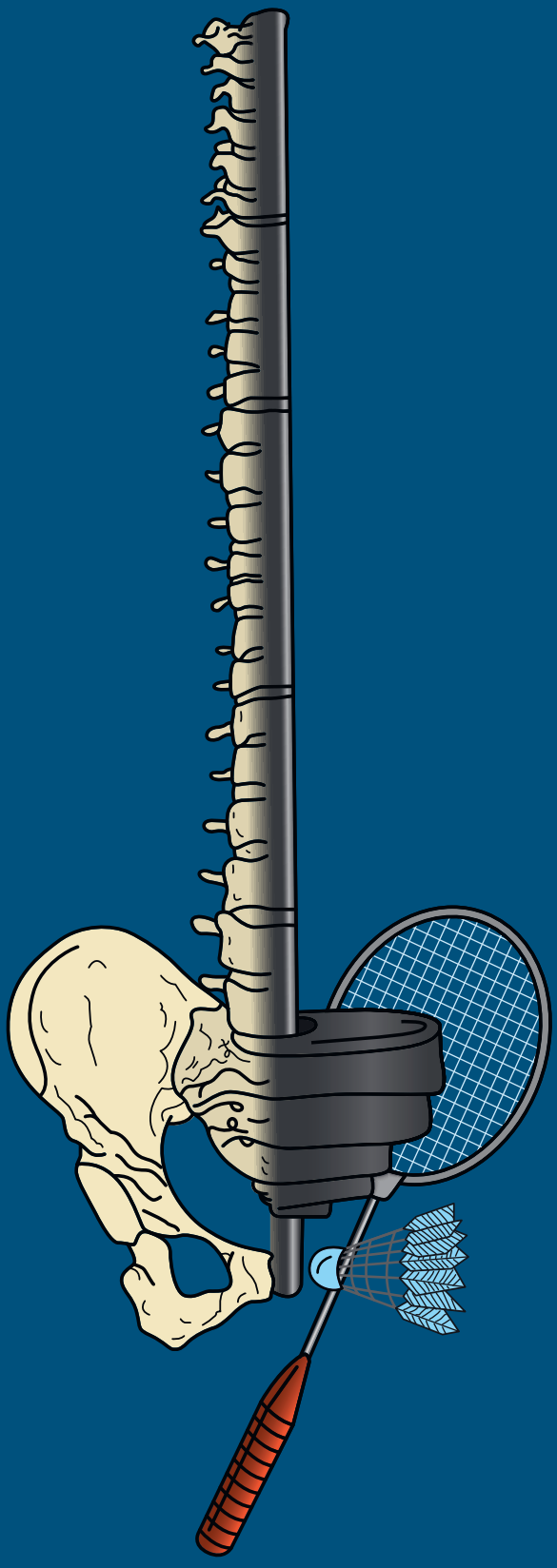
Optimizing physical activity and exercise in people with axial spondyloarthritis

Hilberdink, S.



Chapter 6

Implementing enhancements in supervised group exercise for people with axial spondyloarthritis: a hybrid effectiveness-implementation study

Bas Hilberdink
Florus van der Giesen
Thea Vliet Vlieland
Leti van Bodegom-Vos
Salima van Weely

Scandinavian Journal of Rheumatology 2021 Nov 17;1-9.

Abstract

Objective

The content of supervised group exercise (SGE) for axial spondyloarthritis (axSpA) has hardly changed in recent decades, despite new evidence-based insights to improve SGE quality. This pilot implementation study evaluated the effects and feasibility of enhancements in SGE for people with axSpA in four regions in the Netherlands.

Methods

The implemented enhancements included: 1. More high-intensity aerobic exercise; 2. Exercise personalisation with periodic assessments; 3. Patient education on home exercise. The implementation strategy included a one-day supervisors' training and bimonthly telephone support. To evaluate effects, aerobic capacity (6-Minute Walk Test (6MWT)), physical functioning (Ankylosing Spondylitis Performance-based Improvement (ASPI); improved/not improved), health status (ASAS HI-questionnaire) and home exercise engagement (SQUASH-questionnaire) were assessed at baseline and after one year among 60 participants. Changes were analysed with the Wilcoxon Signed-Rank Test. To evaluate feasibility, a survey among participants and semi-structured interviews with SGE supervisors (n=4) assessed uptake and satisfaction with the enhancements.

Results

Aerobic capacity increased significantly and 35% of participants improved functioning, whereas health status and home exercise engagement did not change. The participants' survey and the supervisors' interviews showed that high-intensity aerobic exercise was implemented successfully, exercise personalisation and periodic assessments were implemented partially and patient education was not implemented at all. Most participants were satisfied with applied changes.

Conclusion

After a one-day training for SGE supervisors and telephone support, SGE enhancements were only partially implemented. Nevertheless, aerobic capacity improved significantly and satisfaction with accomplished changes was high. A nationwide implementation requires adaptations to the implementation strategy to improve feasibility.

Introduction

Axial spondyloarthritis (axSpA) is a chronic inflammatory disease that primarily affects the axial skeleton and is characterised by inflammatory back pain and stiffness (1, 2). Exercise has proven positive effects on symptoms, spinal mobility, cardiorespiratory fitness and physical functioning

in patients with axSpA (3-9). Moreover, it was found that supervised group exercise (SGE) is more beneficial than unsupervised, individual exercise (9-12). Thus, since the early nineties of the past century, SGE for patients with axSpA was implemented in many countries, including the Netherlands, where local patient associations affiliated with the Dutch Arthritis Society currently organise 56 axSpA-specific exercise groups in 17 regions (13). It was found that the delivery of SGE has hardly changed over the past decades, still comprising once weekly sessions with a relatively long duration, mainly focusing on mobility and strengthening exercises (13-17). This is in contrast with recommendations in the literature which state that more attention should be paid to high-intensity aerobic exercise (4-9, 14, 18-22), better exercise personalisation based on periodic assessments (10, 23-27) and educating patients about home exercise and about general, health-enhancing physical activity (3-5, 10, 28, 29).

Implementing these elements could enhance the SGE effectiveness, particularly regarding aerobic capacity, functioning and weekly exercise engagement. After all, studies have shown that the addition of (high-intensity) aerobic exercise can improve functioning and aerobic capacity (4, 9, 14, 19, 21), which is beneficial for the increased cardiovascular risk in axSpA (7, 18). Furthermore, both exercise personalisation and patient education on exercise can improve the overall potential for effectiveness (3, 10, 24) and increase weekly exercise engagement (3, 23, 25-27, 29).

It seems justified to implement these enhancements, yet it appears that knowledge about the feasibility of implementing them is scanty. One recent study, described in an abstract (30), involved a pilot implementation of comparable enhancements in four axSpA-specific exercise groups in Switzerland. Satisfaction levels were high, but they suggested to make the intervention less extensive to improve feasibility (30). These findings may not be fully generalisable to the Netherlands, as implementation strategies need to be tailored to a particular context, addressing specific barriers [30,31].

In the Netherlands, it seems appropriate to focus the implementation strategy on SGE supervisors. The knowledge and skills of supervisors appear to be very important in optimising exercise behaviour of people with axSpA (20, 23, 31) and are crucial for implementing the desired SGE enhancements. However, in the

Netherlands, 75% of axSpA-specific SGE supervisors had no postgraduate training related to rheumatology (13). Successful implementation strategies in other populations, i.e. in people with rheumatoid arthritis (32) and osteoarthritis (33), have also mainly focused on training exercise supervisors.

Given the lack of knowledge, this pilot implementation aims to evaluate the effects and feasibility of implementing enhancements in axSpA-specific SGE, prior to a nationwide implementation in the Netherlands. To evaluate effectiveness, changes in various patient outcomes were assessed, and to evaluate feasibility, both the extent to which the supervisors applied the enhancements and the experiences and satisfaction of participants were examined.

Materials and Methods

Design

A hybrid effectiveness-implementation type 2 design was used, because of the dual focus on both the effectiveness and the feasibility of this pilot implementation. A hybrid study design can speed the scientific progress and facilitate the translation of research findings into routine practice (34, 35). The implementation process started in 2015 in one region where axSpA-specific SGE was delivered, followed by three more regions in 2017. After a baseline survey among the participants, all involved SGE supervisors participated in a training and were urged to apply the proposed enhancements to their SGE. After one year, in 2018, an evaluation survey among participants and interviews with supervisors were used.

The guidelines of the Standards for Reporting Implementation Studies (StaRI) initiative have been followed for the reporting of this pilot implementation study (36).

Intervention and implementation strategy

The intervention to be implemented included: 1) More focus on high-intensity aerobic exercise during SGE, including intensity monitoring (e.g. by heartrate or BORG-scale); 2) Better exercise personalisation by performing periodic physical assessments, which provide insight in personal limitations; 3) Patient education during SGE about home exercise and physical activity (e.g. promotion of an axSpA-specific exercise app, called ´Bewegen met Bechterew´). To implement these enhancements, a strategy was tailored to the context of axSpA-specific SGE in the Netherlands (13) and therefore targeted the SGE supervisors. They received a one-day training, a manual for the physical assessments and bimonthly telephone support and a helpdesk (telephone or e-mail) was available on request. During the

training, supervisors were educated on why and how to implement the enhancements. The training equally consisted of theoretical and practical parts, focussing on axSpA education, exercise recommendations, intensity monitoring, physical assessments and corresponding exercise personalisation. There was some permissiveness as to how and to what extent each enhancement should be implemented by supervisors.

Setting and subjects

Six local patient associations organising axSpA-specific SGE in the Netherlands were invited for this pilot implementation project: eventually, four associations accepted the invitation (after much effort from the researchers). These associations organised nine axSpA-specific SGE classes for 130 patients with axSpA with involvement of 16 supervisors in total. Classes were once a week, combining training on land including sports activities (45-90 minutes) with hydrotherapy (45 minutes), mainly focusing on mobility and strengthening exercises and without any intensity monitoring, periodic physical assessments or patient education (15).

The inclusion criteria for SGE participants in this study were: 1) being willing and able to participate in this study; 2) completion of the baseline survey; 3) either having two physical assessments and/or completing the evaluation survey. A package of numbered surveys and patient information letters was sent to the four local patient associations that organised the SGE. To ensure anonymity, only they had a file with the link between the numbered surveys and the participants' information. The associations were responsible for inviting the SGE participants to the survey and for arranging the distribution, collection and return of the surveys.

Measurements

Effects were evaluated in three ways. First, in the evaluation survey, participants rated the changes they experienced in their functioning after the implementation (*improved*, *no change* or *worsened*). Second, the periodic physical assessments included the 6-Minute Walk Test (6MWT), measuring aerobic capacity (37), the Ankylosing Spondylitis Performance-based Improvement (ASPI), measuring physical functioning with three performance-based tests (38), and three spinal mobility tests, namely lateral spinal flexion, tragus-to-wall distance and chest expansion (39-41). Third, both the evaluation and baseline survey included the ASAS Health Index (ASAS HI), which measures participants' health status (42), and the Short Questionnaire to Assess Health-enhancing physical activity' (SQUASH), which measures the participants' weekly physical activity (43).

To evaluate the feasibility, semi-structured interviews with supervisors and an evaluation surveys among individual participants were conducted. The interviews were conducted by telephone with the coordinating supervisor from each region

(n=4), lasting approximately 45 minutes per interview. Supervisors were asked to what extent each enhancement was implemented, how they experienced its feasibility and its added value and if they had future needs. The answers were used to analyse the uptake of enhancements and compare regions. The evaluation survey examined participants' experiences with the program changes (one 5-point Likert scale and two open questions for positive and negative feedback), with each SGE enhancement (ten multiple choice questions) and with the program's intensity, options for personalisation and amount of mobility, strengthening and aerobic exercise (five multiple choice questions). Finally, to evaluate the feasibility of implementing the physical assessments, it was also analysed which assessment data were collected in the four SGE regions.

Statistical analyses

Descriptive statistics were used for the patient characteristics and the results on the evaluation survey, which were reported as frequency (and percentage) or median (and interquartile range), where appropriate. From the SQUASH, the weekly frequency and duration of aerobic exercise were calculated. Changes between two timepoints in 6MWT, ASPI, the spinal mobility tests, ASAS HI and SQUASH were analysed with the Wilcoxon Signed-Rank Test. In addition, it was calculated how many participants (numbers and percentage) did and did not improve on the ASPI (if at least one item improved with ≥20%, whereas none of the items worsened ≥20%, it was classified as improved (38)) and how many improved, had no change and worsened on the 6MWT with at least 30 meters, its minimal clinically important difference (37). Differences in age and durations of disease and SGE participation between the participants who were and were not included and between the four regions were analysed with the Median test, a non-parametric test comparing medians across two or more independent samples, and differences in gender between these subgroups were analysed with the Chi-square test.

Analyses were performed using IBM SPSS Statistics for Windows, version 23.0 (IBM Corp., Armonk, NY, USA).

Results

Patients

Of the 130 axSpA-specific SGE participants, 118 completed the baseline survey. Of these, a total of 89 were included, of which 62 had at least two physical assessments and 60 completed the evaluation survey, as shown in Figure 1. In Region 3, the assessment was organised only once and in Region 4, the evaluation survey was not sent to the participants due to a delayed start of the implementation project in that region.

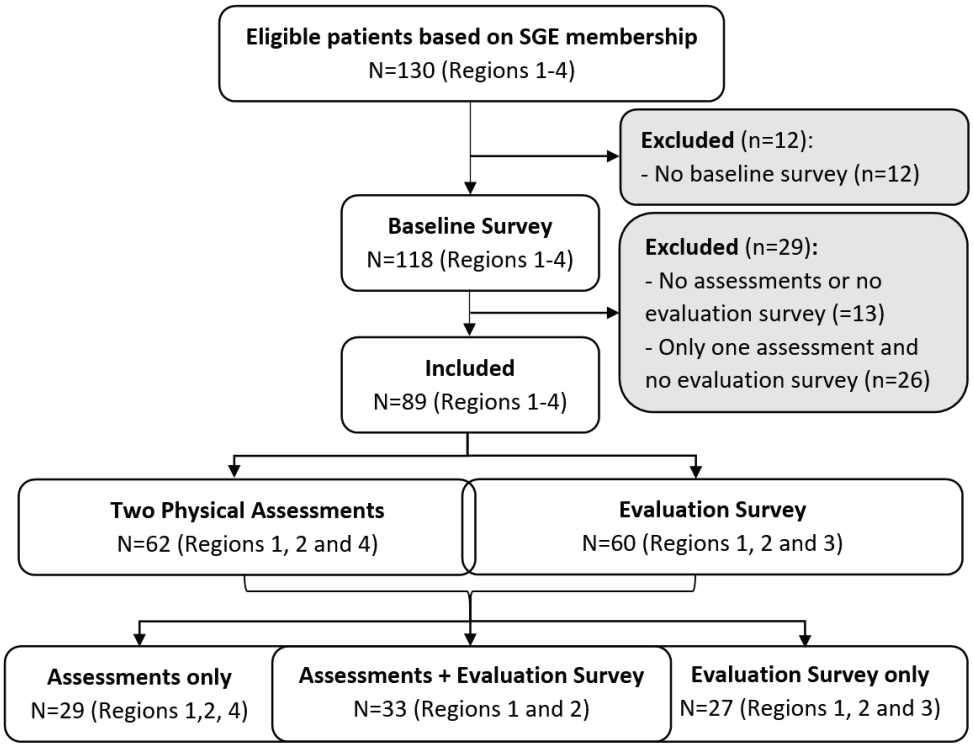


Figure 1. Inclusion flowchart of axial spondyloarthritis patients participating in the pilot implementation of supervised group exercise enhancements.

The Chi-square test showed that the proportion of males was higher among the included participants than among the excluded patients ($p < .05$), whereas there were no significant differences in age, disease duration or SGE participation according to the Median test.

Of the 89 participants, 71% was male and the median (IQR) age was 61 (55;69) years. The median (IQR) disease duration and SGE participation were 28 (14;36) and 21 (7;25) years, respectively. Table 1 presents the differences in baseline characteristics between the different subgroups; none reached statistical significance with the Chi-square or Median tests.

Table 1. Characteristics of the axial spondyloarthritis patients included in this study and the different study subgroups.

	Total (n=89)	Assessments (n=62)	Evaluation (n=60)	Region 1 (n=33)	Region 2 (n=27)	Region 3 (n=16)	Region 4 (n=13)
Age, years, Med (IQR)	61 (55;69)	62 (52;70)	60 (55;68)	59 (51;70)	62 (57;71)	60 (55;64)	62 (54;70)
Gender, male, n (%)	63 (71)	45 (73)	43 (72)	25 (76)	18 (67)	9 (56)	11 (85)
Disease duration, years, Med (IQR)	28 (14;36)	29 (12;38)	26 (16;35)	28 (10;40)	29 (17;34)	26 (23;30)	30 (14;40)
SGE Participation, years, Med (IQR)	22 (9;25)	21 (9;25)	23 (11;27)	19 (8;25)	25 (9;28)	23 (20;27)	21 (13;25)
Medication use, n (%)							
Painkiller [a]	19 (22)	11 (18)	15 (25)	6 (18)	5 (20)	6 (38)	2 (15)
NSAID	47 (54)	35 (58)	31 (52)	21 (64)	15 (60)	4 (25)	7 (54)
Biological DMARD	8 (9)	5 (8)	6 (10)	1 (3)	3 (12)	2 (13)	2 (15)
Synthetic DMARD	13 (15)	7 (12)	9 (15)	5 (15)	4 (16)	3 (19)	1 (8)
None	20 (23)	14 (23)	13 (22)	6 (18)	4 (16)	5 (31)	5 (39)

[a] Acetaminophen or opioid painkillers.

SGE = supervised group exercise; Med = median; IQR = interquartile range; NSAID = nonsteroidal anti-inflammatory drug; DMARD = disease-modifying antirheumatic drug.

Evaluation of effects

In the evaluation survey, 20 of 60 participants (33%) reported to experience improved functioning, 38 (63%) no change and 2 (3%) a negative change since the implementation. In addition, the ASPI qualified 20 of 58 participants (35%) as improved and 38 (65%) as not improved and on the 6MWT, 20 of 56 participants (36%) improved (≥30 meters), whereas 28 (50%) had no clinically significant change and 8 (14%) worsened (≥30 meters). This is presented in Figure 2. Furthermore, Table 2 shows a statistically significant improvement in the 6MWT and a small but statistically significant worsening in tragus-to-wall distance; both *p*-values < .05. No statistically significant changes over time were found in the other two spinal mobility tests, in the ASPI performance-based tests, in health status (ASAS HI) and in frequency and duration of aerobic exercise; all *p*-values > .05.

Table 2. Baseline and follow-up scores and the change over time of measurements evaluating the implementation effects.

	Baseline Med (IQR)	Follow-up Med (IQR)	Change in score Med (IQR)	*P*
Aerobic capacity: 6MWT, meters	552 (481;595)	569 (513;626)	10 (-19;60)	0.019 [a]
Physical functioning: ASPI				
Picking up pens, sec	12.0 (10.0;15.8)	11.8 (9.8;14.3)	-0.2 (-2.2;1.7)	0.321
Putting on socks, sec	12.0 (8.6;18.2)	11.5 (8.6;14.3)	-0.4 (-6.0;1.8)	0.249
Getting up from floor, sec	4.9 (3.4;6.7)	4.3 (3.4;6.2)	0 (-1.1;0.5)	0.389
Spinal mobility				
Lateral flexion, cm	9.5 (5.0;14.3)	9.5 (5.8;14.3)	0 (-1.3;1.0)	0.900
Tragus-to-wall, cm	15.7 (11.9;21.5)	17.5 (13.4;23.3)	0.7 (-0.5;2.6)	0.011 [a]
Chest expansion, cm	2.5 (1.5;4.0)	2.5 (1.5;4.0)	0 (-0.5;0.5)	0.838
Health status: ASAS HI, score	5.0 (3.0;8.0)	5.0 (3.0;8.5)	0 (-1, 1.9)	0.157
Exercise frequency: SQUASH, sessions/week	6 (3;10)	6 (3;9)	0 (-1;2)	0.357
Aerobic exercise: SQUASH, minutes/week	375 (225;555)	405 (245;555)	0 (-120;175)	0.560

[a] Significant improvement with a p value < .05 by the Wilcoxon Signed-Rank Test.
Med = Median. IQR = interquartile range. 6MWT = 6-Minute Walk Test. ASPI = Ankylosing Spondylitis Performance-based Improvement. Sec = seconds. Cm = centimetres. ASAS HI = ASAS Health Index. SQUASH = Short Questionnaire to Assess Health-enhancing physical activity.

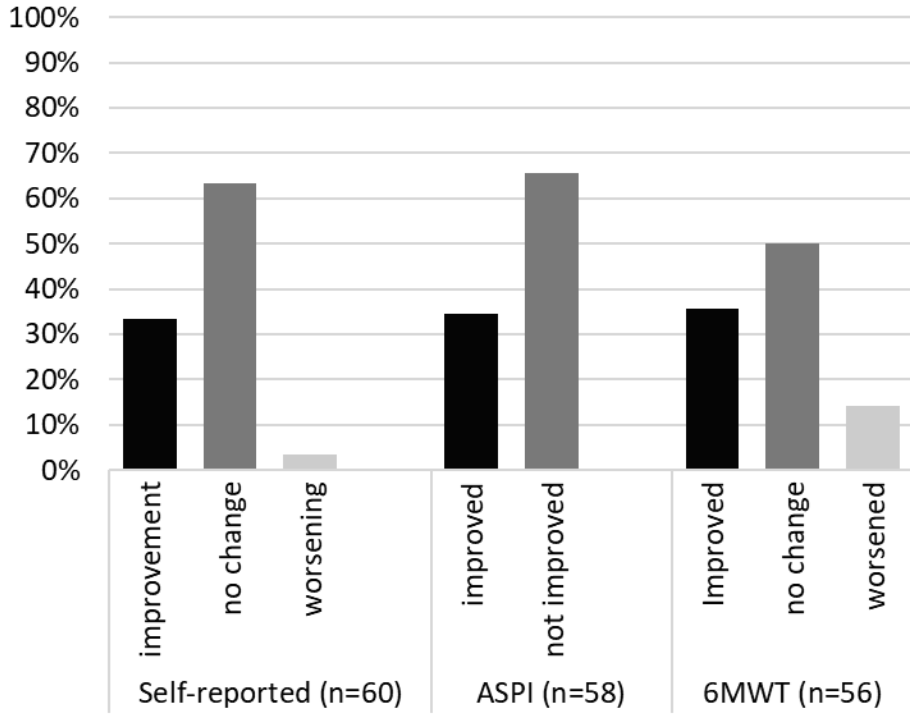


Figure 2. Proportion of participants with (and without) improvement in self-reported functioning, in the Ankylosing Spondylitis Performance-based Improvement (ASPI; improvement = one item improving ≥20% and none worsening ≥20% (38)), and in the 6-Minute Walk Test (6MWT; change = ≥30 meters difference (37)).

Implementation activities

It proved difficult to plan the one-day training with the supervisors, which resulted in four different training days, in order for all 16 supervisors to be able to attend one training day. Regarding the execution of physical assessments, the 6MWT was used in all regions and the ASPI and mobility tests in three of four regions. The time interval between assessments differed between regions: there were twelve, six and nine months between baseline and (first) follow-up physical assessments of participants in Regions 1, 2 and 4, respectively. Region 3 organised assessments just once. During the bimonthly telephone support, supervisors mainly needed advice on personalisation of exercise and intensity monitoring. The helpdesk was only used once: Region 2 had questions about the correct use of the Borg-scale to monitor exercise intensity.

Evaluation of feasibility

Supervisors' interviews

The semi-structured interviews were performed with SGE supervisors from each region (n=4): one of four was male, they were between 28 and 56 years old, and they had between 8 and 30 years of experience with axSpA-specific SGE. All supervisors experienced an increased SGE-quality, mainly due to higher exercise intensity and more variation, especially after the initial physical assessments. Regarding the three enhancements, the following findings were reported:

1. High-intensity aerobic exercise: All supervisors indicated that this was implemented successfully, e.g. by using more aerobic exercises in circuit training and by increasing intensity (getting more out of breath), and it was considered the most important enhancement. One supervisor noticed that the participants were more focused on the exercises. To monitor exercise intensity, heartrate monitors were implemented in one region only, aiming at a heartrate of 70% of the theoretical maximum (220 minus age); two regions used a Borg-scale due to limited availability of heartrate monitors and in one region it was not applied at all as it was considered impractical.
2. Exercise personalisation with physical assessments: All supervisors noted that they sometimes experienced difficulties tailoring the exercises to the large individual differences, e.g. in circuit training. Physical assessments were performed at least once in all regions, but only two regions continued with periodic assessments. The other two regions only performed the assessments once or twice, because it was too time consuming and required additional supervisors. The two regions that continued with the assessments reported to have sufficient supervisors and funding available for this. In all regions, an extra supervisor was employed during the assessments. All supervisors experienced that the participants were very positive about the assessments.
3. Patient education: none of the supervisors provided structural education on home exercise during SGE and two supervisors desired to implement it in the future. In Region 1, however, the importance of home exercises is discussed during yearly evaluations of the assessments.

Finally, the supervisors experienced the one-day training as helpful and suggested repeating the course for further training. As future needs, they mentioned support in educating and motivating participants to exercise at home in addition to SGE and to create a more standardised exercise program, to reduce the quality differences between supervisors.

Table 3. Evaluation of feasibility and satisfaction with implemented enhancement by supervised group exercise participants.

	Total (n=60)	Region 1 (n=19)	Region 2 (n=25)	Region 3 (n=16)
Experienced program changes, n (%)				
Much worse	0/60 (0)	0/19 (0)	0/25 (0)	0/16 (0)
A little worse	4/60 (7)	1/19 (5)	1/25 (4)	2/16 (13)
The same	21/60 (35)	4/19 (21)	11/25 (44)	6/16 (38)
A little better	24/60 (40)	9/19 (47)	9/25 (36)	6/16 (38)
Much better	11/60 (18)	5/19 (26)	4/25 (16)	2/16 (13)
Enhancement 1: High-intensity aerobic exercise				
Satisfied with exercise intensity, n (%)	44/57 (77)	16/19 (84)	23/25 (92)	5/13 (39) [a]
Satisfied with aerobic exercise, n (%)	39/56 (70)	13/19 (68)	16/23 (70)	10/14 (71)
Satisfied with mobility exercise, n (%)	49/55 (89)	16/18 (89)	21/23 (91)	12/14 (86)
Satisfied with strengthening exercise, n (%)	44/57 (77)	14/19 (74)	18/24 (75)	12/14 (80)
Heartrate monitoring is applied, n (%)	29/59 (49)	19/19 (100)	9/25 (36)	1/15 (7) [a]
Heartrate monitoring is favourable, n (%)	27/29 (93)	18/19 (95)	8/9 (89)	1/1 (100)
Heartrate monitoring disrupts exercise, n (%)	3/29 (10)	2/19 (11)	1/9 (11)	0/1 (0)

Table continues

Table 3 (Continued). Evaluation of feasibility and satisfaction with implemented enhancement by supervised group exercise participants.

	Total (n=60)	Region 1 (n=19)	Region 2 (n=25)	Region 3 (n=16)
Enhancement 2: Personalisation by assessments				
Satisfied with exercise personalisation, n (%)	51/58 (88)	16/19 (84)	21/24 (87)	14/15 (93)
Assessment is applied, n (%)	50/58 (86)	19/19 (100)	19/24 (79)	12/15 (80)
Assessment is favourable, n (%)	47/50 (94)	17/19 (89)	18/19 (95)	12/12 (100)
Assessment is physically demanding, n (%)	1/50 (2)	1/19 (5)	0/19 (0)	0/12 (0)
Assessment once yearly is sufficient, n (%)	40/50 (80)	16/19 (84)	17/19 (90)	7/12 (58)
Enhancement 3: Education on home exercise				
Known with axSpA exercise-app, n (%)	12/56 (21)	10/19 (53)*	1/24 (4)	1/13 (8)
Uses axSpA exercise-app, n (%)	1/56 (2)	0/19 (0)	1/24 (4)	0/13 (0)

[a] Significant difference between regions with a p value < .01 by the chi-square test.

Patients' evaluation survey

Table 3 shows the participants' evaluation of the enhancements. This shows that the majority of participants (58%) considered the new program an improvement. Regarding the first enhancement, the vast majority of participants was satisfied with the exercise intensity (77%) and with the amount of aerobic (70%), mobility (89%) and strengthening exercise (77%). When heartrate monitoring was used, most found it favourable (93%) and few experienced it to disrupt the exercise (10%). The results regarding the second enhancement show that in all regions, the majority of participants was satisfied with the exercise personalisation (88%). The physical assessments were applied at least once in 86% of participants and among those, the vast majority (94%) considered it favourable. The third enhancement involved the use of patient education, e.g. by promoting an axSpA-specific exercise app. It was found that only 12 of 56 participants (21%) were familiar with the axSpA-

specific home exercise app, 10 of whom from one region, and just one participant (2%) still used it for home exercise.

Regarding the responses to the open ended feedback of the 60 SGE participants who completed the evaluation survey, 34 (57%) provided positive feedback and 9 (15%) provided negative feedback. The most reported positive change was more focus on aerobic exercise (n=12/60), followed by more focus on active exercises (n=8/60) and exercising with higher intensity (n=6/60) and with more variation (n=6/60). Participants from all regions mentioned more aerobic exercise and higher intensity as positive changes, whereas only two participants mentioned personalisation as a positive change, only one mentioned the physical assessments and none of the participants mentioned anything about patient education. The most reported negative feedback was that some exercises were too heavy (n=4/60).

Discussion

During this pilot implementation of SGE enhancements, approximately one third of SGE participants improved functioning and there was a significant improvement in aerobic capacity, but also a statistically significant, yet very small worsening in one spinal mobility test. There were no significant changes in the other spinal mobility tests, in health status and in weekly aerobic exercise engagement. The interviews with the supervisors and the evaluation surveys among participants showed that not all enhancements were implemented successfully and that the majority of participants was satisfied with the changes. Whereas the supervisors perceived the exercise personalisation as difficult to execute, most participants were satisfied about this aspect. Although the implementation of high-intensity aerobic exercise appears to be successful, the implementation of the exercise personalisation and periodic assessments appeared to be more difficult and patient education about home exercise was not implemented at all.

The effects of this pilot implementation are in line with the realised uptake of enhancements. After all, implementing high-intensity aerobic exercise appeared the most feasible and, accordingly, aerobic capacity was the only outcome that significantly improved, whereas patient education about home exercise not being implemented could explain the lack of change in weekly exercise engagement. Although the median change in 6MWT did not exceed the minimal clinically important difference of 30 meters (37), 36% of participants did have a clinically significant improvement, compared to 14% that worsened (Figure 2). The improvement in aerobic capacity is promising, with potential benefits for the increased cardiovascular risk in axSpA (7, 18, 21). Even larger effects can be

expected if patient education on more frequent (high-intensity) exercise would be implemented. Furthermore, the finding that one third of participants improved functioning, while only 3% experienced a worsening, is also encouraging and important for long-term SGE engagement. The statistically significant worsening of the tragus-to-wall distance may be a concern, as greater focus on aerobic exercise may have reduced the amount of mobility exercise. However, although a minimal clinically important difference of this test is unknown (41), the change in score is very small and does not appear clinically relevant. Moreover, the other two spinal mobility tests are believed to be more responsive (40) and showed no change at all. Regardless, it is essential that supervisors personalise exercise in case a participant shows any deterioration during the assessments. In that case, linking patient education about home exercises to the assessment results could lead to more improvements and less deterioration in outcomes. Therefore, improving the feasibility of the implementation can further increase the effectiveness of SGE.

To improve feasibility, a more comprehensive implementation strategy with more stakeholders seems warranted to increase implementation success. Similar studies with successful implementation targeted more stakeholders than just supervisors, e.g. patients, rheumatologists, local patient associations and health insurance companies (30, 32, 33). The current implementation strategy focused mainly on the supervisors, as the expertise of SGE supervisors was considered an important facilitator for the enhancements (13, 15, 20, 23, 31). Prior to and during a nationwide implementation, it may be desirable to involve all stakeholders to jointly identify potential implementation barriers and possibilities to cope with them. This could also increase supervisors' willingness to participate, which appeared limited when inviting the patient associations for this pilot study.

A potential barrier of the implementation's feasibility could have been limited resources. The main implementation activity was the one-day training for SGE supervisors, whereas other studies with good feasibility used a two- or three-day training (32, 33). More extensive training could be challenging, as it was already difficult to plan a one-day training and two regions declined to participate because the supervisors believed that the compensation did not outweigh the time investment. In addition, limited resources (i.e. funding and supervisors) prevented two regions from continuing with periodic assessments and the limited resources could also be an important reason why patient education was not implemented successfully. Similar studies that successfully implemented patient education were able to organise education separately from the SGE sessions (30, 33). Thus, possibilities for more resources should be explored, as well as more cost-effective solutions, e.g. the use of physical therapy students for the assessments or the use of instruction manuals providing education on home exercise (23). Moreover, the currently used home exercise app appears outdated and has too little focus on aerobic exercise. Furthermore, with more resources, the participation of

supervisors can be better compensated, they can be better trained to implement all enhancements and there can be more demands and less permissiveness regarding the implementation, which should improve the feasibility (44).

There are a few study limitations to be mentioned. First, although the participating regions were spread well across the Netherlands and there were no differences in patient characteristics between these four regions, there may be limited generalisability. After all, among the SGE participants, males were more likely to participate, and compared to other studies (45), the participants represented relatively older axSpA patients with long disease duration and SGE participation. These characteristics may challenge the implementation of changes and it is therefore promising that even in this group there were some positive effects and satisfaction levels were high. In addition, although it is not fully clear to what extent the findings can be generalised to other countries, a Swiss study evaluating the implementation of similar enhancements in axSpA-specific SGE found comparable satisfaction levels among participants (30). Furthermore, while the hybrid study design provided useful insights by evaluating both feasibility and effects, the varying availability and time intervals between baseline and follow-up data between regions might have limited the validity of the effect evaluation. The final limitation is the absence of a control group to compare the changes in outcomes over time. Nevertheless, this study provided a lot of useful information for a possible nationwide implementation of the SGE enhancements.

In conclusion, after a one-day training for SGE supervisors and telephone support, a set of enhancements was partially implemented. Aerobic capacity improved significantly and functioning improved in about one third of the participants. Most of the participants were satisfied with the applied changes. To further increase the effects and feasibility during a nationwide implementation of the SGE enhancements, an increase of resources and a multifaceted implementation strategy also involving other stakeholders seems necessary.

References

1. Van Der Heijde D, Ramiro S, Landewé R, Baraliakos X, Van Den Bosch F, Sepriano A, et al. 2016 update of the ASAS-EULAR management recommendations for axial spondyloarthritis. Ann Rheum Dis. 2017;76:978-91.
2. Ward MM, Deodhar A, Gensler LS, Dubreuil M, Yu D, Khan MA, et al. 2019 Update of the American College of Rheumatology/Spondylitis Association of America/Spondyloarthritis Research and Treatment Network Recommendations for the Treatment of Ankylosing Spondylitis and

Nonradiographic Axial Spondyloarthritis. Arthritis Care Res (Hoboken). 2019;71(10):1285-99.
3. Zão A, Cantista P. The role of land and aquatic exercise in ankylosing spondylitis: a systematic review. Rheumatol Int. 2017;37:1979–90.
4. Rausch Osthoff AK, Niedermann K, Braun J, Adams J, Brodin N, Dagfinrud H, et al. 2018 EULAR recommendations for physical activity in people with inflammatory arthritis and osteoarthritis. Ann Rheum Dis. 2018;77(9):1251-60.
5. Regel A, Sepriano A, Baraliakos X, Van Der Heijde D, Braun J, Landewé R, et al. Efficacy and safety of non-pharmacological and non-biological pharmacological treatment: A systematic literature review informing the 2016 update of the ASAS/EULAR recommendations for the management of axial spondyloarthritis. RMD Open. 2017;3:1-11.
6. Martins NA, Furtado GE, Campos MJ, Leitão JC, Filaire E, Ferreira JP. Exercise and ankylosing spondylitis with New York modified criteria: A systematic review of controlled trials with meta-analysis. Acta Reumatol Port. 2014;39(4):298-308.
7. Pécourneau V, Degboé Y, Barnetche T, Cantagrel A, Constantin A, Ruyssen-Witrand A. Effectiveness of Exercise Programs in Ankylosing Spondylitis: A Meta-Analysis of Randomized Controlled Trials. Arch Phys Med Rehabil. 2018;99:383-9.e1.
8. Sveaas SH, Smedslund G, Hagen KB, Dagfinrud H. Effect of cardiorespiratory and strength exercises on disease activity in patients with inflammatory rheumatic diseases: A systematic review and meta-analysis. Br J Sports Med. 2017;51:1065-72.
9. O'Dwyer T, O'Shea F, Wilson F. Exercise therapy for spondyloarthritis: A systematic review. Rheumatol Int. 2014;34:887-902.
10. Millner JR, Barron JS, Beinke KM, Butterworth RH, Chasle BE, Dutton LJ, et al. Exercise for ankylosing spondylitis: An evidence-based consensus statement. Semin Arthritis Rheum. 2016;45:411-27.
11. Dagfinrud H, Kvien T, Hagen K. Physiotherapy interventions for ankylosing spondylitis. Cochrane Database Syst Rev. 2008(1):CD002822.
12. Reimold AM, Chandran V. Nonpharmacologic therapies in spondyloarthritis. Best Pract Res Clin Rheumatol. 2014;28:779-92.
13. Hilberdink B, van der Giesen F, Vliet Vlieland T, van Weely S. Organisation and content of supervised group exercise for people with axial spondyloarthritis in the Netherlands. Rheumatol Int. 2021;41(2):391-401.
14. Dagfinrud H, Halvorsen S, Vøllestad NK, Niedermann K, Kvien TK, Hagen KB. Exercise programs in trials for patients with ankylosing spondylitis: Do they really have the potential for effectiveness? Arthritis Care Res (Hoboken). 2011;63:597-603.

15. Hilberdink B, van der Giesen F, Vliet Vlieland T, van Gaalen F, van Weely S. Supervised Group Exercise in Axial Spondyloarthritis: Patients' Satisfaction and Perspective on Evidence-Based Enhancements. Arthritis Care Res (Hoboken). 2020;72:829-37.
16. Rausch Osthoff AK, van der Giesen F, Meichtry A, Walker B, van Gaalen FA, Goekoop-Ruiterman YPM, et al. The perspective of people with axial spondyloarthritis regarding physiotherapy: room for the implementation of a more active approach. Rheumatol Adv Pract. 2019;3(2):rkz043.
17. Fontaine KR, Bartlett SJ, Heo M. Are health care professionals advising adults with arthritis to become more physically active? Arthritis Rheum. 2005;53:279-83.
18. Hilberdink B, Vlieland TV, van der Giesen F, van Gaalen F, Goekoop R, Peeters A, et al. Adequately dosed aerobic physical activity in people with axial spondyloarthritis: associations with physical therapy. Rheumatol Int. 2020;40(9):1519-28.
19. Niedermann K, Sidelnikov E, Muggli C, Dagfinrud H, Hermann M, Tamborrini G, et al. Effect of cardiovascular training on fitness and perceived disease activity in people with ankylosing spondylitis. Arthritis Care Res (Hoboken). 2013;65(11):1844-52.
20. Niedermann K, Nast I, Ciurea A, Vliet Vlieland T, van Bodegom-Vos L. Barriers and facilitators of vigorous cardiorespiratory training in axial Spondyloarthritis: Surveys among patients, physiotherapists, rheumatologists. Arthritis Care Res (Hoboken). 2018;71:839-51.
21. Sveaas SH, Bilberg A, Berg IJ, Provan SA, Rollefstad S, Semb AG, et al. High intensity exercise for 3 months reduces disease activity in axial spondyloarthritis (axSpA): a multicentre randomised trial of 100 patients. Br J Sports Med. 2020;54(5):292-7.
22. Sveaas SH, Berg IJ, Fongen C, Provan SA, Dagfinrud H. High-intensity cardiorespiratory and strength exercises reduced emotional distress and fatigue in patients with axial spondyloarthritis: a randomized controlled pilot study. Scand J Rheumatol. 2018;47(2):117-21.
23. Hilberdink B, van der Giesen F, Vliet Vlieland T, Nijkamp M, van Weely S. How to optimize exercise behavior in axial spondyloarthritis? Results of an intervention mapping study. Patient Educ Couns. 2020;103(5):952-9.
24. Hoogeboom TJ, Dopp CM, Boonen A, de Jong S, van Meeteren NL, Chorus AM. THU0568 The Effectiveness of Exercise Therapy in People with Ankylosing Spondylitis: A Systematic Review and Meta-Analysis. Ann Rheum Dis. 2014;73(Suppl 2):379.
25. O'Dwyer T, McGowan E, O'Shea F, Wilson F. Physical Activity and Exercise: Perspectives of Adults with Ankylosing Spondylitis. J Phys Act Health. 2016;13:504-13.

26. O'Dwyer T, Monaghan A, Moran J, O'Shea F, Wilson F. Behaviour change intervention increases physical activity, spinal mobility and quality of life in adults with ankylosing spondylitis: a randomised trial. J Physiother. 2017;63(1):30-9.
27. Fongen C, Sveaas SH, Dagfinrud H. Barriers and Facilitators for Being Physically Active in Patients with Ankylosing Spondylitis: A Cross-sectional Comparative Study. Musculoskeletal Care. 2015;13(2):76-83.
28. Forster D, Warburton L, O'Flynn N. Diagnosis and management of spondyloarthritis in the over-16s: NICE guideline. Br J Gen Pract. 2018;68(672):346-7.
29. Zangi HA, Ndosi M, Adams J, Andersen L, Bode C, Boström C, et al. EULAR recommendations for patient education for people with inflammatory arthritis. Ann Rheum Dis. 2015;74:954-62.
30. Rausch Osthoff AK, Vliet Vlieland T, Braem R, Walker B, Niedermann K. FRI0700-HPR Lessons learned from pilot implementation of physical activity recommendations in axSpA exercise group therapy - less may be more. Ann Rheum Dis. 2019;78(Suppl 2):1049.
31. Edelaar L, Nikiphorou E, Fragoulis GE, Iagnocco A, Haines C, Bakkers M, et al. 2019 EULAR recommendations for the generic core competences of health professionals in rheumatology. Ann Rheum Dis. 2020;79(1):53-60.
32. van der Giesen FJ, van Lankveld W, Hopman-Rock M, de Jong Z, Munneke M, Hazes JMW, et al. Exploring the public health impact of an intensive exercise program for patients with rheumatoid arthritis: A dissemination and implementation study. Arthritis Care Res (Hoboken). 2010;62(6):865-72.
33. Skou ST, Roos EM. Good Life with osteoArthritis in Denmark (GLA:D™): evidence-based education and supervised neuromuscular exercise delivered by certified physiotherapists nationwide. BMC Musculoskelet Disord. 2017;18(1):72.
34. Curran GM, Bauer M, Mittman B, Pyne JM, Stetler C. Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact. Med Care. 2012;50(3):217-26.
35. Landes SJ, McBain SA, Curran GM. An introduction to effectiveness-implementation hybrid designs. Psychiatry Res. 2019;280:112513.
36. Pinnock H, Barwick M, Carpenter CR, Eldridge S, Grandes G, Griffiths CJ, et al. Standards for Reporting Implementation Studies (StaRI) Statement. BMJ. 2017;356:i6795.
37. Bohannon RW, Crouch R. Minimal clinically important difference for change in 6-minute walk test distance of adults with pathology: a systematic review. J Eval Clin Pract. 2017;23(2):377-81.

38. van Weely SF, Dekker J, Steultjens MP, van Denderen JC, Nurmohamed MT, Dijkmans BA, et al. Objective evaluation of physical functioning after tumor necrosis factor inhibitory therapy in patients with ankylosing spondylitis: a selection of 3 feasible performance-based tests. J Rheumatol. 2015;42(4):623-9.
39. Landewé R, van Tubergen A. Clinical Tools to Assess and Monitor Spondyloarthritis. Curr Rheumatol Rep. 2015;17(7):47.
40. Jauregui E, Conner-Spady B, Russell AS, Maksymowych WP. Clinimetric evaluation of the bath ankylosing spondylitis metrology index in a controlled trial of pamidronate therapy. J Rheumatol. 2004;31(12):2422-8.
41. Bohannon RW, Tudini F, Constantine D. Tragus-to-wall: A systematic review of procedures, measurements obtained, and clinimetric properties. J Back Musculoskelet Rehabil. 2019;32(1):179-89.
42. Kiltz U, van der Heijde D, Boonen A, Akkoc N, Bautista-Molano W, Burgos-Vargas R, et al. Measurement properties of the ASAS Health Index: results of a global study in patients with axial and peripheral spondyloarthritis. Ann Rheum Dis. 2018;77(9):1311-7.
43. Wagenmakers R, van den Akker-Scheek I, Groothoff JW, Zijlstra W, Bulstra SK, Kootstra JW, et al. Reliability and validity of the short questionnaire to assess health-enhancing physical activity (SQUASH) in patients after total hip arthroplasty. BMC Musculoskelet Disord. 2008;9:141.
44. Toomey E, Currie-Murphy L, Matthews J, Hurley DA. Implementation fidelity of physiotherapist-delivered group education and exercise interventions to promote self-management in people with osteoarthritis and chronic low back pain: a rapid review part II. Man Ther. 2015;20(2):287-94.
45. O'Dwyer T, O'Shea F, Wilson F. Physical activity in spondyloarthritis: a systematic review. Rheumatol Int. 2015;35:393-404.