Comparison of Face-to-Face vs Digital Delivery of an Osteoarthritis Treatment Program for Hip or Knee Osteoarthritis

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Abstract

IMPORTANCE Digital care platforms have been introduced, but there is limited evidence for their efficacy compared with traditional face-to-face treatment modalities.

OBJECTIVE To compare mean pain reduction among individuals with osteoarthritis (OA) of the knee or hip who underwent face-to-face vs digital first-line intervention.

DESIGN, SETTING, AND PARTICIPANTS This registry-based cohort study included all persons with knee or hip osteoarthritis who participated in structured first-line treatment for osteoarthritis in a primary care setting in Sweden. Inclusion criteria were as follows: the treatment was delivered face-to-face or digitally between April 1, 2018, and December 31, 2019; patients provided 3-month follow-up data for pain; and patients had program adherence of at least 80%. Data analysis was conducted in March 2021.

EXPOSURES Participants completed a 3-month intervention, including education and exercise for hip or knee osteoarthritis, with program adherence of 80% or higher, delivered face-to-face or by a digital application.

MAIN OUTCOMES AND MEASURES Difference in change in joint pain (11-point numeric rating scale, with 0 indicating no pain and 10, the worst possible pain) between baseline and 3-month follow-up between the 2 intervention modalities. A minimal clinically important difference in pain change between groups was predefined as 1 point. Secondary outcomes were walking difficulties, health-related quality of life, willingness to undergo joint surgery, and fear avoidance behavior.

RESULTS A total of 6946 participants (mean [SD] age, 67 [9] years; 4952 [71%] women; 4424 [64%] knee OA; 2504 [36%] hip OA) were included, with 4237 (61%) receiving face-to-face treatment and 2709 (39%) receiving digital treatment. Both the face-to-face (mean change, −1.10 [95% CI −1.17 to −1.02] points) and digital interventions (mean change, −1.87 [95% CI, −1.94 to −1.79] points) resulted in a clinically important pain reduction at 3 months. Participants in the digitally delivered intervention experienced a larger estimated improvement at 3 months (adjusted mean difference, −0.93 [95% CI, −1.04 to −0.81] points). Results of secondary outcomes were broadly consistent with main outcome.

CONCLUSIONS AND RELEVANCE This Swedish national registry-based cohort study showed that people with knee or hip OA participating in first-line intervention experienced clinically relevant improvements in pain, whether delivered face-to-face or digitally. The increased benefit of digital delivery compared with face-to-face delivery was of uncertain clinical importance.


Key Points

Question Is there a clinically relevant difference in joint pain reduction between a 3-month face-to-face or digitally delivered first-line intervention for persons with knee or hip osteoarthritis?

Findings In this cohort study of 6946 participants, a statistically significant difference in pain reduction of uncertain clinical relevance was observed between the face-to-face and digitally delivered osteoarthritis treatment interventions at 3 months, favoring the digital delivery modality.

Meaning In this study, first-line intervention of education and exercise for knee and hip osteoarthritis over 3 months resulted in clinically relevant improvements in pain, irrespective of face-to-face or digital delivery.

Supplemental content

Author affiliations and article information are listed at the end of this article.

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Introduction

Knee and hip osteoarthritis (OA) are among the leading causes of disability globally, with long-term consequences, such as increased risk of disability pension and a higher risk of premature death due to cardiovascular disease. Due to increasing OA prevalence, the identification and implementation of appropriate care and care delivery modalities is a priority for health care systems. Education, exercise, and weight control constitute the first-line treatment for persons with knee and hip OA. It is effective in improving pain, physical function, and quality of life as well as reducing medication intake and sick leave, and in reducing the patient-reported need for surgery due to OA-related symptoms.

Traditionally, first-line treatment has been provided as a face-to-face intervention, requiring the patient to physically visit a primary care clinic or similar. To increase access to health care for the wider community, digital health interventions are recommended by the World Health Organization to complement traditional care, and have been suggested to be beneficial in OA management. Several digital technologies, such as telephone, internet, mobile apps, and virtual reality have been evaluated for OA management with promising results. With the COVID-19 pandemic, digitally delivered management options have gained increased attention. In observational studies, face-to-face and digital first-line OA management interventions both reduced OA symptoms and increased health-related quality of life in persons with hip and knee OA. In a randomized clinical trial, the digital program was more effective in improving patient-reported pain and function, as well as functional performance, than being advised by a general practitioner to follow the recommendations for OA management. To our knowledge, no studies have been published that directly compare the association of face-to-face or digital delivery of otherwise similar OA management programs of education and exercise with outcomes.

In this study, we compare mean treatment effects of 2 different modalities (face-to-face vs digital) of first-line treatment delivery for hip and knee OA after 3 months of program participation. We hypothesized that there would be no clinically relevant difference in the mean treatment effect of the main outcome (joint pain) between the 2 delivery methods.

Methods

This was a retrospective comparative registry-based cohort study that adhered to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guideline. It was preregistered at ClinicalTrials.gov (NCT04836988).

The study comprises data from the National Swedish Quality Registry, Better Management of Patients with Osteoarthritis (BOA registry), and from the registry of a private health care system, Joint Academy (JA). Both treatment programs were reimbursed by the Swedish National Health Insurance. The study was approved by the Swedish Ethical Review Board. All participants were informed that data generated from the registry may be used for research purposes at registration (BOA) or provided digital informed consent for the same purpose at registration (JA).

Interventions

Face-to-Face Program

The BOA registry contains data from persons with symptomatic knee or hip OA who have participated in face-to-face first-line treatment from more than 500 different physical therapist (PT) units all over Sweden. All had symptomatic knee or hip OA, confirmed according to the recommendations for OA diagnosis from the Swedish National Board of Health and Welfare and had participated in a face-to-face intervention, including education and exercise. The education part included information about the pathology and etiology of OA, treatments according to guidelines, exercise in OA, why exercise is needed, obstacles to exercise, how exercises can be incorporated in daily life, and self-management strategies to reduce pain and symptoms. The exercise part included a first face-to-face session with a PT to instruct on an individually adapted exercise program. After that, the participants could choose to...
perform the exercises on their own or during PT-supervised exercise classes held twice a week for 6 to 8 weeks (Table 1).

Digital Program
The digital OA management program was delivered by JA, a smartphone application that includes education and exercises based on the face-to-face OA self-management program described previously. Participants joined the digital program by recommendation from their PT, orthopedic surgeon, their insurance company, or via online search engines. Before participants were accepted into the program, all had a clinical OA diagnosis of the knee or hip confirmed by online questionnaire responses and telephone or video consultation with their PT in the digital program. The clinical OA diagnosis of the knee or hip were according to the recommendations for OA diagnosis by the Swedish National Board of Health and Welfare. The program distributed daily text and video instructions to the participant’s smartphone, with individualized exercises for participants with knee or hip OA and educational information on OA symptoms and self-management based on current international guidelines for the management of OA. The program comprised of text lectures on OA, physical activity, and self-management of OA, followed by short quizzes on the topics. Each lesson lasted between 5 and 10 minutes and came packed in themes, with each theme containing 1 to 5 lessons. Participants received a theme per week for the first 6 weeks and then one every other week for as long as the participant was in the program. The participant also received video instructions to improve strength and neuromuscular control, with levels based on the participant’s progression in

Table 1. Description of the Content of the Face-to-Face and Digital Intervention

<table>
<thead>
<tr>
<th>Category</th>
<th>Face-to-face intervention</th>
<th>Digital intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis</td>
<td>At a face-to-face visit with a physical therapist, according to the Swedish National Board of Health and Welfare.</td>
<td>Patients who did not have doctor-diagnosed knee or hip OA responded to an online diagnostic inclusion/exclusion questionnaire and had a telephone or video consultation with a physical therapist in the digital program to confirm diagnosis according to the Swedish National Board of Health and Welfare.</td>
</tr>
<tr>
<td>Education</td>
<td>1-3 Face-to-face visits with information about pathology and etiology of OA, treatments according to guidelines, exercise in OA, self-management strategies to reduce pain and symptoms.</td>
<td>31 Digital lectures on OA, physical activity, and self-management of OA. Each lesson lasted between 5 and 10 min and came packed in themes, with each theme containing 1-5 lessons. Participants received one theme per week for the first 6 wks, and then one every other wk for as long as the participant was in the program. Each theme contained quizzes to confirm learning objectives. Responses were monitored by app.</td>
</tr>
<tr>
<td>Individualized exercise</td>
<td>1 Session to conduct an individualized exercise program.</td>
<td>The participant received video instructions of exercises tailored to affected joint, aimed at improving muscle strength and neuromuscular control, with difficulty levels based on the individual participant’s progression in the program, monitored by app. Each participant was assigned to a physical therapist available through asynchronous text chat, video chat, and telephone, who through therapist app supervised the participant throughout the program.</td>
</tr>
<tr>
<td>Supervised exercise</td>
<td>1-2 Times a week for 6 wk supervised in group by a physical therapist.</td>
<td>Each participant was assigned a personal physical therapist available through asynchronous text chat, video chat, and telephone. Patient reported weekly pain by free text and numerical rating scale in app. Therapist monitored participant progression through validated patient-reported outcomes in therapist app, and adjusted difficulty as needed. Participant received daily reminders of exercise sessions. Altogether 163 digital exercise sessions, each lasting 5-10 min, over 12 wk, instructed through exercise videos. App registered completion of exercises.</td>
</tr>
<tr>
<td>Follow-up</td>
<td>Face-to-face visit at 3 mo.</td>
<td>Online questionnaires at 3 mo.</td>
</tr>
</tbody>
</table>

Abbreviation: OA, osteoarthritis.
the program. Over 12 weeks, a total of 163 exercise sessions and 31 educational sessions were provided. Each participant was assigned to a personal PT available through asynchronous text chat, video chat, and telephone, who supervised the participant throughout the whole program (Table 1).

Data Extraction
All participant data were collected via online questionnaires in the digital program and via online questionnaires and by a physical therapist in the face-to-face program. Data for all participants who had been enrolled in either of the 2 programs between April 1, 2018, and December 31, 2019, were extracted from the BOA and JA registries. The data from the 2 registries were then linked using national personal identification numbers to identify and exclude individuals who had participated in both programs during the specified time window from further analysis. For inclusion in the present analysis, the following criteria should be met: (1) clinical diagnosis of OA, with knee or hip OA as their index (most symptomatic) joint; (2) 3-month follow-up data for the main outcome on or before March 31, 2020; and (3) program adherence of 80% or higher. These criteria were consistent with the Swedish clinical practice guideline recommendations for first-line treatment of knee and hip OA issued by the National Board of Health and Welfare.27 Adherence was defined as 80% or more completed education videos, exercises, and questionnaires offered in the digital program and participation in the educational part and at least 10 of the 12 supervised exercise sessions offered in the face-to-face program. Adherence to lessons and exercises was registered automatically by the digital program, and by the PT in the face-to-face program. Supervised physical therapist-led face-to-face exercise with greater than 80% adherence was the recommended treatment for these patients. Those in this face-to-face group that chose to do their exercises at home were not supervised and did not report adherence to the register and were therefore excluded. Data extracted included demographics (sex, age, body mass index, education level, working status, index joint, on the waiting list for joint surgery) as well as data describing the physical activity level, walking difficulties, joint pain, health-related quality of life, fear-avoidance behavior, willingness for surgery, and adherence to the intervention.

Main Exposures and Outcomes

Exposures
The main exposure was 3 months of first-line OA treatment delivered either face-to-face or digitally. Participants had a program adherence rate of 80% or higher.

Main Outcome
The main outcome was the self-reported change in mean pain during the last week in the most affected joint between baseline and 3-month follow-up, measured with the numeric rating scale (NRS). The NRS is an 11-point scale, where 0 indicates no pain and 10 indicates the worst possible pain.28

Secondary Outcomes
There were 4 secondary outcomes. In priority order, they were (1) 3-month follow-up in self-reported walking difficulties (yes or no), assessed with the question, “Do you have problems walking as result of your joint problems?”29 (2) change in overall health-related quality of life, assessed with the EuroQol-5-dimension (EQ-5D) descriptive system questionnaire (visual analog scale 0-100 for BOA participants and 0-10 for JA participants, with scores for JA participants recalculated to a 0-100 scale),30 where a higher score indicates better overall health-related quality of life; (3) willingness to undergo joint surgery (yes or no) after 3 months, assessed with the question “Are your symptoms so severe, that you wish to undergo surgery for your hip/knee?” and (4) fear-avoidance behavior (yes or no) after 3 months, assessed with the question, “Are you afraid your joints will be injured by physical training/activity?”
Statistical Analysis

This was an observational study designed to test the equivalence between a digital and a face-to-face first-line intervention on joint pain for persons with OA of the hip or knee. All variables were normally distributed, and descriptive data are presented as mean (SD) and frequency (%) as appropriate. To establish equivalence between the interventions, the mean pain change after the intervention should differ by less than 1 point on a 0-to-10 NRS pain scale. This equivalence bound was selected based on previous work suggesting 1-point change as the minimal clinical important difference in persons with OA. The mean difference in change in pain after 3 months between intervention groups was analyzed using linear regression with robust standard errors, both in terms of crude and adjusted differences. Adjusted analyses included age, sex, weight, height, education level, working status, most affected joint, other affected joints, on waiting list for surgery, physical activity (training and daily exercise), overall health, pain, EQ-5D score, fear of movement, and previous surgery of the index joint, selected to counteract confounding bias according to the modified disjunctive cause criterion. Due to the large number of missing height measurements, adjusted analyses were performed using multiple imputation by chained equations. The reason for missingness was technical difficulties in the data entry questionnaire. The imputation was based on a linear regression model and included all variables from the main analysis. Fifty imputations were performed. As a sensitivity analysis, the latter was also performed without imputation, in a complete case analysis. Sensitivity analyses were also performed using propensity score matching. Here, logistic regression was used to generate the propensity score and the 1-to-1, nearest neighbor approach was used for matching. Propensity score balance was examined using standardized differences for all propensity score variables. Secondary end points were analyzed in an analogous manner. Means and proportions are presented at baseline and 3 months for continuous and binary outcomes, respectively, together with 95% CIs. For continuous outcomes, mean change is presented as well, together with 95% CIs, and for binary outcomes the change in proportions are presented and 95% CIs calculated using linear regression with cluster robust standard errors. All analyses were performed using Stata version 17.0 (StataCorp). Statistical significance was set at \( P < .05 \), and all tests were 2-tailed. Data analysis was conducted in March 2021. Results for the main and complete case analyses are provided in eTables 3, 4, and 5 in the Supplement.

Results

Data for 23,623 (BOA) and 9,099 (JA) participants were extracted from the registries. Overall, 6,946 participants were included in the final analysis (Figure and Table 2). The mean (SD) age was 67 (9) years; 4,952 participants (71%) were women; 4,424 (64%) had knee OA and 2,504 (36%) hip OA, with 4,237 (61%) receiving face-to-face treatment and 2,709 (39%) receiving digital treatment.

Figure. Flowchart of the Inclusion Process

The first box includes all persons having registered in the programs and had the first telephone contact with the physical therapist (digital) or participated in the first educational session (face-to-face) between April 1, 2018, and December 31, 2019. Characteristics for the entire group and for those with adherence of less than 80% appear in eTables 1 and 2 in the Supplement. NRS indicates numerical rating scale.
Main Outcome
Both the face-to-face (mean change, −1.10 [95% CI, −1.17 to −1.02]) and digital intervention (mean change, −1.87 [95% CI, −1.94 to −1.79]) resulted in a clinically important pain reduction at 3 months. Participants in the digitally delivered intervention showed a −0.92 (95% CI, −1.02 to −0.81) points mean adjusted and imputed greater decrease in pain at 3 months compared with the face-to-face intervention (Table 3).

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Participants, No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Face-to-face (n = 4237)</td>
</tr>
<tr>
<td>Sex</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2855 (67)</td>
</tr>
<tr>
<td>Male</td>
<td>1382 (33)</td>
</tr>
<tr>
<td>Index joint</td>
<td></td>
</tr>
<tr>
<td>Knee</td>
<td>2817 (67)</td>
</tr>
<tr>
<td>Hip</td>
<td>1402 (33)</td>
</tr>
<tr>
<td>Age, mean (SD), y</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>68.5 (8.6)</td>
</tr>
<tr>
<td>BMI</td>
<td></td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>28.1 (4.9)</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>Elementary</td>
<td>1192 (28.3)</td>
</tr>
<tr>
<td>High school</td>
<td>1728 (41.1)</td>
</tr>
<tr>
<td>University</td>
<td>1286 (30.6)</td>
</tr>
<tr>
<td>Working status</td>
<td></td>
</tr>
<tr>
<td>Working</td>
<td>803 (19.0)</td>
</tr>
<tr>
<td>Studying</td>
<td>NR</td>
</tr>
<tr>
<td>Sick leave</td>
<td>177 (4.2)</td>
</tr>
<tr>
<td>Retired</td>
<td>3173 (75.2)</td>
</tr>
<tr>
<td>Unemployed</td>
<td>66 (1.6)</td>
</tr>
<tr>
<td>Physically active, meeting recommended 150 min/wk</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>4209</td>
</tr>
<tr>
<td>Yes</td>
<td>1705 (40.5)</td>
</tr>
<tr>
<td>On waiting list for surgery</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>4217</td>
</tr>
<tr>
<td>Yes</td>
<td>253 (6.0)</td>
</tr>
<tr>
<td>NRS joint pain, mean (SD), 0-10</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>4208</td>
</tr>
<tr>
<td>Mean (SD)</td>
<td>64.9 (18.6)</td>
</tr>
<tr>
<td>Wish for surgery</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>4134</td>
</tr>
<tr>
<td>Yes</td>
<td>1144 (27.5)</td>
</tr>
<tr>
<td>No</td>
<td>2990 (72.5)</td>
</tr>
<tr>
<td>Walking difficulties</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>4204</td>
</tr>
<tr>
<td>Yes</td>
<td>3534 (84.1)</td>
</tr>
<tr>
<td>No</td>
<td>670 (15.9)</td>
</tr>
<tr>
<td>Fear of movement</td>
<td></td>
</tr>
<tr>
<td>No.</td>
<td>4194</td>
</tr>
<tr>
<td>Yes</td>
<td>519 (12.3)</td>
</tr>
<tr>
<td>No</td>
<td>3675 (87.7)</td>
</tr>
</tbody>
</table>

Abbreviations: BMI, body mass index (calculated as weight in kilograms divided by height in meters squared); EQ-5D, EuroQol-5-dimension; NR, not reported; NRS, numerical rating scale; VAS, visual analog scale.
## Table 3. Data for Baseline, Follow-up, and Change Between Baseline and Follow-up and Between the 2 Delivery Modalities for Main and Secondary Outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Face-to-face delivery (n = 4237)</th>
<th>Digital delivery (n = 2709)</th>
<th>Digital vs face-to-face, difference in change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Baseline (95% CI)</td>
<td>Follow-up (95% CI)</td>
<td>Change from baseline to follow-up (95% CI)</td>
</tr>
<tr>
<td>NRS, 0-10</td>
<td>5.8 (5.7 to 5.9)</td>
<td>4.7 (4.6 to 4.8)</td>
<td>−1.1 (−1.2 to −1.0)</td>
</tr>
<tr>
<td>EQ-5D VAS, 0-100</td>
<td>64.9 (64.3 to 65.5)</td>
<td>68.9 (68.3 to 69.5)</td>
<td>4.0 (3.5 to 4.6)</td>
</tr>
<tr>
<td>Wish for surgery, %</td>
<td>27.5 (26.2 to 28.9)</td>
<td>25.4 (24.1 to 26.7)</td>
<td>−2.1 (−3.4 to −0.8)</td>
</tr>
<tr>
<td>Walking difficulties, %</td>
<td>84.1 (82.9 to 85.1)</td>
<td>70 (70 to 70)</td>
<td>−13.8 (−15.1 to −12.4)</td>
</tr>
<tr>
<td>Fear of movement, %</td>
<td>12.3 (11.3 to 13.4)</td>
<td>5.5 (4.9 to 6.3)</td>
<td>−6.9 (−7.9 to −5.8)</td>
</tr>
</tbody>
</table>

Abbreviations: EQ-5D, EuroQol–5-Dimension; NRS, numeric rating scale; VAS, visual analog scale.

* Favors face-to-face treatment.
* Favors digital treatment.
* Differences in proportions at 3 months.
* Adjusted differences in proportions at 3 months.
* Imputation used in this analysis.
Secondary Outcomes

All comparisons of secondary outcomes between groups reported here are adjusted for baseline values. Both interventions resulted in improved outcomes for all secondary outcomes at 3 months (Table 3).

At 3 months, the mean difference in proportion of persons experiencing walking difficulties between the 2 study groups was 2.3% (95% CI, −0.1% to 4.7%) (Table 3). Participants in the digitally delivered intervention experienced less improvement in health-related quality of life at 3 months compared with the face-to-face intervention (mean difference, −5.63 [95% CI, −6.62 to −4.65] points) (Table 3). The proportion of participants who expressed a wish for surgery after 3 months was smaller for the digital compared with face-to-face intervention (mean difference, −2.7% [95% CI −4.7% to −0.7%]) (Table 2). Finally, the difference in proportion of participants in the digital vs face-to-face intervention expressing fear of movement at 3 months was 1.0% (95% CI, −0.2% to 2.2%) (Table 3).

Sensitivity Analysis

Propensity score matching did not result in any important change in the main outcome (mean difference between interventions, −0.98 [95% CI, −1.17 to −0.79] points). Neither did the complete case linear regression analysis (data not shown).

Discussion

Participants in face-to-face vs digital exercise intervention both reported clinically relevant reductions in pain by 3 months, the main outcome of the study. While participants in the digitally delivered intervention reported greater improvement in pain, the 95% CI of the difference between the groups barely exceeded our predefined equivalence margin of 1 point, suggesting that the observed difference was of uncertain clinical relevance. In line with the main finding, which showed results of the 2 interventions bordering on equivalence, we observed only minor differences in secondary outcomes.

The prevalence of OA has increased substantially in the last decades, increasing the disease burden for both individuals and society.34 Digital delivery of first-line intervention has the potential to reach more individuals with OA and improve the suboptimal implementation of exercise and education in the management of OA.35-37 A recent systematic review and meta-analysis showed that a digital structured self-management program for OA may result in small to moderate benefits in pain reduction and physical function compared with joining a surgery waiting list, treatment as usual or minimal interventions, alternative treatments, or other digital-based interventions. Another review of systematic reviews showed that the pain and function outcomes were comparable for digital or telerehabilitation and face-to-face treatments in persons with musculoskeletal disorders.38 Our present study suggests that digital treatments are associated with clinically significant improvements in pain and show a larger pain reduction compared with a face-to-face intervention.

The difference in pain reduction between the 2 modalities, while being of uncertain clinical relevance, may be associated with the way treatment was offered. In the digital intervention, exercise and education was offered 5 to 7 days a week for 3 months, whereas exercise was offered twice a week for 6 weeks and education at 2 sessions in the face-to-face intervention. A longer duration of the treatment program may be beneficial for pain improvement.21,39 Daily exercise reminders and the possibility to have daily contact with a PT may also facilitate behavioral changes in favor of digital treatment.40 Although the difference was small, a higher proportion of the participants in the digital program had changed their mind and no longer wished to undergo surgery at 3 months follow-up. This difference may be related to the higher pain reduction in this group. Future studies will reveal whether changes in attitude to knee surgery are maintained long term.

On the other hand, the improvement in health-related quality of life was greater in the face-to-face group than the digital group. This is in line with a systematic review showing only a small improvement for health-related quality of life after participating in a digital program.57 It was postulated that social interactions between patients participating in group exercises may enhance self-efficacy.41 Possibly, an increase in the patients’ beliefs in their own capability may have a larger
effect on health-related quality of life\textsuperscript{42} in this group compared with the digital group, where exercises were performed individually without social interactions between patients. Further quantitative and qualitative studies are needed to confirm this. When considering the 6\% better comparative improvement in the face-to-face program, we acknowledge that there is no established cut-off for clinical relevance using the EQ-5D VAS.

The results from the present study show that both modalities of first-line treatment for knee or hip OA are associated with clinically important OA pain reduction as well as improvements in secondary outcomes and should be seen as complementary modes of delivering a widely recommended treatment for a very common disease. A comparative costing analysis of the 2 modes of care delivery showed that, overall, the digital model cost around 25\% of the face-to-face model of care.\textsuperscript{43} A formal cost-effectiveness comparison is pending. The differences in the 2 study populations suggest that the different delivery modes may attract different persons, ie, the participants in the digital group were younger, a higher proportion were women, they had a higher education level, and a higher proportion were still working. By providing both face-to-face and digital treatments, we may be able to deliver first-line treatment for OA to more persons, facilitate shared decision-making in the choice of treatment, and thereby increase the chance of successful treatment outcomes.\textsuperscript{44,45}

Strengths and Limitations
A major strength of this study is that we included nearly 7000 participants who underwent similar structured first-line treatments for OA, including the same set of outcomes, in a clinical setting in Sweden. This study also has several limitations. The number of participants not providing a report at 3 months follow-up was high both for the digital and face-to-face delivery, which is common in registry-based studies from clinical settings,\textsuperscript{45} and we have no information on the reasons for loss to follow-up. We only included participants with an adherence to the intervention of 80\% or greater, since the aim of the study was to compare the results for persons performing the treatment as recommended by national guidelines, and the most common range to determine satisfactory adherence was reported to be 80\% to 99\%.\textsuperscript{46} We can thus only generalize the results to persons with satisfactory adherence to the intervention. In this study including clinical data, between 37\% (digital) and 49\% (face-to-face) of participants did not reach an adherence of 80\%. This subgroup of participants was slightly younger and included a slightly higher proportion of women (in both treatment modalities) (eTable 2 in the Supplement). Additional studies are needed to better understand factors important for program adherence and treatment implementation to enable tailoring of first-line treatment programs so to reach as many persons as possible in need of such treatment.

The EQ-5D VAS was measured from 0 to 100 in the face-to-face population and from 0 to 10 in the digital population. We transformed the data for the digital intervention from 0 to 100, which may have introduced some bias. While both treatment modes included the outcomes reported here, minor differences in the wording of questions between them may have affected results. All outcome data were collected digitally and directly from the participant in the digital program, while in the face-to-face program some of the data were collected from the patient by the PT and then entered into the registry. The present comparison was made between 2 specific treatment models, and our conclusions may not be applicable to other face-to-face or digital treatments of OA.

Conclusions
In this study, first-line interventions for knee and hip osteoarthritis over 3 months were associated with clinically relevant improvements in pain, whether delivered face-to-face or digitally. We suggest that first-line OA interventions should be offered both digitally and face-to-face and that persons with knee and hip OA should be able to choose the mode of treatment delivery they prefer to reach as many persons with OA as possible.
ARTICLE INFORMATION
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SUPPLEMENT.

eTable 1. Patient Characteristics for Participants in Face-to-Face and Digital Intervention, Whole Sample

eTable 2. Sex, Index Joint, BMI, and Baseline Pain for Participants With Adherence of Less Than 80% in Face-to-Face and Digital Programs

eTable 3. Linear Regression Analysis

eTable 4. Propensity Score Analysis

eTable 5. Complete Case Analysis