ($F(1, 99)=15.17$, $P<.001$, $\eta^2_p=.13$). There was no significant main effect of condition ($F(1, 99)=1.61$, $P=.21$, $\eta^2_p=.02$). Table 4 shows the descriptive values of the sample.

Table 4. Descriptive representation of the acceptance values.

Measurement time	Condition	M^a	*SD*
Pre values	EG	9.94	2.54
	CG	9.98	2.42
Post values	EG	12.10	2.24
	CG	10.88	2.62

Notes. [a]Values range between 3 and 15; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

Performance Expectancy

We found a similar pattern of results for performance expectancy. There was a significant effect of time ($F(1, 99)=81.96$, $P<.001$, $\eta^2_p=.45$) and a significant time x condition interaction ($F(1, 99)=10.14$, $P=.002$, $\eta^2_p=.09$). The main effect of condition got not significant ($F(1, 99)=1.17$, $P=.28$, $\eta^2_p=0.1$). Table 5 shows the descriptive values of the sample.

Table 5. Descriptive representation of the performance expectancy values.

Measurement time	**Condition**	***M***[ab]	***SD***[c]
Pre values	EG[d]	9.86	2.57
	CG[e]	9.98	2.26
Post values	EG	12.14	2.02
	CG	11.08	2.61

Notes. [a]Values range between 3 and 15; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

Credibility

The pattern of results for credibility reflects the above as well. We found a significant main effect of time ($F(1, 99)=149.72$, $P<.001$, $\eta^2_p=.60$) and a significant time x condition effect ($F(1, 99)=25.99$, $P<.001$, $\eta^2_p=.21$). We found no significant main effect of condition ($F(1, 99)=2.45$, $P=.12$, $\eta^2_p=.02$). Table 6 shows the descriptive values of the sample.

Table 6. Descriptive representation of the credibility values.

Measurement time	**Condition**	***M***[ab]	***SD***[c]
Pre values	EG[d]	5,43	1,48
	CG[e]	5,53	1,37
Post values	EG	7,16	1,26
	CG	6,24	1,44

Notes. [a]Values range between 1 and 10; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	1
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	3
	2b	Specific objectives or hypotheses	3
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	3
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	-
Participants	4a	Eligibility criteria for participants	3
	4b	Settings and locations where the data were collected	3
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	5
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	3
	6b	Any changes to trial outcomes after the trial commenced, with reasons	-
Sample size	7a	How sample size was determined	3
	7b	When applicable, explanation of any interim analyses and stopping guidelines	-
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	2
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	-
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	2
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those	-

		assessing outcomes) and how	
	11b	If relevant, description of the similarity of interventions	4
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	6
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	6
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	6
	13b	For each group, losses and exclusions after randomisation, together with reasons	6
Recruitment	14a	Dates defining the periods of recruitment and follow-up	2
	14b	Why the trial ended or was stopped	-
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	6
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	2
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	7
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	-
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	-
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	-
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	10
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	10
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	8
Other information			
Registration	23	Registration number and name of trial registry	2
Protocol	24	Where the full trial protocol can be accessed, if available	-
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	11

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.

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Effects of a video intervention on physicians' acceptance of pain apps: a randomized controlled trial

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Effects of a video intervention on physicians' acceptance of pain apps: a randomized controlled trial

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Abstract

Objectives

The aim of our study was to determine and enhance physicians’ acceptance, performance expectancy and credibility of health apps for chronic pain patients. We further investigated predictors of acceptance.

Design

Randomized experimental trial with a parallel-group repeated measures design.

Setting and participants

248 physicians working in various, mainly outpatient settings in Germany.

Intervention and outcome

Physicians were randomly assigned to either an experimental group (short video about health apps) or a control group (short video about chronic pain). Primary outcome measure was acceptance. Performance expectancy and credibility of health apps were secondary outcomes. In addition, we assessed 101 medical students to evaluate the effectiveness of the video intervention in young professionals.

Results

In general, physicians' acceptance of health apps for chronic pain patients was moderate (M=9.51, SD=3.53, scale ranges from 3-15). All primary and secondary outcomes were enhanced by the video intervention: A repeated-measures ANOVA yielded a significant interaction effect for acceptance ($F(1, 246)=15.28$, $p=.01$), performance expectancy ($F(1, 246)=6.10$, $p=.01$) and credibility ($F(1, 246)=25.61$, $p<.001$). The same pattern of results was evident among medical students.

Linear regression analysis revealed credibility (β=.34, $p<.001$) and performance expectancy (β .30, $p<.001$) as the two strongest factors influencing acceptance, followed by skepticism (β=-.18, $p<.001$) and intuitive appeal (β=.11, $p=.03$).

Conclusions and recommendations

Physicians’ acceptance of health apps was moderate, and was strengthened by a three minute video. Besides performance expectancy, credibility seems to be a promising factor associated with acceptance. Future research should focus on ways to implement acceptability-increasing interventions into routine care.

Trial registration: https://osf.io/x693r

Strengths and limitations of this study

- This is the first study to examine physicians´ acceptance and expectations about health apps for chronic pain.

- A strength of the study is the investigation of both practitioners and medical students as future physicians.
- The study has a strong active control group.
- A limitation is the online-only data collection, due to which a selection bias may have occurred.

INTRODUCTION

Since the Global Burden of Disease Study was first conducted in the 1990s, chronic pain has been identified as the leading cause of years lived with disability[1]. Chronic pain has various negative health consequences and adverse impacts on quality of life[2–4]. Although there are effective treatments for chronic pain[5,6], effect sizes tend to be small[7]. Further, the sustained efficacy of treatments is uncertain[8]. This is problematic, because chronic pain raises costs dramatically for health care systems[9,10] and is a significant contributor to work disability[11]. The likelihood of returning to work correlates with the duration of pain: the longer patients are out of work, the less likely they are to return to full-time employment[12,13]. Therefore, the principle for treating pain is that it should start as early as possible. However, many people, especially in rural areas, have no access to adequate pain treatment[14,15], even though it is considered a human right[16].

Electronic health (eHealth) offerings can help to alleviate these problems and provide patients with evidence-based interventions[17]. Smartphone apps, falling under the mobile health (mHealth) category, especially have great potential for both practitioners and patients[18]: First, because of the widespread use of smartphones, they can reach patients with chronic pain at a low threshold[19]. Second, they can help patients better manage their pain, for example as a treatment adjunct or in the absence of a pain expert[20–22]. Pain apps offer a wide range of application possibilities ranging from diary functions for monitoring pain to specific interventions. Two recent meta-analyses conclude that pain apps can reduce patients' pain in the long term[23] and have positive effects on depression and pain catastrophizing[24]. However, despite their positive potential, it should be mentioned that most pain apps have not been scientifically evaluated yet and privacy protection is often not sufficiently guaranteed[25]. Besides these problems, there are various other barriers to the implementation of health apps into clinical practice.

One barrier on the practitioners' side is that they play a gatekeeping role in electronic treatment forms[26]. Even if physicians consider health apps to be helpful[27], integrating health apps into their daily work is slow[28]. Although many patients are eager to try health apps[29] health professionals recommend them seldom[30,31]. One potential reason for this is their moderate acceptance of eHealth[32]. There is ample evidence that acceptance is an important prerequisite for implementing new technologies into practice[33,34].

Across studies, an important factor influencing acceptance (respective the intention to apply new technology) is performance expectancy[32,35–38].

To increase acceptance, acceptance-enhancing video interventions have proven to be effective in patients and health practitioners[33,39,40]. However, not all studies were able to increase practitioners' acceptance [41,42], suggesting that the presentation and content of educational videos are relevant[33].

Since previous research mainly investigated eHealth in general focusing on internet interventions, little is known about the acceptance of mobile health apps. The main aims of this study were to assess physicians' acceptance of health apps and to increase their acceptance, performance expectancy and credibility via a short video intervention. Our further aim was to identify variables that influence physicians' acceptance of health apps for chronic pain. To the best of our knowledge, this is the first experimental study assessing and modifying physicians' acceptance of health apps in the context of chronic pain.

METHODS

Study Design

The present study is a web-based experimental trial with a parallel-group design using simple randomization procedure. Self-rating questionnaires were used to assess pre- and post-intervention outcomes.

The study was preregistered with the Open Science Framework on 12/17/2020 (Trial Registration Number: https://osf.io/x693r). All study participants gave their informed consent. The survey was approved by the Ethics Committee of Philipps University of Marburg (reference 2020-72k-2). Completing the survey took an average of 14 minutes. Measurements were collected online via the software platform Unipark (Enterprise Feedback Suite survey, version Fall 2020, Questback). Randomization was performed within the Unipark software. All procedures complied with the German Psychological Society's ethical guidelines.

Participants

Data collection was performed between December 2020 and April 2021. The sample size was determined using an a priori power analysis with G*Power version 3.1.9.3[43]. Following a similar preceding study[33], we based our calculations on a small effect between groups (expected f=.16; power=.8; alpha error probability of .05), resulting in a necessary sample size of 230. Because we assumed a 10% dropout rate, we planned to survey 253 subjects. We recruited physicians via email distribution lists, physician networks, and emails to practices. Due to the different recruitment methods, we can only estimate the number of physicians contacted. We assume that we reached approximately 10000 physicians, of whom 354 started the survey. The response rate is comparable to a similar study[33]. 257 participants completed the questionnaires at post-intervention, yielding a completer rate of 73% (Figure 1). Inclusion criteria were being employed as a physician and sufficient knowledge of the German language. Study participants were collected online through practices, hospitals and medical communities. We additional recruited a sample of 101 medical students via Facebook groups for medical students as well as email distribution lists of medical schools.

[Please insert figure 1 about here]

Measures

Primary Outcome

Acceptance of the Unified Theory of Acceptance and Use of Technology model (UTAUT)[34] was our primary outcome. Acceptance according to the UTAUT model is conceived as the intention to use (new) technologies. The three acceptance items (table 1) were added together as a cumulative score, giving a range of 3 – 15. To make our data easier to interpret, we considered values as low (3 – 6), moderate (7 – 11) and high (12 – 15). This classification is similar to other studies[32,33]. Cronbach's alpha was .93.

Secondary Outcomes

Performance expectancy of the UTAUT model was our secondary outcome. It was surveyed by means of 3 items (Table 1). Performance expectancy is conceptualized as the expectation that an intervention will be beneficial.

An additional secondary outcome was the credibility of health apps, which we assessed via the credibility/expectancy questionnaire (CEQ)[44]. The credibility scale (e.g., *"How logical does the medical use of health apps for chronic pain seem to you?"*), includes 3 items and asks about treatment credibility on a 9-point response scale (ranging from 1=not at all useful to 9=very useful). Cronbach's alpha for the credibility scale was .91.

Primary and secondary outcomes were measured both before and after the intervention. With our medical student cohort, only the primary and secondary outcomes were assessed, but not the predictors of acceptance.

Predictors of acceptance

Predictors of acceptance were examined. For this purpose, we used the baseline variable of acceptance as dependent variable and multiple predictors as independent variables (see Statistical Analysis).

Socio-demographic variables included age, gender, daily smartphone time and smartphone use in a professional context. All of the following items had to be slightly adapted for the purpose of this study.

We assessed the four main constructs of UTAUT model[34]. The UTAUT model is an established model which states that the four constructs performance expectancy

(Cronbach's alpha of .94); effort expectancy (Cronbach's alpha of .84); facilitating conditions (Spearman's correlation of .17); and social influence (Spearman's correlation of .79) have an effect on the acceptance and intention to use (new) technologies. The scales consist of statements (table 1) that can be agreed to on a 5-point response scale (answers ranging from 1=totally disagree to 5=totally agree). Higher values indicate a higher level of the construct. Items were adapted from different studies[39,45,46].

From the Attitudes toward Psychological Online Interventions questionnaire (APOI)[47], we used the skepticism and perception of risks scale, which contains 4 statements (e.g., *"It is difficult for patients to effectively integrate health apps into their daily lives."*) that can be agreed on a 5-point scale (ranging from 1=totally agree to 5=totally disagree). We excluded 1 item because its content did not fit the survey *("By using a POI [Psychological Online Interventions], I do not receive professional support."*). Cronbach's alpha for this scale was .57.

Openness (e.g., *"I would use new treatments to help my patients."*) and intuitive appeal (e.g., *"If you learned about a new health app, how likely would you be to use it if it appealed to you intuitively?"*) were assessed with the Evidence-based Practice Attitude Scale-36 (EBPAS)[48]. The EBPAS measures difficulties and supportive factors in implementing evidence-based treatment approaches. Both scales consist of 4 statements or questions that can be agreed to on a 5-point response scale (ranging from 0=not at all to 4=to a very great extent). Cronbach's alpha of .84 (openness) and .87 (intuitive appeal).

Before starting the survey, we gave participants a brief definition of health apps and instructed them that all questions are related to health apps for chronic pain patients.

Table 1 UTAUT Items.

UTAUT Scale	**Items**
Acceptance	1. I can basically imagine prescribing a health app. 2. I would prescribe health apps regularly. 3. I would recommend health apps to colleagues.
Performance Expectancy	1. Using health apps would improve the effectiveness of my work. 2. Using health apps would help me in my work and increase my productivity. 3. Overall, health apps would help me treat my patients.
Effort Expectancy	1. Using health apps would be easy. 2. Using health apps would be easy for me. 3. The use of health apps would be clear and understandable to me.
Social Influence	1. Colleagues would advise me to use health apps.

	2. My supervisors and/or experienced colleagues would recommend that I use health apps.
Facilitating Conditions	1. I would get support for technical problems with health apps. 2. I have the necessary technical skills to use health apps.

Notes. Items are adapted from[39,45,46].

Intervention

The control group (CG) watched a video (3:10 minutes) providing general information about chronic pain (e.g., prevalence and costs for the health care system and psychosocial consequences for people suffering from chronic pain). The experimental group (EG) watched a video (3:23 minutes) that discussed the content of health apps (e.g., how they can be used and the results of recent studies). We kept the information of both videos in simple language. In terms of content, the videos only gave a general overview of the topic without going into too much detail. Both videos were matched in terms of visuals (Figure 2). Skipping the video was not possible due to the survey software. We produced the video with the commercial software Powtoon (2012–2021 Powtoon Limited). A professional narrator recorded the audio track. An English translation of the spoken text is in the supplementary material.

[Please insert figure 2 about here]

Statistical Analysis

We used the 26th version of IBM SPPS Statistics software for statistical analyses. There were no missing data due to the software (participants had to answer all questions to get to the next page). For all analyses, we used a type-1 error level of 5%.

Both Mahalanobis distance and Cook's distance were used to detect multivariate outliers[49]. According to the suggestion of Pituch and Stevens (2016), univariate outliers were calculated using standardized values[49]. We checked data for plausibility before exclusion. In addition, we checked subjects' comments at the end of the survey for possible bias.

To detect any differences between baseline values, we conducted a multivariate analysis of variance (MANOVA) for age; APOI; EBPAS; CEQ; and the UTAUT variables. We assessed gender differences using a chi-square test.

The video's influence on our primary and secondary outcomes was assessed via a 2 (condition) x 2 (time) repeated measures analysis of variance (ANOVA). Partial eta squared was used as the effect size measure, as suggested by Richardson (2011). Effect sizes were classified according to Richardson[50] based on Cohen[51]. To reduce inflation of the alpha error, we applied Bonferroni correction to secondary outcomes[52].

The variables influencing health apps' acceptance were calculated using linear regression, in which we added predictor groups blockwise: first, demographic variables (age; gender; daily smartphone time; smartphone use in a working context). The APOI, EBPAS, and CEQ scales were then added. Last, the four UTAUT predictors were added to the model. Acceptance from the pre-measurement was the dependent variable[32]. Because of the large number of predictors and resulting overestimation of R^2, we referred to an adjusted R^2 as the outcome[53].

Patient and public involvement

No patient involved.

RESULTS

Sample Characteristics

After inspecting the data, there was one exclusion because the subject stated that he had filled in the questionnaires arbitrarily. 8 subjects were excluded because they had stated "psychological psychotherapist" as their specialist direction, which in Germany indicates that they were not physicians but psychologists. This reduced our sample to 248 (38.71% female) (n_{EG}=124; n_{CG}=124). The average age was 49.56 years (*SD*=11.51). There were no baseline differences between conditions. The most common fields of specialization were general practitioners (89); surgeons (39); anesthesiologists (29); neurologists and psychiatrists (23). Acceptance levels at baseline across both conditions were moderate (*M*=9.51, *SD*=3.53) with 21.4% in the low range, 47.1% in the moderate range, and 31.5% in the high range. See table 2 for a complete list of specialty directions, additional demographic variables as well as pre-values of the baseline measures.

Table 2 Demographic characteristics.

Variables	Experimental Group	Control Group
Age	49.65 ± 11.57	49.47 ± 11.49
Number (% female)	124 (35.50)	124 (41.90)
Professional environment (%)		
Outpatient	89 (71.8)	77 (62.1)
Inpatient	30 (24.2)	33 (26.6)
Other	5 (4.0)	14 (11.3)
Medical Specialty (%)[a]		
General medicine	49 (39.5)	40 (32.3)
Surgery	17 (13.7)	22 (17.7)
Neurology	17 (13.7)	6 (4.8)
Anesthesiology	11 (8.9)	18 (14.5)
Orthopedics	6 (4.8)	8 (6.5)

Pediatrics	5 (4)	8 (6.5)
Other	19 (15.4)	22 (17.7)
CEQ		
Credibility	5.28 ± 1.78	5.14 ± 1.96
APOI		
Scepticism and Perception of Risks	2.66 ± 0.74	2.68 ± 0.81
EBPAS		
Openness	3.65 ± 0.87	3.66 ± 0.93
Intuitive Appeal	3.64 ± 0.88	3.57 ± 0.93
UTAUT		
Acceptance	9.73 ± 3.33	9.30 ± 3.72
Performance Expectancy	8.60 ± 3.00	8.30 ± 3.10
Effort Expectancy	11.03 ± 2.47	10.73 ± 2.42
Social Influence	5.80 ± 2.10	5.40 ± 1.95
Facilitating Conditions	7.60 ± 1.71	7.48 ± 1.95

Notes. Values represent averages (± standard deviation), frequency or percentages; CEQ=credibility/expectancy questionnaire (range: 1-9); APOI=Attitudes toward Psychological Online Interventions questionnaire (range:1-5); EBPAS=Evidence-based Practice Attitude Scale-36 (range: 0-4); UTAUT=Unified Theory of Acceptance and Use of Technology (Acceptance, Performance Expectancy, Effort Expectancy range: 3-15, Social Influence and Facilitating Conditions range 2-10); [a]Only those medical specialties are listed that were represented by more than 5% in one of the two groups.

Primary Outcome

Our subjects' acceptance was increased by means of the video (significant main effect of time ($F(1, 246)=15.28$, $p<.001$, $\eta^2_p=.06$)). Further subjects of the EG showed higher increases than those of the CG (significant time x condition interaction ($F(1, 246)=15.28$, $p=.01$, $\eta^2_p=.02$)). After the intervention, the EG ($M=10.51$, $SD=3.28$) had higher post-acceptance scores than the CG ($M=9.48$, $SD=3.57$) ($t(246)=-2.37$, $p=.01$). Group comparison of post-assessment data reveals a small effect (Cohen's d=.30). Figure 3 shows a comparison between the medical student sample and the physicians.

[please insert figure 3 about here]

Secondary Outcomes

Performance expectancy could also be increased by the video (main effect of time ($F(1, 246)=66.85$, $p<.001$, $\eta^2_p=.21$)). Again, the increase was higher in the EG than in the CG (significant time x condition interaction ($F(1, 246)=6.10$, $p=.01$, $\eta^2_p=.02$)). The EG ($M=9.94$, $SD=3.16$) had higher post-performance expectancy scores than the CG ($M=9.02$, *SD*=3.34) (*t*(246)=-2.23, *p*=.01). Again, group comparison of the post-assessment data reveals a small effect (Cohen's d=.28).

We found the same pattern of results for credibility. It was increased by the video (significant effect of time ($F(1, 246)=64.47$, $p<.001$, $\eta^2_p=.21$), with a higher increase in the EG (significant time x condition interaction ($F(1, 246)=25.61$, $p<.001$, $\eta^2_p=.09$)). Post values of the EG (*M*=6.07, *SD*=1.87) were higher than those of the CG (*M*=5.31. *SD*=2.14) (*t*(246)=-2.95, *p*=.002). Post-assessment group comparison reveals a small to moderate effect for credibility (Cohen's d=.38). Figure 4 shows a comparison between the medical student sample and the physicians in terms of credibility.

[Please insert figure 4 about here]

The medical students' pattern of results was identical to those illustrated above (see (supplementary material for a detailed presentation of results and demographic variables). The time x condition interaction effect for acceptance had an effect size of $\eta^2_p=.13$ (Figure 2); for performance expectancy an effect size of $\eta^2_p=.09$; and for credibility an effect size of $\eta^2_p=.21$ (Figure 3).

Predictors of acceptance

Linear regression with the predictors from the first block was significant ($R^2_{adj}=.14$, $F(4, 242)=11.01$, $p<.001$). Age (β=-.23, *p*=.001) and smartphone use in a professional context (β=.20, *p*=.002) were related to acceptance.

The model improved when we added the second block with APOI, EBPAS as well as CEQ scales ($R^2_{adj}=.70$, $F(8, 238)=72.35$, $p<.001$). Credibility (β=.51, *p*<.001) was the strongest predictor followed by skepticism (β=-.24, *p*<.001) and intuitive appeal (β=.13, *p*=.01). None of the predictors from the first block were significant.

The model improved marginally after adding the UTAUT variables ($R^2_{adj}=.73$, $F(12, 234)=56.24$, $p<.001$). Again, credibility was the best predictor (β=.34, *p*<.001), followed by performance expectancy (β=.30, *p*<.001), skepticism (β=-.18, *p*<.001) and intuitive appeal (β=.11, *p*=.03). None of the other predictors were significant. A table with all predictors is provided in the supplementary material.

DISCUSSION

The current study is the first to explicitly investigate physicians' acceptance of health apps focusing on chronic pain. Our results complement preceding studies by adding the physicians' perspective within an outpatient setting. The main aims of this study were to survey physicians' current acceptance of health apps for patients with chronic pain and to increase their acceptance. In general, physicians' and medical students' acceptance for health apps was moderate, which indicates a higher openness than previous studies[32]. The experimental intervention successfully increased acceptance, performance expectancy and credibility of health apps among physicians and medical students. Our additional study aim was to identify variables that influence acceptance. Credibility and performance expectancy were the strongest predictors of acceptance, followed by skepticism and intuitive appeal.

We found that our physicians' moderate acceptance of health apps was higher than that reported in previous studies: A survey conducted between 2015 and 2016 among various health care professionals observed rather low acceptance rates for electronic health interventions[32]. According to a recent study, psychotherapists exhibited mixed acceptance of blended care (a combination of internet and mobile based interventions and face-to-face therapy)[33]. However, the aforementioned study was conducted several years ago and perceptions of eHealth may have changed in the meantime. In particular, the COVID-19 pandemic may have influenced opinions about electronic health interventions[54]. Also, unlike the studies mentioned above, we specifically asked about health apps in our survey.

Our results indicate that brief, visually appealing educational videos may be an effective acceptance-facilitating intervention for physicians. Results from acceptance-enhancing interventions in other studies were inconclusive. Some researchers demonstrated positive effects[33], while others identified no effects[41,42]. Most researchers employed video interventions to increase acceptance toward eHealth interventions in general (e.g. online interventions) but not by focusing on apps in particular. Another potential explanation of our positive findings is the specific focus on chronic pain, as the perceived usefulness of e- and mHealth interventions could be disorder-specific.

However, the higher effect sizes of the student sample lead us to cautiously conclude that the intervention may be more effective with students. Young professionals thus appear to be more receptive to interventions promoting the acceptance of health apps. This could be due to a generally higher level of skill and familiarity among the younger sample in using mobile technologies. Since high acceptance does not automatically lead to action[55], long-term studies examining the actual use of health apps among (prospective) physicians would be worthwhile.

The strong association we detected between performance expectancy and acceptance is in line with other research findings. Across studies, performance expectancy has consistently shown to be one of the most important predictors of acceptance of new technologies in the healthcare sector[32,37]. This strong association between performance expectancy and acceptance suggests that physicians' acceptance can be increased by highlighting the benefits of health apps for their patients and themselves. This is also supported by a study which found that physicians are more likely to use mobile devices with drug reference software if they believe it will help their patients[56]. In contrast to Hennemann and colleagues[32], we found no impact of social influence on acceptance, nor did we find any influence of facilitating conditions as Liu and colleagues did[37]. Note that the subjects in those two studies were surveyed in inpatient settings. We mainly surveyed physicians in an outpatient setting. Accordingly, our physicians were probably relying less on their employer's facilitation because they are often self-employed. The same might apply to social support: Medical practices employ much less staff than hospitals, a fact that may have contributed to this construct being less significant in this survey. Additionally, it is worth mentioning that the two studies above did not specifically survey acceptance towards health apps and that they were conducted a few years ago. The relevance of certain constructs like facilitating conditions may have lessened since then.

The association we found between credibility and acceptance also concurs with previous research findings. A study with college students concluded that credibility influences the perceptions of health apps positively[57]. The credibility of new technologies in the healthcare field is important[58] as it increases the likelihood that the technology will be used in the short and long term[59,60]. Accordingly, the low prescription rates (or the paucity of recommendations) of health apps by physicians could be partly attributable to their lack of credibility. One potential reason for this is the low quality of many health apps on the market[61]. Important to the credibility of information about new electronic health measures is the source of the information. Websites controlled by editors are perceived to be more credible, as is information from independent medical experts[62]. Because the source of the material appears to be more important than its design[63], independent research institutes can play an important role in disseminating evidence-based information about electronic health care interventions. By including highly visible videos on their websites, they could increase both the acceptance and awareness of health apps. Our results indicate that such an approach holds particular promise for medical students, highlighting the call for establishing eHealth curricula in education[58,64].

Technological influences will continue to make strong inroads into medicine[65], which requires that health care professionals are able to adapt new technologies flexibly. Especially considering the rapid technological progress in this area, the evidence from earlier studies and from ours provide valuable information about the importance of communicating with physicians, psychotherapists, and other professional groups in the health care sector about eHealth in general and health apps in particular. Video interventions can be an effective and cost-saving method of communicating the potential, opportunities, and limitations of these new technologies. They reach the target group at a low threshold, for example, by being included on informational websites, newsletters or at training courses. This informational material should emphasize both performance expectancy and the credibility of the intervention being addressed.

In addition to raising acceptance towards health apps, it is also important to provide physicians with specific recommendations on which apps are best to use with which patients. Due to the volume of the still growing market, it is hardly possible for an individual to get a profound overview of the range of health apps available. It therefore seems sensible to establish guidelines for physicians about which apps can be helpful for which problems - just as there are guidelines for medications for diseases. To achieve this, a recent study suggests specific recommendations from medical associations or scientific societies, as well as specialized training in this field[66]. In this way, physicians could be helped to integrate health apps into their workflows[67].

Limitations

Our study has some limitations. First, there may have been a selection bias due to the data collection method. Thus, physicians who were already open and interested in mHealth may have participated, which would restrict the generalizability of our results. Furthermore, our results relied solely on self-reporting. Most of our items were adaptations of already tested items or scales on questionnaires. This approach was necessary due to the lack of appropriate health app-specific questionnaires, but it remains a limitation. In addition, the scale facilitating conditions had low correlation measures, accordingly results of this scale should be interpreted with caution. Because of the survey's brevity, we could not collect many other potentially relevant constructs like technologization threat[47] or previous experience with health apps. As acceptance due to self-regulatory deficits[68] does not guarantee that intention becomes an action in the future[55], longitudinal surveys to examine whether video interventions increase the actual recommendations or prescriptions of the respective technologies should be one of the next steps in research.

Strengths

To our knowledge, this is the first study that investigated and increased physicians' acceptance of health apps for managing chronic pain. This professional group is of particular interest due to the gatekeeper role they play in the healthcare system. Furthermore, we based the UTAUT questionnaires on predecessor studies, to increase comparability. In addition, we engaged a strong control group whose intervention was timed, visually, and audibly matched to the intervention video. Despite the brevity of the survey and our strong control group, we identified a superior effect of the intervention video. The video intervention was very short and can be integrated at a low-threshold within different platforms.

Conclusion

Our results show that physicians are open to using health apps for chronic pain patients as they demonstrated moderate to high acceptance rates. Our study also shows that performance expectancy and credibility had the strongest influence on acceptance. As low-threshold entities, brief video interventions are useful tools that can strengthen these constructs and reach a high number of health professionals. They can thus be helpful in overcoming certain barriers to implementing mobile health interventions in clinical practice. Future studies should examine the long-term effect of acceptance facilitating interventions and their impact on behavioral measures.

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Disclosure of Interest

None declared.

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Author Contributions

HJH, JAG, WR, JR: Conception and design of the study; HJH: data collection, analysis, and interpretation, manuscript preparation; JAG, WR, JR: supervision, manuscript editing and reviewing; JR: project administration. All authors approved the final manuscript.

Data sharing statement

Data can be shared upon reasonable request. A request can be made to the corresponding author.

Legends of the figures

Figure 1 Flowchart.

Figure 2 Screenshots of the video interventions. Left: Video of the EG describing possible applications of pain apps; Right: Video of the CG describing psychosocial consequences of chronic pain.

Figure 3 Level of acceptance. Left: Physicians; Right: Medical students; EG=Experimental Group; CG=Control Group; pre=Measurement before the video; post=Measurement after the video; Error bars indicate standard errors; *p<.05; **p<.005.

Figure 4 Level of credibility. Left: Physicians; Right: Medical students; EG=Experimental Group; CG=Control Group; pre=Measurement before the video; post=Measurement after the video; Error bars indicate standard errors; ***p*<.001.

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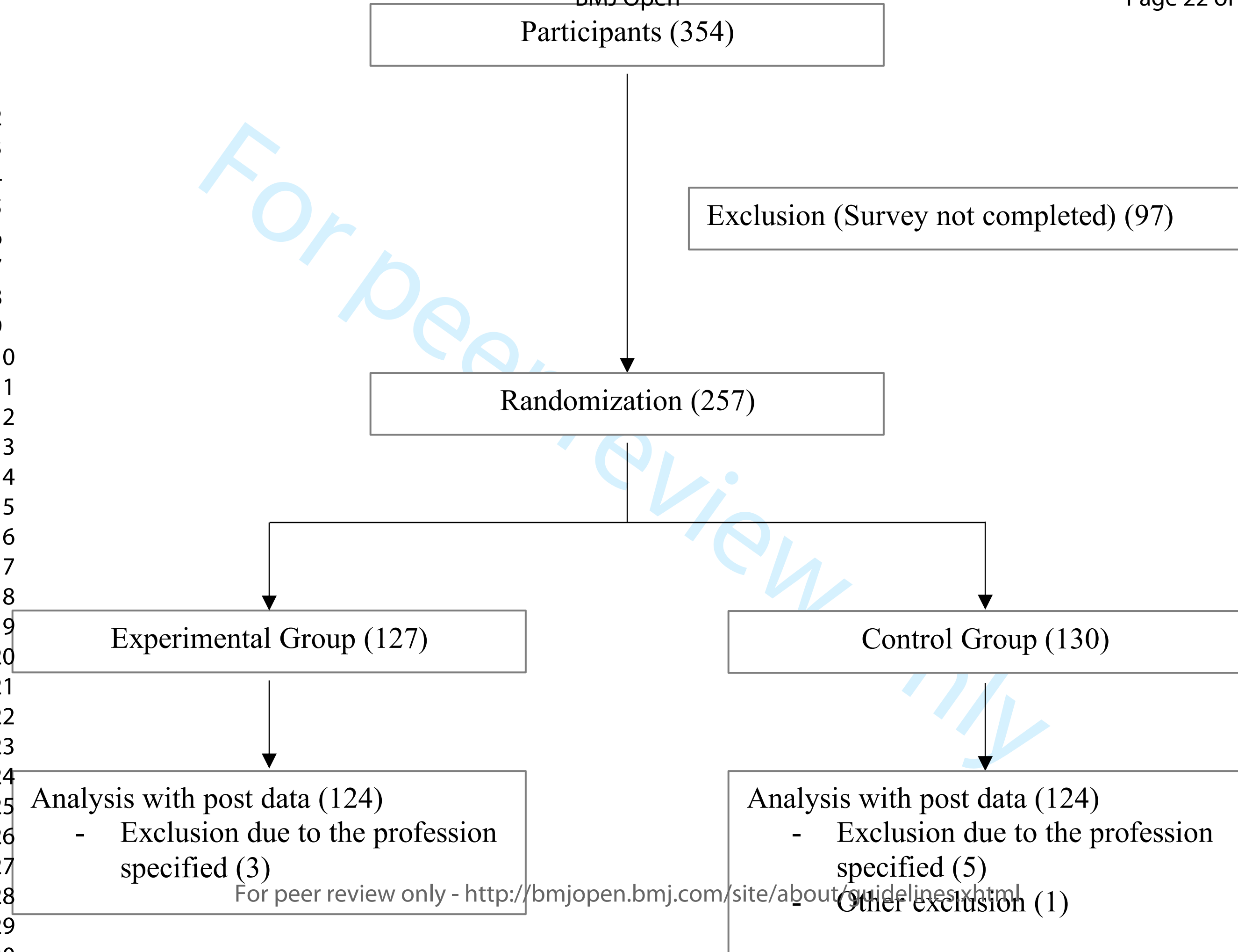
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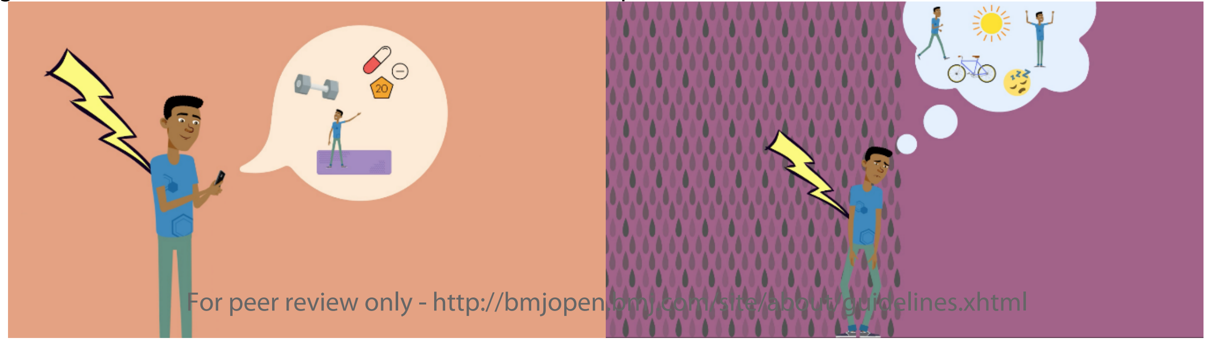
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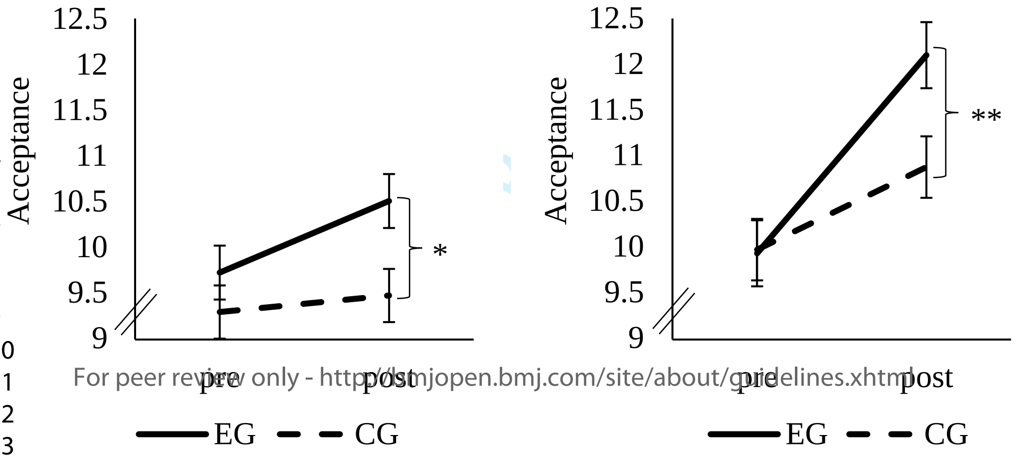
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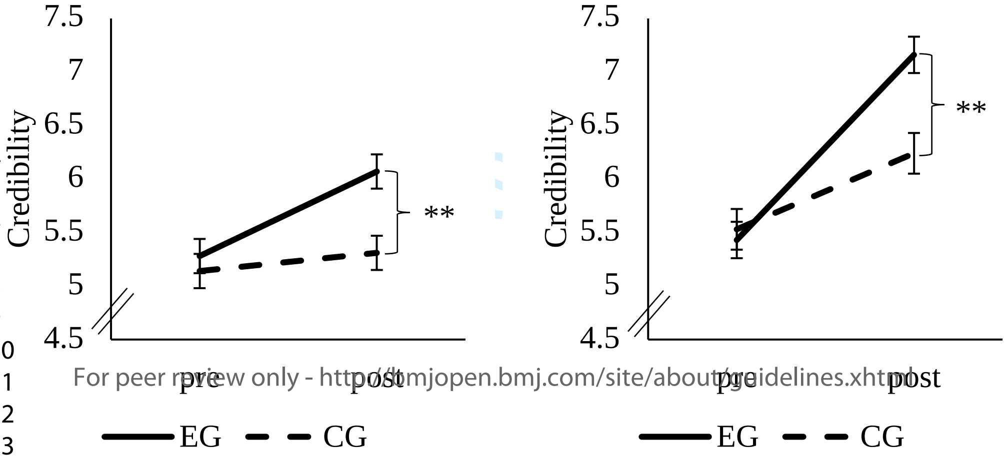
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SUPPLEMENTARY MATERIAL

Transcripts and English translations of the video interventions

German transcript of the health app-video

Seite 0

Gesundheits-Apps für chronische Schmerzpatient*innen

Seite 1

In diesem Video geht es um Gesundheits-Apps für chronische Schmerzpatient*innen. Darum, was sie sind, welchen Nutzen Patient*innen aus ihnen ziehen können und wie der aktuelle Wissenschaftsstand zu ihrer Wirksamkeit aussieht.

Seite 2

Ende des Jahres 2019 trat das „Digitale Versorgungs-Gesetz" in Kraft. Es ermöglicht Ärztinnen und Ärzten ihren Patient*innen zertifizierte Gesundheits-Apps auf Rezept zu verschreiben.

Seite 3

Das Einsatzgebiet von Gesundheits-Apps ist vielfältig.

Sie können etwa nach einem klinischen Aufenthalt zur Nachsorge oder in der ambulanten Versorgung als Therapiebegleitung eingesetzt werden.

Gerade bei chronischen Schmerzen erscheinen Gesundheits-Apps sinnvoll. Sie stehen Patient*innen jederzeit bei der Bewältigung ihrer Beschwerden zur Verfügung und können beispielsweise bei einem Schmerzschub direkt zur Hand genommen werden.

Seite 4

Ziele solcher Apps sind vor allem der Aufbau und die Aufrechterhaltung von Bewältigungsstrategien für den Umgang mit Schmerzen.

Sie können Patient*innen dabei unterstützen, hinsichtlich ihrer Gesundheitsziele am Ball zu bleiben und ihre mit ihrer Ärztin oder ihrem Arzt vereinbarten Vorsätze zu erreichen. Das kann mittels einer Erinnerungsfunktion, aufgestellten Bewegungsplänen oder ähnlichen geschehen.

Weiterhin können Schmerztagebücher geführt werden, die Patient*in und Behandler*in einen visuellen Überblick über den Schmerzverlauf geben.

Darüber hinaus helfen Gesundheits-Apps Patient*innen dabei, körperliche Übungen durchzuführen – beispielsweise mit unterstützenden Videos.

Sie können auch einen Überblick über die aktuelle Medikation geben. Ebenfalls hilfreich sind vertiefende Hintergrundinformationen, geleitete Entspannungsverfahren oder eine Schritt für Schritt durchgeführte gedankliche Neubewertung der Schmerzsymptome.

Seite 5

Mittlerweile gibt es eine ganze Reihe von Studien, die sich mit der Wirksamkeit von Gesundheits-Apps befasst haben.

Seite 6

Bereits 2013 zeigten Parker und Kollegen, dass auch ältere, technisch weniger versierte, Patient*innen an der Nutzung von Gesundheits-Apps zur Unterstützung ihrer Krankheitsbewältigung interessiert sind.

Seite 7

Eine Studie aus Norwegen zeigt, dass Patient*innen, die zusätzlich zur ärztlichen Behandlung eine Smartphone-Intervention nutzten, ihre chronischen Schmerzen eher akzeptieren können und weniger negative Gedanken ihnen gegenüber haben.

Seite 8

Toelle und Kollegen zeigten 2019, dass die Behandlung mit einer Gesundheits-App zu einer geringeren Schmerzintensität führt.

Seite 9

Weitere Studien zeigen, dass Patient*innen, die zusätzlich zu ihrer Behandlung Gesundheits-Apps nutzen, zufriedener mit ihrer Behandlung sind… ihren Alltag aktiver gestalten… und ein effektiveres Selbstmanagement haben.

Seite 10

Neben diesen Ergebnissen gibt es viele weitere Studien, die sich mit Gesundheits-Apps auseinandersetzen und unser Wissen zu diesem Thema erweitern.

Seite 11

Auch wenn es weiterer Forschung bedarf, um das Wirksamkeitspotential von Gesundheits-Apps abschließend einschätzen zu können, sind die bisherigen Studienergebnisse sehr vielversprechend.

Wichtig dabei ist, dass Apps in eine Behandlung eingebunden werden und diese nicht ersetzen sollen.

Ist das gegeben können Apps eine wertvolle Therapiebereicherung sein.

English translation

Page 0

Health apps for chronic pain patients

Page 1

This video is about health apps for chronic pain patients: what they are, how patients can benefit from them, and what the current state of science is regarding their effectiveness.

Page 2

At the end of 2019, the "Digital Care Act" came into force. It enables doctors to prescribe certified health apps to their patients.

Page 3

Health apps can be used in a variety of ways.

For example, they can be used after a clinical stay for follow-up care or in outpatient care as therapy support.

In the case of chronic pain in particular, health apps seem to be useful. They are available to patients at any time to help them cope with their symptoms and can, for example, help immediately in the event of a pain attack.

Page 4

The main aim of such apps is to establish and maintain coping strategies for dealing with pain.

They can help patients stay on track with their health goals and achieve the resolutions they have agreed on with their doctor. This can be done via a reminder function, established exercise plans, or similar.

Furthermore, pain diaries can be used to give patients and doctors a visual overview of their patient's pain course.

In addition, health apps help patients do physical exercises - for example, through supporting videos.

They can also provide an overview of current medication. Other helpful features include in-depth background information, guided relaxation procedures, or a step-by-step mental re-evaluation of pain symptoms.

Page 5

Quite a few studies have investigated the effectiveness of health apps.

Page 6

As early as 2013, Parker and colleagues showed that older, less tech-savvy patients are interested in using health apps to assist with their disease management.

Page 7

A study from Norway showed that patients who used a smartphone intervention in addition to medical treatment were more likely to accept their chronic pain and have fewer negative thoughts about it.

Page 8

Toelle and colleagues showed in 2019 that treatment with a health app led to lower pain intensity.

Page 9

Other studies show that patients who use health apps in addition to their treatment are more satisfied with their treatment... are more active in their daily lives... and have more effective self-management.

Page 10

In addition to these findings, many other studies have addressed health apps and deepened our knowledge on this topic.

Page 11

Although more research is needed to conclusively assess the potential effectiveness of health apps, the study results to date are very promising.

It is important to note that apps should be integrated within treatment and not replace it.

If that is the case, apps can be a valuable supplement to therapy.

German transcript of the control-video

Seite 0
Chronische Schmerzen

Seite 1

In diesem Video geht es um chronische Schmerzen: Was sie sind und welche Ursachen sie haben; wie stark ihre Verbreitung in der Bevölkerung ist und welche Behandlungsmöglichkeiten es gibt.

Seite 2

Von chronischen Schmerzen wird gesprochen, sobald man länger als 6 Monate anhaltende Schmerzen hat.

Chronische Schmerzen können in allen Körperregionen entstehen. Mit Abstand am häufigsten treten sie jedoch im Rücken auf. Aber auch chronische Kopf- oder Gelenkschmerzen sind keine Seltenheit.

Seite 3

In der Bevölkerung sind chronische Schmerzen weit verbreitet:

Von 900 Patient*innen in ambulanten Arztpraxen haben 327 chronische Schmerzen – das entspricht über 36% der Patient*innen. Insgesamt leiden 12 bis 15 Millionen Menschen in Deutschland an anhaltenden oder wiederkehrenden Schmerzen. Häufig führen Schmerzen zu anhaltenden Einschränkungen ihres Arbeits- oder Privatlebens.

Gerade Rückenschmerzen stellen ein zentrales Problem dar.

Seite 4

Rückenschmerzen im Allgemeinen und chronische Rückenschmerzen im Speziellen sind der häufigste Grund für Arbeitsausfälle. Über 12% der deutschen Bevölkerung sieht sich aufgrund ihrer Rückenschmerzen in ihrer Lebensführung eingeschränkt.

Diese Zahlen machen chronische Rückenschmerzen zur teuersten Krankheit der westlichen Industrieländer.

Rückenschmerzen sind also im wortwörtlichen Sinne das Volksleiden Nummer 1 – und das obwohl die körperliche Belastung der Arbeitnehmer*innen immer geringer wird.

Seite 5

Zur Diagnostik chronischer Schmerzen verwendet man unter anderem spezifische Schmerzfragebögen, die die Schmerzintensität, -qualität und -lokalisation erfassen. Weiterhin wird erhoben, wie stark die Beeinträchtigung in der alltäglichen Lebensführung durch die Schmerzen ist.

Eine gute Diagnostik ist wichtig, da chronische Schmerzen viele Ursachen haben können, wie zum Beispiel:

Nervenschädigungen; Veränderungen in der knöchernen Struktur; psychische Belastungen; Entzündungen; muskuläre Prozesse und weitere.

Seite 6

Abgesehen davon, dass chronische Schmerzen ein hohes Maß an körperlichen Unbehagen verursachen, können sie entsprechend ihrer vielseitigen Ursachen, sehr unterschiedliche psycho-soziale Folgen haben.

Diese reichen von einem andauernden Gefühl der körperlichen Unsicherheit; Einschränkungen der Bewegungsfreiheit und des Autonomiegefühls bis hin zu einem verringerten Selbstwert- oder Kontrollgefühl. Auch Schlafstörungen sind eine häufige Folge chronischer Schmerzen.

Aufgrund des hohen Leidensdruck betroffener Patient*innen, ist eine gut eingebundene Behandlung der Schmerzen von hoher Wichtigkeit.

Seite 7

Ganz allgemein wird eine multimodale Behandlung empfohlen, also eine Behandlung die von verschiedenen Gruppen von Behandler*innen durchgeführt wird.

Ärzt*innen untersuchen dabei, welche körperlichen Ursachen die Schmerzen erklären können und stehen Patient*innen für die medizinische Behandlung zur Seite.

Physiotherapeut*innen können Bewegungsübungen mit den Patient*innen einüben, die sie im Alltag z. B. mobiler machen können.

Und Psychotherapeut*innen erarbeiten Möglichkeiten, die Lebensqualität der Schmerz-Patient*innen zu verbessern.

Die Therapiekonzepte für die Behandlung chronischer Schmerzen haben sich in den letzten Jahren stetig weiterentwickelt. Die multimodale Einbindung der Patient*innen in die unterschiedlichen Behandlungsgruppen bleibt aber ein zentrales Konzept.

English translation

Page 0

Chronic pain

Page 1

This video is about chronic pain: what it is and what causes it; how prevalent it is in the population; and what treatment options are available.

Page 2

Chronic pain is defined as pain that lasts longer than 6 months.

Chronic pain can occur in all regions of the body. However, it occurs by far most frequently in the back. But chronic headaches and joint pain are not uncommon either.

Page 3

Chronic pain is widespread in the population:

Out of 900 patients* in outpatient medical practices, 327 have chronic pain - this corresponds to over 36% of patients. In total, 12 to 15 million people in Germany suffer from persistent or recurring pain. Pain often leads to persistent restrictions in their work or private life.

Back pain in particular is a major problem.

Page 4

Back pain in general and chronic back pain in particular are the most common reason for lost work days. More than 12% of the German population feels that their lifestyle is restricted because of their back pain.

These figures make chronic back pain the most expensive disease in Western industrialized countries.

Back pain is therefore literally the number one health problem among the population - despite the fact that the amount of physical strain on employees keeps dropping.

Page 5

To diagnose chronic pain, specific pain questionnaires are used that record pain intensity, quality and location. The extent to which the pain interferes with everyday life is also assessed.

A good diagnosis is important, because chronic pain can have many causes, such as:

nerve damage, anomalies in the bony structure, psychological stress, inflammation, muscular processes, etc.

Page 6

Apart from the fact that chronic pain causes such physical discomfort, it can have very different psycho-social consequences according to its multifaceted causes.

These range from a persistent feeling of physical insecurity; restrictions in freedom of movement and sense of autonomy; to a diminished sense of self-worth or control. Sleep disturbances are also a frequent consequence of chronic pain.

Due to the high level of suffering of affected patients, well-integrated pain therapy is essential.

Page 7

In general, a multimodal treatment is recommended, i.e. a treatment carried out by different groups of practitioners.

Physicians investigate the physical causes of the pain and assist patients with medical treatment.

Physiotherapists can practice movement exercises with patients that can enhance their mobility in everyday life, for example.

And psychotherapists work out ways to improve the quality of life of pain patients.

Therapy concepts for treating chronic pain continue to develop. However, the multimodal integration of patients within various treatment groups remains a central concept.

SUPPLEMENTARY MATERIAL

Student results

Student demographic characteristics

Demographic data of the students can be found in table 3.

Table 3. Demographic characteristics of the student sample

Variables	Experimental Group	Control Group
Age	23.53 (3.10)	23.37 (2.91)
Number (% female)	49 (73.47)	52 (76.92)
Study time in years	3.00 (1.69)	2.99 (1.49)

Results of the repeated-measures ANOVA among students

Acceptance

Student's acceptance could be increased as a result of the video. The 2 x 2 ANOVA revealed a significant main effect of time ($F(1, 99)=88.95$, $p<.001$, $\eta_{p2}=.48$) as well as a significant time x condition interaction ($F(1, 99)=15.17$, $p<.001$, $\eta_{p2}=.13$). There was no significant main effect of condition ($F(1, 99)=1.61$, $p=.21$, $\eta_{p2}=.02$). Table 4 shows the descriptive values of the sample.

Table 4. Descriptive representation of the acceptance values.

Measurement time	Condition	*M*[a]	*SD*
Pre values	EG	9.94	2.54
	CG	9.98	2.42
Post values	EG	12.10	2.24
	CG	10.88	2.62

Notes. [a]Values range between 3 and 15; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

Performance Expectancy

We found a similar pattern of results for performance expectancy. There was a significant effect of time ($F(1, 99)=81.96$, $p<.001$, $\eta_{p2}=.45$) and a significant time x condition interaction ($F(1, 99)=10.14$, $p=.002$, $\eta_{p2}=.09$). The main effect of condition got not significant ($F(1, 99)=1.17$, $p=.28$, $\eta_{p2}=0.1$). Table 5 shows the descriptive values of the sample.

Table 5. Descriptive representation of the performance expectancy values.

Measurement time	**Condition**	***M***[ab]	***SD***[c]
Pre values	EG[d]	9.86	2.57
	CG[e]	9.98	2.26
Post values	EG	12.14	2.02
	CG	11.08	2.61

Notes. [a]Values range between 3 and 15; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

Credibility

The pattern of results for credibility reflects the above as well. We found a significant main effect of time ($F(1, 99)=149.72$, $p<.001$, $\eta_{p2}=.60$) and a significant time x condition effect ($F(1, 99)=25.99$, $p<.001$, $\eta_{p2}=.21$). We found no significant main effect of condition ($F(1, 99)=2.45$, $p=.12$, $\eta_{p2}=.02$). Table 6 shows the descriptive values of the sample.

Table 6. Descriptive representation of the credibility values.

Measurement time	**Condition**	***M***[ab]	***SD***[c]
Pre values	EG[d]	5.43	1.48
	CG[e]	5.53	1.37
Post values	EG	7.16	1.26
	CG	6.24	1.44

Notes. [a]Values range between 1 and 10; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

SUPPLEMENTARY MATERIAL

Summary of linear regression

Table 7. Summary of linear regression predicting acceptance towards pain apps.

Predictor	*B*	*SE*[a]	β	t	*p*
Block 1					
Age	-.01	.01	-.03	-.73	.47
Sex	.09	.26	.01	.36	.72
Daily Smartphone time	-.01	.20	-.002	-.04	.96
Professional smartphone use	.18	.11	.06	1.63	.10
Block 2					
Scepticism and Perception of Risks[b]	-.82	.20	-.18	-4.13	>.001
Openness[c]	.19	.16	.05	1.17	.25
Intuitive Appeal[c]	.432	.20	.11	2.15	.03
Credibility[d]	.64	.11	.34	5.71	>.001
Block 3					
Performance Expectancy	.34	.07	.30	5.32	>.001
Effort Expectancy	.07	.07	.05	1.00	.32
Social Influence	-.06	.07	-.03	-.77	.44
Facilitating Conditions	-.001	.08	.00	-.01	.99

Notes. [a]Standard error; [b]Attitudes toward Psychological Online Interventions questionnaire; [c]Evidence-based Practice Attitude Scale-36; [d]Credibility/Expectancy Questionnaire.

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	2
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	3
	2b	Specific objectives or hypotheses	4
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	4
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	-
Participants	4a	Eligibility criteria for participants	4
	4b	Settings and locations where the data were collected	4
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	5
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	5
	6b	Any changes to trial outcomes after the trial commenced, with reasons	-
Sample size	7a	How sample size was determined	4
	7b	When applicable, explanation of any interim analyses and stopping guidelines	-
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	4
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	-
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	4
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those	-

		assessing outcomes) and how	
	11b	If relevant, description of the similarity of interventions	7
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	7
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	7
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	8
	13b	For each group, losses and exclusions after randomisation, together with reasons	8
Recruitment	14a	Dates defining the periods of recruitment and follow-up	4
	14b	Why the trial ended or was stopped	-
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	8
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	7
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	7
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	-
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	-
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	-
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	13
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	13
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	11
Other information			
Registration	23	Registration number and name of trial registry	3
Protocol	24	Where the full trial protocol can be accessed, if available	-
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	14

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.

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Effects of a video intervention on physicians' acceptance of pain apps: a randomized controlled trial

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Title

Effects of a video intervention on physicians' acceptance of pain apps: a randomized controlled trial

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Abstract

Objectives

The aim of our study was to determine and enhance physicians' acceptance, performance expectancy and credibility of health apps for chronic pain patients. We further investigated predictors of acceptance.

Design

Randomized experimental trial with a parallel-group repeated measures design.

Setting and participants

248 physicians working in various, mainly outpatient settings in Germany.

Intervention and outcome

Physicians were randomly assigned to either an experimental group (short video about health apps) or a control group (short video about chronic pain). Primary outcome measure was acceptance. Performance expectancy and credibility of health apps were secondary outcomes. In addition, we assessed 101 medical students to evaluate the effectiveness of the video intervention in young professionals.

Results

In general, physicians' acceptance of health apps for chronic pain patients was moderate (M=9.51, SD=3.53, scale ranges from 3-15). All primary and secondary outcomes were enhanced by the video intervention: A repeated-measures ANOVA yielded a significant interaction effect for acceptance (F(1, 246)=15.28, p=.01), performance expectancy (F(1, 246)=6.10, p=.01) and credibility (F(1, 246)=25.61, p<.001). The same pattern of results was evident among medical students.

Linear regression analysis revealed credibility (β=.34, p<.001) and performance expectancy (β .30, p<.001) as the two strongest factors influencing acceptance, followed by skepticism (β=-.18, p<.001) and intuitive appeal (β=.11, p=.03).

Conclusions and recommendations

Physicians' acceptance of health apps was moderate, and was strengthened by a three minute video. Besides performance expectancy, credibility seems to be a promising factor associated with acceptance. Future research should focus on ways to implement acceptability-increasing interventions into routine care.

Trial registration: https://osf.io/x693r

Strengths and limitations of this study

- This is the first study to examine physicians´ acceptance and expectations about health apps for chronic pain.

- A strength of the study is the investigation of both practitioners and medical students as future physicians.
- The study has a strong active control group.
- A limitation is the online-only data collection, due to which a selection bias may have occurred.

INTRODUCTION

Since the Global Burden of Disease Study was first conducted in the 1990s, chronic pain has been identified as the leading cause of years lived with disability[1]. Chronic pain has various negative health consequences and adverse impacts on quality of life[2–4]. Although there are effective treatments for chronic pain[5,6], effect sizes tend to be small[7]. Further, the sustained efficacy of treatments is uncertain[8]. This is problematic, because chronic pain raises costs dramatically for health care systems[9,10] and is a significant contributor to work disability[11]. The likelihood of returning to work correlates with the duration of pain: the longer patients are out of work, the less likely they are to return to full-time employment[12,13]. Therefore, the principle for treating pain is that it should start as early as possible. However, many people, especially in rural areas, have no access to adequate pain treatment[14,15], even though it is considered a human right[16].

Electronic health (eHealth) offerings can help to alleviate these problems and provide patients with evidence-based interventions[17]. Smartphone apps, falling under the mobile health (mHealth) category, especially have great potential for both practitioners and patients[18]: First, because of the widespread use of smartphones, they can reach patients with chronic pain at a low threshold[19]. Second, they can help patients better manage their pain, for example as a treatment adjunct or in the absence of a pain expert[20–22]. Pain apps offer a wide range of application possibilities ranging from diary functions for monitoring pain to specific interventions. Two recent meta-analyses concluded that pain apps can reduce patients' pain by a small effect[23] and have a small positive effect on depression and short-term pain catastrophizing[24]. However, despite their positive potential, it should be mentioned that most pain apps have not been scientifically evaluated yet and privacy protection is often not sufficiently guaranteed[25]. Besides these problems, there are various other barriers to the implementation of health apps into clinical practice.

One barrier on the practitioners' side is that they play a gatekeeping role in electronic treatment forms[26]. Even if physicians consider health apps to be helpful[27], integrating health apps into their daily work is slow[28]. Although many patients are eager to try health apps[29] health professionals recommend them seldom[30,31]. One potential reason for this is their moderate acceptance of eHealth[32]. There is ample evidence that acceptance is an important prerequisite for implementing new technologies into practice[33,34].

Across studies, an important factor influencing acceptance (respective the intention to apply new technology) is performance expectancy[32,35–38].

To increase acceptance, acceptance-enhancing video interventions have proven to be effective in patients and health practitioners[33,39,40]. However, not all studies were able to increase practitioners' acceptance [41,42], suggesting that the presentation and content of educational videos are relevant[33].

Since previous research mainly investigated eHealth in general focusing on internet interventions, little is known about the acceptance of mobile health apps. The main aims of this study were to assess physicians' acceptance of health apps and to increase their acceptance, performance expectancy and credibility via a short video intervention. Our further aim was to identify variables that influence physicians' acceptance of health apps for chronic pain. To the best of our knowledge, this is the first experimental study assessing and modifying physicians' acceptance of health apps in the context of chronic pain.

METHODS

Study Design

The present study is a web-based experimental trial with a parallel-group design using simple randomization procedure (1:1 allocation ratio). Self-rating questionnaires were used to assess pre- and post-intervention outcomes.

The study was preregistered with the Open Science Framework on 12/17/2020 (Trial Registration Number: https://osf.io/x693r). All study participants gave their informed consent. The survey was approved by the Ethics Committee of Philipps University of Marburg (reference 2020-72k-2). Completing the survey took an average of 14 minutes. Measurements were collected online via the software platform Unipark (Enterprise Feedback Suite survey, version Fall 2020, Questback). Randomization was performed within the Unipark software. All procedures complied with the German Psychological Society's ethical guidelines.

Participants

Data collection was performed between December 2020 and April 2021. The sample size was determined using an a priori power analysis with G*Power version 3.1.9.3[43]. Following a similar preceding study[33], we based our calculations on a small effect between groups (expected f=.16; power=.8; alpha error probability of .05), resulting in a necessary sample size of 230. Because we assumed a 10% dropout rate, we planned to survey 253 subjects. We recruited physicians via email distribution lists, physician networks, and emails to practices. Due to the different recruitment methods, we can only estimate the number of physicians contacted. We assume that we reached approximately 10000 physicians, of whom 354 started the survey. The response rate is comparable to a similar study[33]. 257 participants completed the questionnaires at post-intervention, yielding a completer rate of 73% (Figure 1). Inclusion criteria were being employed as a physician and sufficient knowledge of the German language. Study participants were collected online through practices, hospitals and medical communities. In addition, we recruited a sample of 101 medical students via Facebook groups for medical students as well as email distribution lists of medical schools.

[Please insert figure 1 about here]

Measures

Primary Outcome

Acceptance of the Unified Theory of Acceptance and Use of Technology model (UTAUT)[34] was our primary outcome. Acceptance according to the UTAUT model is conceived as the intention to use (new) technologies. The three acceptance items (table 1) were added together as a cumulative score, giving a range of 3 – 15. To make our data easier to interpret, we considered values as low (3 – 6), moderate (7 – 11) and high (12 – 15). This classification is similar to other studies[32,33]. Cronbach's alpha was .93.

Secondary Outcomes

Performance expectancy of the UTAUT model was our secondary outcome. It was surveyed by means of 3 items (Table 1). Performance expectancy is conceptualized as the expectation that an intervention will be beneficial.

An additional secondary outcome was the credibility of health apps, which we assessed via the credibility/expectancy questionnaire (CEQ)[44]. The credibility scale (e.g., *"How logical does the medical use of health apps for chronic pain seem to you?"*), includes 3 items and asks about treatment credibility on a 9-point response scale (ranging from 1=not at all useful to 9=very useful). Cronbach's alpha for the credibility scale was .91.

Primary and secondary outcomes were measured both before and after the intervention. With our cohort of medical students, only the primary and secondary outcomes were assessed, but not the predictors of acceptance.

Predictors of acceptance

Predictors of acceptance were examined. For this purpose, we used the baseline variable of acceptance as dependent variable and multiple predictors as independent variables (see Statistical Analysis).

Socio-demographic variables included age, gender, daily smartphone time and smartphone use in a professional context. All of the following items had to be slightly adapted for the purpose of this study.

We assessed the four main constructs of UTAUT model[34]. The UTAUT model is an established model which states that the four constructs performance expectancy

(Cronbach's alpha of .94); effort expectancy (Cronbach's alpha of .84); facilitating conditions (Spearman's correlation of .17); and social influence (Spearman's correlation of .79) have an effect on the acceptance and intention to use (new) technologies. The scales consist of statements (table 1) that can be agreed to on a 5-point response scale (answers ranging from 1=totally disagree to 5=totally agree). Higher values indicate a higher level of the construct. Items were adapted from different studies[39,45,46].

From the Attitudes toward Psychological Online Interventions questionnaire (APOI)[47], we used the skepticism and perception of risks scale, which contains 4 statements (e.g., *"It is difficult for patients to effectively integrate health apps into their daily lives."*) that can be agreed on a 5-point scale (ranging from 1=totally agree to 5=totally disagree). We excluded 1 item because its content did not fit the survey *("By using a POI [Psychological Online Interventions], I do not receive professional support."*). Cronbach's alpha for this scale was .57.

Openness (e.g., *"I would use new treatments to help my patients."*) and intuitive appeal (e.g., *"If you learned about a new health app, how likely would you be to use it if it appealed to you intuitively?"*) were assessed with the Evidence-based Practice Attitude Scale-36 (EBPAS)[48]. The EBPAS measures difficulties and supportive factors in implementing evidence-based treatment approaches. Both scales consist of 4 statements or questions that can be agreed to on a 5-point response scale (ranging from 0=not at all to 4=to a very great extent). Cronbach's alpha of .84 (openness) and .87 (intuitive appeal).

Before starting the survey, we gave participants a brief definition of health apps and instructed them that all questions are related to health apps for chronic pain patients.

Table 1 UTAUT Items.

UTAUT Scale	**Items**
Acceptance	1. I can basically imagine prescribing a health app. 2. I would prescribe health apps regularly. 3. I would recommend health apps to colleagues.
Performance Expectancy	1. Using health apps would improve the effectiveness of my work. 2. Using health apps would help me in my work and increase my productivity. 3. Overall, health apps would help me treat my patients.
Effort Expectancy	1. Using health apps would be easy. 2. Using health apps would be easy for me. 3. The use of health apps would be clear and understandable to me.
Social Influence	1. Colleagues would advise me to use health apps.

	2. My supervisors and/or experienced colleagues would recommend that I use health apps.
Facilitating Conditions	1. I would get support for technical problems with health apps. 2. I have the necessary technical skills to use health apps.

Notes. Items are adapted from[39,45,46].

Intervention

The control group (CG) watched a video (3:10 minutes) providing general information about chronic pain (e.g., prevalence and costs for the health care system and psychosocial consequences for people suffering from chronic pain). The experimental group (EG) watched a video (3:23 minutes) that discussed the content of health apps (e.g., how they can be used and the results of recent studies). We kept the information of both videos in simple language. In terms of content, the videos only gave a general overview of the topic without going into too much detail. Both videos were matched in terms of visuals (Figure 2). Skipping the video was not possible due to the survey software. We produced the video with the commercial software Powtoon (2012–2021 Powtoon Limited). A professional narrator recorded the audio track. An English translation of the spoken text is in the supplementary material.

[Please insert figure 2 about here]

Statistical Analysis

We used the 26th version of IBM SPPS Statistics software for statistical analyses. There were no missing data due to the software (participants had to answer all questions to get to the next page). For all analyses, we used a type-1 error level of 5%.

Both Mahalanobis distance and Cook's distance were used to detect multivariate outliers[49]. According to the suggestion of Pituch and Stevens (2016), univariate outliers were calculated using standardized values[49]. We checked data for plausibility before exclusion. In addition, we checked subjects' comments at the end of the survey for possible bias.

To detect any differences between baseline values, we conducted a multivariate analysis of variance (MANOVA) for age; APOI; EBPAS; CEQ; and the UTAUT variables. We assessed gender differences using a chi-square test.

The video's influence on our primary and secondary outcomes was assessed via a 2 (condition) x 2 (time) repeated measures analysis of variance (ANOVA). Partial eta squared was used as the effect size measure, as suggested by Richardson (2011). Effect sizes were classified according to Richardson[50] based on Cohen[51]. To reduce inflation of the alpha error, we applied Bonferroni correction to secondary outcomes[52].

The variables influencing health apps' acceptance were calculated using linear regression, in which we added predictor groups blockwise: first, demographic variables (age; gender; daily smartphone time; smartphone use in a working context). The APOI, EBPAS, and CEQ scales were then added. Last, the four UTAUT predictors were added to the model. Acceptance from the pre-measurement was the dependent variable[32]. Because of the large number of predictors and resulting overestimation of R^2, we referred to an adjusted R^2 as the outcome[53].

Patient and public involvement

No patient involved.

RESULTS

Sample Characteristics

After inspecting the data, there was one exclusion because the subject stated that he had filled in the questionnaires arbitrarily. 8 subjects were excluded because they had stated "psychological psychotherapist" as their specialist direction, which in Germany indicates that they were not physicians but psychologists. This reduced our sample to 248 (38.71% female) (n_{EG}=124; n_{CG}=124). The average age was 49.56 years (*SD*=11.51). There were no baseline differences between conditions. The most common fields of specialization were general practitioners (89); surgeons (39); anesthesiologists (29); neurologists and psychiatrists (23). Acceptance levels at baseline across both conditions were moderate (*M*=9.51, *SD*=3.53) with 21.4% in the low range, 47.1% in the moderate range, and 31.5% in the high range. See table 2 for a complete list of specialty directions, additional demographic variables as well as pre-values of the baseline measures.

Table 2 Demographic characteristics.

Variables	**Experimental Group**	**Control Group**
Age	49.65 ± 11.57	49.47 ± 11.49
Number (% female)	124 (35.50)	124 (41.90)
Professional environment (%)		
Outpatient	89 (71.8)	77 (62.1)
Inpatient	30 (24.2)	33 (26.6)
Other	5 (4.0)	14 (11.3)
Medical Specialty (%)[a]		
General medicine	49 (39.5)	40 (32.3)
Surgery	17 (13.7)	22 (17.7)
Neurology	17 (13.7)	6 (4.8)
Anesthesiology	11 (8.9)	18 (14.5)
Orthopedics	6 (4.8)	8 (6.5)

Pediatrics	5 (4)	8 (6.5)
Other	19 (15.4)	22 (17.7)
CEQ		
Credibility	5.28 ± 1.78	5.14 ± 1.96
APOI		
Scepticism and Perception of Risks	2.66 ± 0.74	2.68 ± 0.81
EBPAS		
Openness	3.65 ± 0.87	3.66 ± 0.93
Intuitive Appeal	3.64 ± 0.88	3.57 ± 0.93
UTAUT		
Acceptance	9.73 ± 3.33	9.30 ± 3.72
Performance Expectancy	8.60 ± 3.00	8.30 ± 3.10
Effort Expectancy	11.03 ± 2.47	10.73 ± 2.42
Social Influence	5.80 ± 2.10	5.40 ± 1.95
Facilitating Conditions	7.60 ± 1.71	7.48 ± 1.95

Notes. Values represent averages (± standard deviation), frequency or percentages; CEQ=credibility/expectancy questionnaire (range: 1-9); APOI=Attitudes toward Psychological Online Interventions questionnaire (range:1-5); EBPAS=Evidence-based Practice Attitude Scale-36 (range: 0-4); UTAUT=Unified Theory of Acceptance and Use of Technology (Acceptance, Performance Expectancy, Effort Expectancy range: 3-15, Social Influence and Facilitating Conditions range 2-10); [a]Only those medical specialties are listed that were represented by more than 5% in one of the two groups.

Primary Outcome

Our subjects' acceptance was increased by means of the video (significant main effect of time (F(1, 246)=15.28, p<.001, η^2_p=.06)). Further subjects of the EG showed higher increases than those of the CG (significant time x condition interaction (F(1, 246)=15.28, p=.01, η^2_p=.02)). After the intervention, the EG (M=10.51, SD=3.28) had higher post-acceptance scores than the CG (M=9.48, SD=3.57) (t(246)=-2.37, p=.01). Group comparison of post-assessment data revealed a small effect (Cohen's d=.30). Figure 3 shows a comparison between the medical student sample and the physicians.

[please insert figure 3 about here]

Secondary Outcomes

Performance expectancy could also be increased by the video (main effect of time (F(1, 246)=66.85, p<.001, η^2_p=.21)). Again, the increase was higher in the EG than in the CG (significant time x condition interaction (F(1, 246)=6.10, p=.01, η^2_p=.02)). The EG (M=9.94, SD=3.16) had higher post-performance expectancy scores than the CG (M=9.02, *SD*=3.34) (*t*(246)=-2.23, *p*=.01). Again, group comparison of the post-assessment data revealed a small effect (Cohen's d=.28).

We found the same pattern of results for credibility. It was increased by the video (significant effect of time ($F(1, 246)=64.47$, $p<.001$, $\eta^2_p=.21$), with a higher increase in the EG (significant time x condition interaction ($F(1, 246)=25.61$, $p<.001$, $\eta^2_p=.09$)). Post values of the EG (*M*=6.07, *SD*=1.87) were higher than those of the CG (*M*=5.31. *SD*=2.14) (*t*(246)=-2.95, *p*=.002). Post-assessment group comparison revealed a small to moderate effect for credibility (Cohen's d=.38). Figure 4 shows a comparison between the medical student sample and the physicians in terms of credibility.

[Please insert figure 4 about here]

The medical students' pattern of results was identical to those illustrated above (see (supplementary material for a detailed presentation of results and demographic variables). The time x condition interaction effect for acceptance had an effect size of $\eta^2_p=.13$ (Figure 2); for performance expectancy an effect size of $\eta^2_p=.09$; and for credibility an effect size of $\eta^2_p=.21$ (Figure 3).

Predictors of acceptance

Linear regression with the predictors from the first block was significant ($R^2_{adj}=.14$, $F(4, 242)=11.01$, $p<.001$). Age (β=-.23, *p*=.001) and smartphone use in a professional context (β=.20, *p*=.002) were related to acceptance.

The model improved when we added the second block with APOI, EBPAS as well as CEQ scales ($R^2_{adj}=.70$, $F(8, 238)=72.35$, $p<.001$). Credibility (β=.51, *p*<.001) was the strongest predictor followed by skepticism (β=-.24, *p*<.001) and intuitive appeal (β=.13, *p*=.01). None of the predictors from the first block were significant.

The model improved marginally after adding the UTAUT variables ($R^2_{adj}=.73$, $F(12, 234)=56.24$, $p<.001$). Again, credibility was the best predictor (β=.34, *p*<.001), followed by performance expectancy (β=.30, *p*<.001), skepticism (β=-.18, *p*<.001) and intuitive appeal (β=.11, *p*=.03). None of the other predictors were significant. A table with all predictors is provided in the supplementary material.

DISCUSSION

The current study is the first to explicitly investigate physicians' acceptance of health apps focusing on chronic pain. Our results complement preceding studies by adding the physicians' perspective within an outpatient setting. The main aims of this study were to survey physicians' current acceptance of health apps for patients with chronic pain and to increase their acceptance. In general, physicians' and medical students' acceptance for health apps was moderate, which indicates a higher openness than previous studies[32]. The experimental intervention successfully increased acceptance, performance expectancy and credibility of health apps among physicians and medical students. Our additional study aim was to identify variables that influence acceptance. Credibility and performance expectancy were the strongest predictors of acceptance, followed by skepticism and intuitive appeal.

We found that our physicians' moderate acceptance of health apps was higher than that reported in previous studies: A survey conducted between 2015 and 2016 among various health care professionals observed rather low acceptance rates for electronic health interventions[32]. According to a recent study, psychotherapists exhibited mixed acceptance of blended care (a combination of internet and mobile based interventions and face-to-face therapy)[33]. However, the aforementioned study was conducted several years ago and perceptions of eHealth may have changed in the meantime. In particular, the COVID-19 pandemic may have influenced opinions about electronic health interventions[54]. Also, unlike the studies mentioned above, we specifically asked about health apps in our survey.

Our results indicate that brief, visually appealing educational videos may be an effective acceptance-facilitating intervention for physicians. Results from acceptance-enhancing interventions in other studies were inconclusive. Some researchers demonstrated positive effects[33], while others identified no effects[41,42]. Most researchers employed video interventions to increase acceptance toward eHealth interventions in general (e.g. online interventions) but not by focusing on apps in particular. Another potential explanation of our positive findings is the specific focus on chronic pain, as the perceived usefulness of e- and mHealth interventions could be disorder-specific.

However, the higher effect sizes of the student sample lead us to cautiously conclude that the intervention may be more effective with students. Although young age does not automatically lead to higher digital health competencies[55], young professionals appear to be more receptive to interventions that promote the acceptance of health apps. This could be due to a generally higher familiarity of younger people in using smartphones and their preference for this medium for obtaining health information[56]. Since high acceptance does not automatically lead to action[57], long-term studies examining the actual use of health apps among (prospective) physicians would be worthwhile.

The strong association we detected between performance expectancy and acceptance is in line with other research findings. Across studies, performance expectancy has consistently shown to be one of the most important predictors of acceptance of new technologies in the healthcare sector[32,37]. This strong association between performance expectancy and acceptance suggests that physicians' acceptance can be increased by highlighting the benefits of health apps for their patients and themselves. This is also supported by a study which found that physicians are more likely to use mobile devices with drug reference software if they believe it will help their patients[58]. In contrast to Hennemann and colleagues[32], we found no impact of social influence on acceptance, nor did we find any influence of facilitating conditions as Liu and colleagues did[37]. Note that the subjects in those two studies were surveyed in inpatient settings. We mainly surveyed physicians in an outpatient setting. Accordingly, our physicians were probably relying less on their employer's facilitation because they are often self-employed. The same might apply to social support: Medical practices employ much less staff than hospitals, a fact that may have contributed to this construct being less significant in this survey. Additionally, it is worth mentioning that the two studies above did not specifically survey acceptance towards health apps and that they were conducted a few years ago. The relevance of certain constructs like facilitating conditions may have lessened since then.

The association we found between credibility and acceptance also concurs with previous research findings. A study with college students concluded that credibility influences the perceptions of health apps positively[59]. The credibility of new technologies in the healthcare field is important[60] as it increases the likelihood that the technology will be used in the short and long term[61,62]. Accordingly, the low prescription rates (or the paucity of recommendations) of health apps by physicians could be partly attributable to their lack of credibility. One potential reason for this is the low quality of many health apps on the market[63]. Important to the credibility of information about new electronic health measures is the source of the information. Websites controlled by editors are perceived to be more credible, as is information from independent medical experts[64]. Because the source of the material appears to be more important than its design[65], independent research institutes can play an important role in disseminating evidence-based information about electronic health care interventions. By including highly visible videos on their websites, they could increase both the acceptance and awareness of health apps. Our results indicate that such an approach holds particular promise for medical students, highlighting the call for establishing eHealth curricula in education[60,66].

Technological influences will continue to make strong inroads into medicine[67], which requires that health care professionals are able to adapt new technologies flexibly. Especially considering the rapid technological progress in this area, the evidence from earlier studies and from ours provide valuable information about the importance of communicating with physicians, psychotherapists, and other professional groups in the health care sector about eHealth in general and health apps in particular. Video interventions can be an effective and cost-saving method of communicating the potential, opportunities, and limitations of these new technologies. They reach the target group at a low threshold, for example, by being included on informational websites, newsletters or at training courses. This informational material should emphasize both performance expectancy and the credibility of the intervention being addressed.

In addition to increasing acceptance of health apps, it is also important to provide physicians with specific recommendations on which apps are best to use for which patients. Due to the volume of the still growing market, it is hardly possible for individuals to get a comprehensive overview of the range of health apps available. It therefore seems sensible to establish guidelines for physicians on which apps can be helpful for which problems - just as there are guidelines for medications for diseases. To achieve this, a recent study suggests specific recommendations from medical associations or scientific societies, as well as special training in this area[68]. This could help physicians integrate health apps into their workflows[69].

Limitations

Our study has some limitations. First, due to our broad definition of pain apps, participants may have assumed different usage scenarios for health apps. This could have influenced their acceptance. Accordingly, future studies could investigate attitudes toward specific apps, e.g. psychological intervention apps. There may have been a selection bias due to the data collection method. Thus, physicians who were already open and interested in mHealth may have participated, which would restrict the generalizability of our results. Furthermore, our results relied solely on self-reporting. Most of our items were adaptations of already tested items or scales on questionnaires. This approach was necessary due to the lack of appropriate health app-specific questionnaires, but it remains a limitation. In addition, the scale facilitating conditions had low correlation measures, accordingly results of this scale should be interpreted with caution. Because of the survey's brevity, we could not collect many other potentially relevant constructs like technologization threat[47] or previous experience with health apps. As acceptance due to self-regulatory deficits[70] does not guarantee that intention becomes an action in the future[57], longitudinal surveys to examine whether video interventions increase the actual recommendations or prescriptions of the respective technologies should be one of the next steps in research.

Strengths

To our knowledge, this is the first study that investigated and increased physicians' acceptance of health apps for managing chronic pain. This professional group is of particular interest due to the gatekeeper role they play in the healthcare system. Furthermore, we based the UTAUT questionnaires on predecessor studies, to increase comparability. In addition, we engaged a strong control group whose intervention was timed, visually, and audibly matched to the intervention video. Despite the brevity of the survey and our strong control group, we identified a superior effect of the intervention video. The video intervention was very short and can be integrated at a low-threshold within different platforms.

Conclusion

Our results show that physicians are open to using health apps for chronic pain patients as they demonstrated moderate to high acceptance rates. Our study also shows that performance expectancy and credibility had the strongest influence on acceptance. As low-threshold entities, brief video interventions are useful tools that can strengthen these constructs and reach a high number of health professionals. They can thus be helpful in overcoming certain barriers to implementing mobile health interventions in clinical practice. Future studies should examine the long-term effect of acceptance facilitating interventions and their impact on behavioral measures.

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Disclosure of Interest

None declared.

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Author Contributions

HJH, JAG, WR, JR: Conception and design of the study; HJH: data collection, analysis, and interpretation, manuscript preparation; JAG, WR, JR: supervision, manuscript editing and reviewing; JR: project administration. All authors approved the final manuscript.

Data sharing statement

Data can be shared upon reasonable request. A request can be made to the corresponding author.

Legends of the figures

Figure 1 Flowchart.

Figure 2 Screenshots of the video interventions. Left: Video of the EG describing possible applications of pain apps; Right: Video of the CG describing psychosocial consequences of chronic pain.

Figure 3 Change in acceptance. EG=Experimental Group; CG=Control Group; pre=measurement before the video; post=measurement after the video; Error bars indicate standard errors; **p*<.05; ***p*<.005.

Figure 4 Change in credibility. EG=Experimental Group; CG=Control Group; pre=measurement before the video; post=measurement after the video; Error bars indicate standard errors; ***p*<.001.

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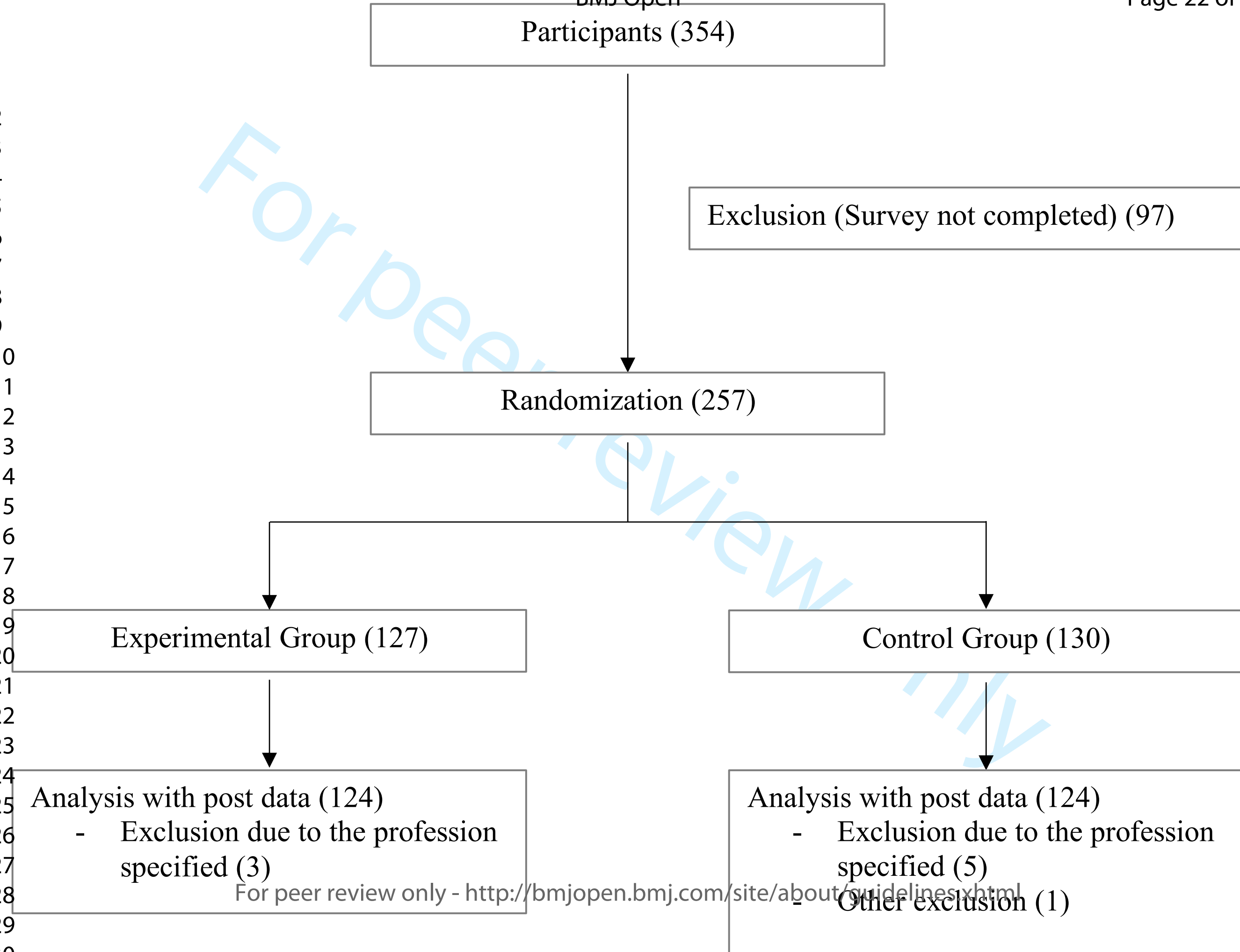
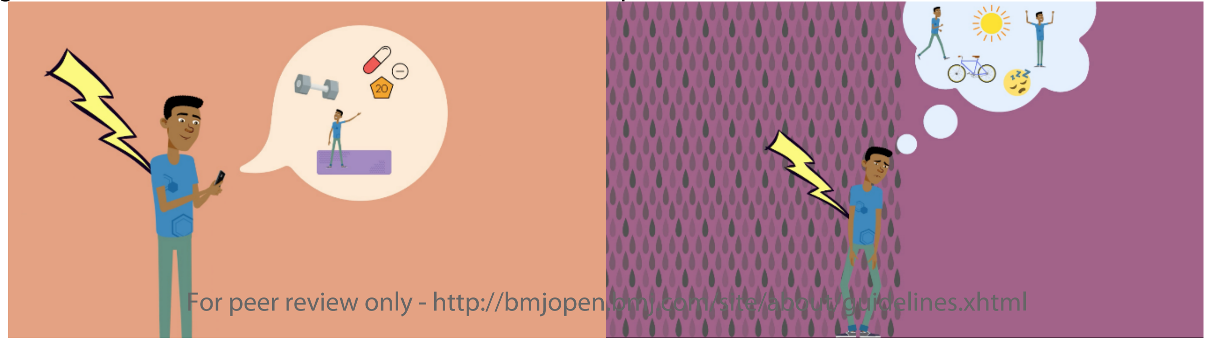

Participants (354)
Exclusion (Survey not completed) (97)
Randomization (257)
Experimental Group (127)
Control Group (130)
Analysis with post data (124)
- Exclusion due to the profession specified (3)
Analysis with post data (124)
- Exclusion due to the profession specified (5)
- Other exclusion (1)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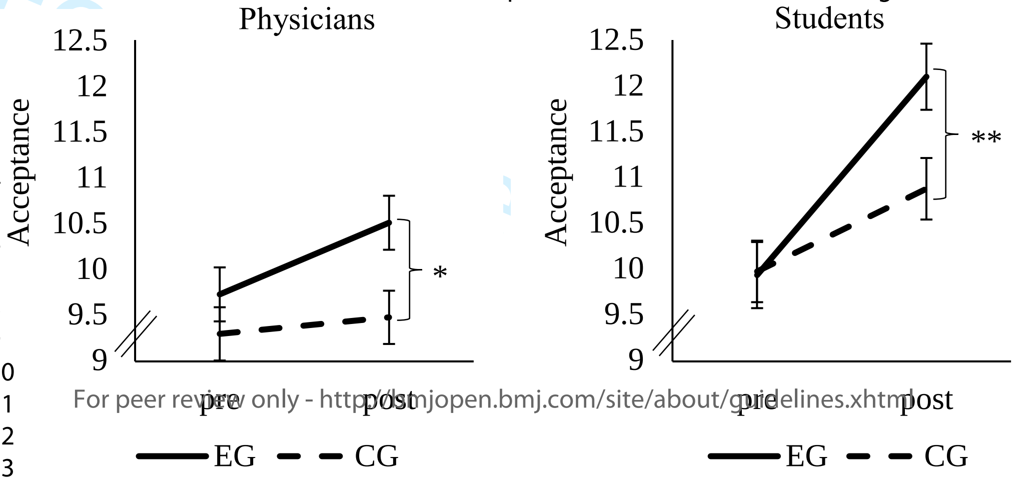
Physicians
Students
Acceptance
12.5
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pre
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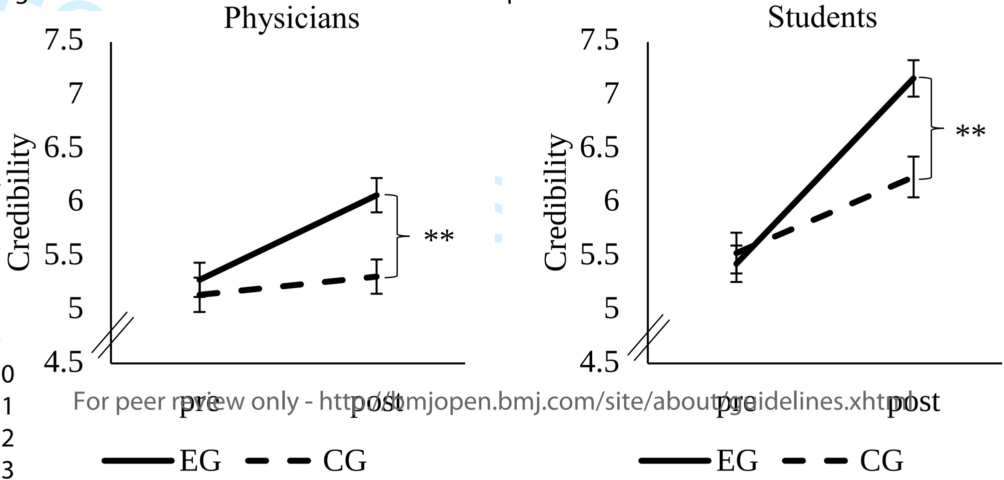
Physicians
Credibility
7.5
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Students
Credibility
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SUPPLEMENTARY MATERIAL

Transcripts and English translations of the video interventions

German transcript of the health app-video

Seite 0
Gesundheits-Apps für chronische Schmerzpatient*innen

Seite 1

In diesem Video geht es um Gesundheits-Apps für chronische Schmerzpatient*innen. Darum, was sie sind, welchen Nutzen Patient*innen aus ihnen ziehen können und wie der aktuelle Wissenschaftsstand zu ihrer Wirksamkeit aussieht.

Seite 2
Ende des Jahres 2019 trat das „Digitale Versorgungs-Gesetz“ in Kraft. Es ermöglicht Ärztinnen und Ärzten ihren Patient*innen zertifizierte Gesundheits-Apps auf Rezept zu verschreiben.

Seite 3
Das Einsatzgebiet von Gesundheits-Apps ist vielfältig.

Sie können etwa nach einem klinischen Aufenthalt zur Nachsorge oder in der ambulanten Versorgung als Therapiebegleitung eingesetzt werden.

Gerade bei chronischen Schmerzen erscheinen Gesundheits-Apps sinnvoll. Sie stehen Patient*innen jederzeit bei der Bewältigung ihrer Beschwerden zur Verfügung und können beispielsweise bei einem Schmerzschub direkt zur Hand genommen werden.

Seite 4
Ziele solcher Apps sind vor allem der Aufbau und die Aufrechterhaltung von Bewältigungsstrategien für den Umgang mit Schmerzen.

Sie können Patient*innen dabei unterstützen, hinsichtlich ihrer Gesundheitsziele am Ball zu bleiben und ihre mit ihrer Ärztin oder ihrem Arzt vereinbarten Vorsätze zu erreichen. Das kann mittels einer Erinnerungsfunktion, aufgestellten Bewegungsplänen oder ähnlichen geschehen.

Weiterhin können Schmerztagebücher geführt werden, die Patient*in und Behandler*in einen visuellen Überblick über den Schmerzverlauf geben.

Darüber hinaus helfen Gesundheits-Apps Patient*innen dabei, körperliche Übungen durchzuführen – beispielsweise mit unterstützenden Videos.

Sie können auch einen Überblick über die aktuelle Medikation geben. Ebenfalls hilfreich sind vertiefende Hintergrundinformationen, geleitete Entspannungsverfahren oder eine Schritt für Schritt durchgeführte gedankliche Neubewertung der Schmerzsymptome.

Seite 5
Mittlerweile gibt es eine ganze Reihe von Studien, die sich mit der Wirksamkeit von Gesundheits-Apps befasst haben.

Seite 6

Bereits 2013 zeigten Parker und Kollegen, dass auch ältere, technisch weniger versierte, Patient*innen an der Nutzung von Gesundheits-Apps zur Unterstützung ihrer Krankheitsbewältigung interessiert sind.

Seite 7

Eine Studie aus Norwegen zeigt, dass Patient*innen, die zusätzlich zur ärztlichen Behandlung eine Smartphone-Intervention nutzten, ihre chronischen Schmerzen eher akzeptieren können und weniger negative Gedanken ihnen gegenüber haben.

Seite 8

Toelle und Kollegen zeigten 2019, dass die Behandlung mit einer Gesundheits-App zu einer geringeren Schmerzintensität führt.

Seite 9

Weitere Studien zeigen, dass Patient*innen, die zusätzlich zu ihrer Behandlung Gesundheits-Apps nutzen, zufriedener mit ihrer Behandlung sind… ihren Alltag aktiver gestalten… und ein effektiveres Selbstmanagement haben.

Seite 10

Neben diesen Ergebnissen gibt es viele weitere Studien, die sich mit Gesundheits-Apps auseinandersetzen und unser Wissen zu diesem Thema erweitern.

Seite 11

Auch wenn es weiterer Forschung bedarf, um das Wirksamkeitspotential von Gesundheits-Apps abschließend einschätzen zu können, sind die bisherigen Studienergebnisse sehr vielversprechend.

Wichtig dabei ist, dass Apps in eine Behandlung eingebunden werden und diese nicht ersetzen sollen.

Ist das gegeben können Apps eine wertvolle Therapiebereicherung sein.

English translation

Page 0

Health apps for chronic pain patients

Page 1

This video is about health apps for chronic pain patients: what they are, how patients can benefit from them, and what the current state of science is regarding their effectiveness.

Page 2

At the end of 2019, the "Digital Care Act" came into force. It enables doctors to prescribe certified health apps to their patients.

Page 3

Health apps can be used in a variety of ways.

For example, they can be used after a clinical stay for follow-up care or in outpatient care as therapy support.

In the case of chronic pain in particular, health apps seem to be useful. They are available to patients at any time to help them cope with their symptoms and can, for example, help immediately in the event of a pain attack.

Page 4

The main aim of such apps is to establish and maintain coping strategies for dealing with pain.

They can help patients stay on track with their health goals and achieve the resolutions they have agreed on with their doctor. This can be done via a reminder function, established exercise plans, or similar.

Furthermore, pain diaries can be used to give patients and doctors a visual overview of their patient's pain course.

In addition, health apps help patients do physical exercises - for example, through supporting videos.

They can also provide an overview of current medication. Other helpful features include in-depth background information, guided relaxation procedures, or a step-by-step mental re-evaluation of pain symptoms.

Page 5

Quite a few studies have investigated the effectiveness of health apps.

Page 6

As early as 2013, Parker and colleagues showed that older, less tech-savvy patients are interested in using health apps to assist with their disease management.

Page 7

A study from Norway showed that patients who used a smartphone intervention in addition to medical treatment were more likely to accept their chronic pain and have fewer negative thoughts about it.

Page 8

Toelle and colleagues showed in 2019 that treatment with a health app led to lower pain intensity.

Page 9

Other studies show that patients who use health apps in addition to their treatment are more satisfied with their treatment... are more active in their daily lives... and have more effective self-management.

Page 10

In addition to these findings, many other studies have addressed health apps and deepened our knowledge on this topic.

Page 11

Although more research is needed to conclusively assess the potential effectiveness of health apps, the study results to date are very promising.

It is important to note that apps should be integrated within treatment and not replace it.

If that is the case, apps can be a valuable supplement to therapy.

German transcript of the control-video

Seite 0

Chronische Schmerzen

Seite 1

In diesem Video geht es um chronische Schmerzen: Was sie sind und welche Ursachen sie haben; wie stark ihre Verbreitung in der Bevölkerung ist und welche Behandlungsmöglichkeiten es gibt.

Seite 2

Von chronischen Schmerzen wird gesprochen, sobald man länger als 6 Monate anhaltende Schmerzen hat.

Chronische Schmerzen können in allen Körperregionen entstehen. Mit Abstand am häufigsten treten sie jedoch im Rücken auf. Aber auch chronische Kopf- oder Gelenkschmerzen sind keine Seltenheit.

Seite 3

In der Bevölkerung sind chronische Schmerzen weit verbreitet:

Von 900 Patient*innen in ambulanten Arztpraxen haben 327 chronische Schmerzen – das entspricht über 36% der Patient*innen. Insgesamt leiden 12 bis 15 Millionen Menschen in Deutschland an anhaltenden oder wiederkehrenden Schmerzen. Häufig führen Schmerzen zu anhaltenden Einschränkungen ihres Arbeits- oder Privatlebens.

Gerade Rückenschmerzen stellen ein zentrales Problem dar.

Seite 4

Rückenschmerzen im Allgemeinen und chronische Rückenschmerzen im Speziellen sind der häufigste Grund für Arbeitsausfälle. Über 12% der deutschen Bevölkerung sieht sich aufgrund ihrer Rückenschmerzen in ihrer Lebensführung eingeschränkt.

Diese Zahlen machen chronische Rückenschmerzen zur teuersten Krankheit der westlichen Industrieländer.

Rückenschmerzen sind also im wortwörtlichen Sinne das Volksleiden Nummer 1 – und das obwohl die körperliche Belastung der Arbeitnehmer*innen immer geringer wird.

Seite 5

Zur Diagnostik chronischer Schmerzen verwendet man unter anderem spezifische Schmerzfragebögen, die die Schmerzintensität, -qualität und -lokalisation erfassen. Weiterhin wird erhoben, wie stark die Beeinträchtigung in der alltäglichen Lebensführung durch die Schmerzen ist.

Eine gute Diagnostik ist wichtig, da chronische Schmerzen viele Ursachen haben können, wie zum Beispiel:

Nervenschädigungen; Veränderungen in der knöchernen Struktur; psychische Belastungen; Entzündungen; muskuläre Prozesse und weitere.

Seite 6

Abgesehen davon, dass chronische Schmerzen ein hohes Maß an körperlichen Unbehagen verursachen, können sie entsprechend ihrer vielseitigen Ursachen, sehr unterschiedliche psycho-soziale Folgen haben.

Diese reichen von einem andauernden Gefühl der körperlichen Unsicherheit; Einschränkungen der Bewegungsfreiheit und des Autonomiegefühls bis hin zu einem verringerten Selbstwert- oder Kontrollgefühl. Auch Schlafstörungen sind eine häufige Folge chronischer Schmerzen.

Aufgrund des hohen Leidensdruck betroffener Patient*innen, ist eine gut eingebundene Behandlung der Schmerzen von hoher Wichtigkeit.

Seite 7

Ganz allgemein wird eine multimodale Behandlung empfohlen, also eine Behandlung die von verschiedenen Gruppen von Behandler*innen durchgeführt wird.

Ärzt*innen untersuchen dabei, welche körperlichen Ursachen die Schmerzen erklären können und stehen Patient*innen für die medizinische Behandlung zur Seite.

Physiotherapeut*innen können Bewegungsübungen mit den Patient*innen einüben, die sie im Alltag z. B. mobiler machen können.

Und Psychotherapeut*innen erarbeiten Möglichkeiten, die Lebensqualität der Schmerz-Patient*innen zu verbessern.

Die Therapiekonzepte für die Behandlung chronischer Schmerzen haben sich in den letzten Jahren stetig weiterentwickelt. Die multimodale Einbindung der Patient*innen in die unterschiedlichen Behandlungsgruppen bleibt aber ein zentrales Konzept.

English translation

Page 0

Chronic pain

Page 1

This video is about chronic pain: what it is and what causes it; how prevalent it is in the population; and what treatment options are available.

Page 2

Chronic pain is defined as pain that lasts longer than 6 months.

Chronic pain can occur in all regions of the body. However, it occurs by far most frequently in the back. But chronic headaches and joint pain are not uncommon either.

Page 3

Chronic pain is widespread in the population:

Out of 900 patients* in outpatient medical practices, 327 have chronic pain - this corresponds to over 36% of patients. In total, 12 to 15 million people in Germany suffer from persistent or recurring pain. Pain often leads to persistent restrictions in their work or private life.

Back pain in particular is a major problem.

Page 4

Back pain in general and chronic back pain in particular are the most common reason for lost work days. More than 12% of the German population feels that their lifestyle is restricted because of their back pain.

These figures make chronic back pain the most expensive disease in Western industrialized countries.

Back pain is therefore literally the number one health problem among the population - despite the fact that the amount of physical strain on employees keeps dropping.

Page 5

To diagnose chronic pain, specific pain questionnaires are used that record pain intensity, quality and location. The extent to which the pain interferes with everyday life is also assessed.

A good diagnosis is important, because chronic pain can have many causes, such as:

nerve damage, anomalies in the bony structure, psychological stress, inflammation, muscular processes, etc.

Page 6

Apart from the fact that chronic pain causes such physical discomfort, it can have very different psycho-social consequences according to its multifaceted causes.

These range from a persistent feeling of physical insecurity; restrictions in freedom of movement and sense of autonomy; to a diminished sense of self-worth or control. Sleep disturbances are also a frequent consequence of chronic pain.

Due to the high level of suffering of affected patients, well-integrated pain therapy is essential.

Page 7

In general, a multimodal treatment is recommended, i.e. a treatment carried out by different groups of practitioners.

Physicians investigate the physical causes of the pain and assist patients with medical treatment.

Physiotherapists can practice movement exercises with patients that can enhance their mobility in everyday life, for example.

And psychotherapists work out ways to improve the quality of life of pain patients.

Therapy concepts for treating chronic pain continue to develop. However, the multimodal integration of patients within various treatment groups remains a central concept.

SUPPLEMENTARY MATERIAL

Student results

Student demographic characteristics

Demographic data of the students can be found in table 3.

Table 3. Demographic characteristics of the student sample

Variables	Experimental Group	Control Group
Age	23.53 (3.10)	23.37 (2.91)
Number (% female)	49 (73.47)	52 (76.92)
Study time in years	3.00 (1.69)	2.99 (1.49)

Results of the repeated-measures ANOVA among students

Acceptance

Student's acceptance could be increased as a result of the video. The 2 x 2 ANOVA revealed a significant main effect of time (F(1, 99)=88.95, p<.001, η_{p2}=.48) as well as a significant time x condition interaction (F(1, 99)=15.17, p<.001, η_{p2}=.13). There was no significant main effect of condition (F(1, 99)=1.61, p=.21, η_{p2}=.02). Table 4 shows the descriptive values of the sample.

Table 4. Descriptive representation of the acceptance values.

Measurement time	Condition	M^a	*SD*
Pre values	EG	9.94	2.54
	CG	9.98	2.42
Post values	EG	12.10	2.24
	CG	10.88	2.62

Notes. [a]Values range between 3 and 15; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

Performance Expectancy

We found a similar pattern of results for performance expectancy. There was a significant effect of time (F(1, 99)=81.96, p<.001, η_{p2}=.45) and a significant time x condition interaction (F(1, 99)=10.14, p=.002, η_{p2}=.09). The main effect of condition got not significant (F(1, 99)=1.17, p=.28, η_{p2}=0.1). Table 5 shows the descriptive values of the sample.

Table 5. Descriptive representation of the performance expectancy values.

Measurement time	**Condition**	***M***[ab]	***SD***[c]
Pre values	EG[d]	9.86	2.57
	CG[e]	9.98	2.26
Post values	EG	12.14	2.02
	CG	11.08	2.61

Notes. [a]Values range between 3 and 15; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

Credibility

The pattern of results for credibility reflects the above as well. We found a significant main effect of time ($F(1, 99)=149.72$, $p<.001$, $\eta_{p2}=.60$) and a significant time x condition effect ($F(1, 99)=25.99$, $p<.001$, $\eta_{p2}=.21$). We found no significant main effect of condition ($F(1, 99)=2.45$, $p=.12$, $\eta_{p2}=.02$). Table 6 shows the descriptive values of the sample.

Table 6. Descriptive representation of the credibility values.

Measurement time	**Condition**	***M***[ab]	***SD***[c]
Pre values	EG[d]	5.43	1.48
	CG[e]	5.53	1.37
Post values	EG	7.16	1.26
	CG	6.24	1.44

Notes. [a]Values range between 1 and 10; *M* = Mean; *SD* = Standard deviation; EG = Experimental Group; CG = Control Group.

SUPPLEMENTARY MATERIAL

Summary of linear regression

Table 7. Summary of linear regression predicting acceptance towards pain apps.

Predictor	***B***	***SE*[a]**	**β**	**t**	***p***
Block 1					
Age	-.01	.01	-.03	-.73	.47
Sex	.09	.26	.01	.36	.72
Daily Smartphone time	-.01	.20	-.002	-.04	.96
Professional smartphone use	.18	.11	.06	1.63	.10
Block 2					
Scepticism and Perception of Risks[b]	-.82	.20	-.18	-4.13	>.001
Openness[c]	.19	.16	.05	1.17	.25
Intuitive Appeal[c]	.432	.20	.11	2.15	.03
Credibility[d]	.64	.11	.34	5.71	>.001
Block 3					
Performance Expectancy	.34	.07	.30	5.32	>.001
Effort Expectancy	.07	.07	.05	1.00	.32
Social Influence	-.06	.07	-.03	-.77	.44
Facilitating Conditions	-.001	.08	.00	-.01	.99

Notes. [a]Standard error; [b]Attitudes toward Psychological Online Interventions questionnaire; [c]Evidence-based Practice Attitude Scale-36; [d]Credibility/Expectancy Questionnaire.

CONSORT 2010 checklist of information to include when reporting a randomised trial*

Section/Topic	Item No	Checklist item	Reported on page No
Title and abstract			
	1a	Identification as a randomised trial in the title	1
	1b	Structured summary of trial design, methods, results, and conclusions (for specific guidance see CONSORT for abstracts)	2
Introduction			
Background and objectives	2a	Scientific background and explanation of rationale	3
	2b	Specific objectives or hypotheses	4
Methods			
Trial design	3a	Description of trial design (such as parallel, factorial) including allocation ratio	4
	3b	Important changes to methods after trial commencement (such as eligibility criteria), with reasons	-
Participants	4a	Eligibility criteria for participants	4
	4b	Settings and locations where the data were collected	4
Interventions	5	The interventions for each group with sufficient details to allow replication, including how and when they were actually administered	5
Outcomes	6a	Completely defined pre-specified primary and secondary outcome measures, including how and when they were assessed	5
	6b	Any changes to trial outcomes after the trial commenced, with reasons	-
Sample size	7a	How sample size was determined	4
	7b	When applicable, explanation of any interim analyses and stopping guidelines	-
Randomisation:			
Sequence generation	8a	Method used to generate the random allocation sequence	4
	8b	Type of randomisation; details of any restriction (such as blocking and block size)	-
Allocation concealment mechanism	9	Mechanism used to implement the random allocation sequence (such as sequentially numbered containers), describing any steps taken to conceal the sequence until interventions were assigned	
Implementation	10	Who generated the random allocation sequence, who enrolled participants, and who assigned participants to interventions	4
Blinding	11a	If done, who was blinded after assignment to interventions (for example, participants, care providers, those	-

		assessing outcomes) and how	
	11b	If relevant, description of the similarity of interventions	7
Statistical methods	12a	Statistical methods used to compare groups for primary and secondary outcomes	7
	12b	Methods for additional analyses, such as subgroup analyses and adjusted analyses	7
Results			
Participant flow (a diagram is strongly recommended)	13a	For each group, the numbers of participants who were randomly assigned, received intended treatment, and were analysed for the primary outcome	8
	13b	For each group, losses and exclusions after randomisation, together with reasons	8
Recruitment	14a	Dates defining the periods of recruitment and follow-up	4
	14b	Why the trial ended or was stopped	-
Baseline data	15	A table showing baseline demographic and clinical characteristics for each group	8
Numbers analysed	16	For each group, number of participants (denominator) included in each analysis and whether the analysis was by original assigned groups	7
Outcomes and estimation	17a	For each primary and secondary outcome, results for each group, and the estimated effect size and its precision (such as 95% confidence interval)	7
	17b	For binary outcomes, presentation of both absolute and relative effect sizes is recommended	-
Ancillary analyses	18	Results of any other analyses performed, including subgroup analyses and adjusted analyses, distinguishing pre-specified from exploratory	-
Harms	19	All important harms or unintended effects in each group (for specific guidance see CONSORT for harms)	-
Discussion			
Limitations	20	Trial limitations, addressing sources of potential bias, imprecision, and, if relevant, multiplicity of analyses	13
Generalisability	21	Generalisability (external validity, applicability) of the trial findings	13
Interpretation	22	Interpretation consistent with results, balancing benefits and harms, and considering other relevant evidence	11
Other information			
Registration	23	Registration number and name of trial registry	3
Protocol	24	Where the full trial protocol can be accessed, if available	-
Funding	25	Sources of funding and other support (such as supply of drugs), role of funders	14

*We strongly recommend reading this statement in conjunction with the CONSORT 2010 Explanation and Elaboration for important clarifications on all the items. If relevant, we also recommend reading CONSORT extensions for cluster randomised trials, non-inferiority and equivalence trials, non-pharmacological treatments, herbal interventions, and pragmatic trials. Additional extensions are forthcoming: for those and for up to date references relevant to this checklist, see www.consort-statement.org.