Journal of Geriatric Cardiology | JGC
RESEARCH ARTICLE
J Geriatr Cardiol 2023; 20(11): 767–778

Exercise-based real-time telerehabilitation for older patients recently discharged after transcatheter aortic valve implantation: An extended feasibility study

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https://doi.org/10.26599/1671-5411.2023.11.003

ABSTRACT

OBJECTIVES To assess the extended feasibility of a telerehabilitation program and its effects on physical performance in older adults who have recently undergone transcatheter aortic valve implantation (TAVI).

METHODS In this single-center feasibility study, patients underwent an eight-week telerehabilitation program, involving web-based home exercise training twice weekly, an activity tracker, access to an informative website, and one online session with a nurse, starting one-week postoperative. Data collection was performed before surgery and three months postoperative. The feasibility of the intervention was based on recruitment and adherence to the program. As a secondary outcome, we evaluated the change in six-minute walk distance from before surgery to three months postoperative.

RESULTS Forty-one patients scheduled for TAVI were assessed for eligibility; 15 patients (37%) were enrolled. Of these, eight were excluded after surgery due to tiredness (n = 2), non-cardiac related hospital readmission (n = 2), fluctuating health (n = 1), death during hospital stay (n = 1), and reduced cognition (n = 2). Seven patients completed the eight-week web-based intervention and were evaluated three months postoperative. Their median (IQR) age was 83 [81, 87] years, and the sample comprised three men and four women. Their walked distance improved from median (IQR) 262 [199, 463] before surgery, to 381 [267, 521] meters three months postoperative. No adverse events were reported.

CONCLUSION Web-based telerehabilitation, including supervised exercise training, in older adults who have recently undergone TAVI was feasible for a small number of patients who completed the eight-week intervention. This was reflected in an improvement in their walked distance three months after the surgery. However, the low recruitment and retention rates do question the overall feasibility of this intervention in a frail, older population of post-TAVI patients.

Transcatheter aortic valve implantation (TAVI) is the standard of care for treatment of severe aortic valve stenosis, especially in patients of old age or who are deemed to be at high perioperative mortality risk.[1,2] The benefits of TAVI are reduced mortality[3,4] and improved quality of life,[5–7] particularly in terms of increased mobility and usual activities of daily living.[5,8]

Cardiac rehabilitation (CR) is recommended following TAVI to improve functional capacity and quality of life,[9–11] while reducing mortality.[12] However, referral to or participation in CR in this particular population is low.[13–15] Cardiac telerehabilitation (CTR), defined as the use of information and communication technologies to support rehabilitation,[16,17] has proven to be as effective as center- or hospital-based CR in improving functional outcomes and reducing morbidity and mortality,[18,19] as well as improving patient activation and health literacy,[20] while being cost-effective.[21] Thus, CTR can be an effective and viable alternative to traditional CR programs, particularly for older adults who may face barriers to accessing rehabilitation services. Meanwhile, the effectiveness of CTR following TAVI has been poorly investigated, possibly because the use of modern technology to enhance postsurgical outcomes in an elderly population is still limited.[22–24] We have previously reported results from a mixed-methods feasibility study of a CTR for TAVI patients, the TeleTAVI program, where each patient tested the prototype for a period of two weeks.[25] We found that the TeleTAVI program was highly appreciated by the participants due to the web-based setting with provision of supervised exercise training with real-time feedback, without need of transportation. Meanwhile, we were challenged by a 60% study dropout rate due to unstable data coverage at patients´ homes as well as participants´ limited IT skills.[25] Consequently, we adapted the TeleTAVI program to last twelve weeks post-TAVI and provided additional IT support throughout the intervention period.

The aim of this study was to examine whether the adapted TeleTAVI program was feasible in older adults who have recently undergone TAVI. We hypothesized that an intervention period of twelve weeks and the possibility of receiving extended IT support during the project period would increase adherence and compliance to the program.

MATERIAL AND METHODS

Design

This was a single-center feasibility study performed in preparation for a randomized controlled trial, targeting older adults who have undergone TAVI. We describe the recruitment process and explore the practicability of delivering telerehabilitation, including real-time web-based supervised exercise training twice weekly for a period of eight weeks, followed by four weeks self-training. To determine adherence and compliance to the program, we assessed: (1) recruitment, retention, and training adherence rates; (2) patients´ needs for IT support; and (3) changes in outcome measures from before surgery to three months post-surgery. As part of the present study, we also performed individual interviews with patients who completed the TeleTAVI program and with the health professionals involved in the program in order to gain knowledge of their experiences with using heath technologies and in participating in the program.[26] The study was reported in accordance with the CONSORT (Consolidated Standards of Reporting Trials) extended guidelines for feasibility and pilot studies.[27]

Setting

Participants were recruited at the Department of Cardiology, Aalborg University Hospital, Denmark between March and May 2021. The hospital performs 120 TAVI procedures annually. The Danish National Health Service provides tax-supported health care for all inhabitants, guaranteeing free access to family physicians, public hospitals, and municipality-based care as well CR after hospital discharge.

Ethics

The study was registered at the hospital´s research board (registration 2020-054) and complied with the General Data Protection Regulations. The Regional Ethics Committee stated that no approval was required for the study. Informed written consent was obtained from all participants before inclusion.

Inclusion and Exclusion Criteria

Eligible participants were adults scheduled for elective TAVI who were capable of reading and understanding Danish. Indications for TAVI in the present patient cohort were patients with symptomatic aortic stenosis deemed to be at high surgical risk and/or at an age of ≥ 80 years. Exclusion criteria were physical deficits adversely influencing physical performance, known decreased cognitive functioning, and serious hearing or seeing impairments. Furthermore, we excluded patients who did not have internet at home or with poor data coverage at their home address, based on the results of the prototype testing as reported previously.[25]

Telerehabilitation Program

The TeleTAVI program comprised home web-based exercise training, an activity tracker to register daily steps, access to an informative website,[28] and one web-based session with a cardiac nurse specialist. Figure 1 illustrates the timeline of the

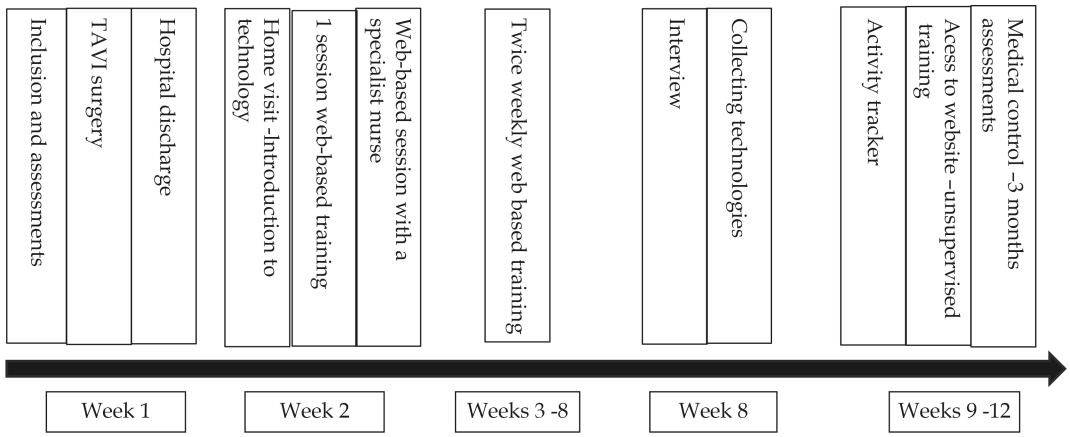

Figure 1 Timeline of the TeleTAVI.

TeleTAVI program from intervention through rehabilitation and clinical follow-up.

Telerehabilitation Technologies

The technologies used in the study are presented as supplementary material (Figure 1S), and have previously been comprehensively described.[25,26] Shortly, the technologies consisted of a tablet (Apple iPad) for use during the exercise sessions and for access to the informative website, an activity tracker (Beurer AS97), and a booklet in paper form with text information on how to use the technologies. The booklet also contained information regarding the scheduled online training sessions and could be used as a training diary. The technologies and training equipment for the home-based training sessions were delivered to the participants' homes one week after hospital discharge. We used the Open Telehealth application (OTH) [29] installed on the tablet to collect data on daily steps.

Exercise Training

The exercise training was web-based, individualized, and took place at patients’ homes. It was delivered in groups, started one week after TAVI, and lasted a total of twelve weeks. The first eight weeks were supervised. The program followed the national recommendations for CR with a combination of aerobic and strength training twice weekly, each session lasting 30–45 min.[30] The target intensity was Borg CR10 dyspnea 6–8.[31] Patients were also instructed to take a 30-min walk daily at a moderate intensity level. An additional unsupervised training program was available through access to the project´s website installed on the tablets and illustrated in the booklet,[28] for use during the first eight-week project period.

A summary of the sessions’ design and examples of exercises is provided in Table 1. Each participant was provided with training equipment, consisting of dumbbells (1, 2, 3 kg), a step bench, a training matt, and a tube grip elastic band. For resistance training, patients progressed to a heavier weight whenever they effortlessly managed to perform 10 repetitions with their previous weight.[32] The change to a heavier weight took place during the supervised training sessions.

To facilitate individualization of the exercise sessions, we scheduled two different groups, both taking place on the same weekday, as it seemed appropriate to group the patients with similar physical performance levels. The different time schedules also enabled patients to join another session should they miss their scheduled session on a given day. Two physiotherapists were present during the training sessions, the first to provide IT support before or during the sessions and the second to guide patients through the training program.

At the end of the first eight weeks, patients were given the choice to continue wearing the activity tracker for a further four weeks, registering the daily number of steps in their training diary placed in the booklet. Also, they could follow the exercise videos available at the project´s website, should they have a tablet or a computer of their own. Alternatively, they could perform the exercises as illustrated in their booklets.

Technology Management and IT Support

The introduction to the technology took place at

Table 1 Summary of session design and example of exercises.

	Varm up	Aerobic training	Resistance training	Cool down/streching
Time allocated during the sessions	5–8 min	20 min	10–15 min	10 min
Example of exercises performed	Stretching arms and trunk; standing trunk rolling Thoracic rotation Dynamic side bend Pursed lip breathing Walking	Walking Walking with high knee rise Up and down - step bench Jumping jacks	Standing or sitting pull with Tubi grip Arm curl – dumbbells Heel raise Sit to stand Abdominal muscles Upper truncus	Static dynamic range of motion exercises targeting the thoracic column and core Pursed lip breathing Chest opening stretches Neck and shoulder stretches
*Target intensity	3–4	6–9	6–8	2–3

*Borg 0-10 exertion scale. For resistance training: target 3x10 repetitions for each exercise. Free weight exercises with dumbbells: 1 kg; 2 kg or 3 kg. The choice of a higher weight was based on Borg 5 at the 3. Set repetition. Aerobic exercises were intercalated with resistance training exercises.

patients' homes one week after hospital discharge. Patients were thoroughly instructed on the use of the technologies and on how to connect to the web-based sessions. Furthermore, patients tried out the different exercises and equipment to be used during the training sessions.

The first author (BCB) provided IT support by telephone calls and, if necessary, using the application TeamViewer [33] to help participants to log in to the web-based sessions or for uploading data regarding their daily steps to the project's database.

Recruitment of Participants, Data Collection, and Analysis

Eligible patients were approached for inclusion on the last working day before the surgery. The baseline assessments took place after written consent was obtained. The 12-week follow-up took place at the hospital clinic on the same day as the scheduled clinical post-TAVI follow-up. The assessments were performed by experienced physiotherapists.

Assessments

Demographic and perioperative data were collected from patients´ medical records. The following assessments were performed the day before surgery and again at the 3-month follow-up: a 6-min walk test (6MWT);[34] 30STS test (30-seconds sit-to-stand test) to assess functional lower extremity muscle strength [35]; and 4-m walk test to assess gait speed.[36] A gait speed < 0.7 m/s following TAVI is defined as frailty.[36] For hand grip strength we used the DHD-1 digital hand dynamometer.[35] For health-related quality of life, we used the HeartQol,[37] which is a disease-specific questionnaire validated for patients who have undergone cardiac valve replacement surgery.[37,38] Higher HeartQol values are related to worse quality-of-life. The Visual Analogue Scale (EQ-VAS) was used for responders' self-evaluated health.[39] EQ-VAS values range from 0 (the worst imaginable health) to 100 (the best imaginable health). The MCID for the EQ-VAS in cardiac patients has not yet been established, though it has been reported to be eight points in stable COPD patients.[40] At baseline, we also assessed the cognitive function via the Mini-Mental Scale Evaluation (MMSE).[41] For frailty, we used the Tilburg Frailty Indicator (TFI). The TFI is a validated self-administered instrument for assessing multidimensional frailty in community-dwelling older people.[42] The cut-off value for frailty according to the TFI is ≥ 5 points.[43] Data were stored using the Redcap electronic data capture tool (Redcap Consortium, Vanderbilt University Medical Centre, Nashville, USA), hosted by the North Denmark Region.

Feasibility and Secondary Data

We registered process data consisting of number of home visits, need and type of IT support, and compliance with the training sessions. We also collected information on patients´ self-reported exertion level during the supervised web-based training sessions. At the twelve-week clinical control, patients were asked about their exercise habits after the initial 8-weeks supervised training. Data on individual daily steps during the eight-week supervised intervention period were collected from the OTH platform or by patients´ own entries in their personal diaries. The maximum possible number of entries for the first eight-week period was 56 days.

Data Analysis

Descriptive statistics were used to describe the study population. We used non-parametric statistics to analyze baseline differences between patients completing the three-month follow-up and those who did not complete the study. Due to the small number of participants and subsequent skewed data, we present results as median and interquartile range (IQR) or as numbers (frequency and percentage) when appropriate. Differences in "3 months minus baseline value" were thus expressed as absolute values. A 2-sided P value < 0.05 was considered statistically significant. Analyses were performed with SPSS statistical software (IBM Analytics, NY, USA).

Based on results from the first phase of the study,[25] we set the compliance with the web-based training sessions to 60% (10 out of 16 possible sessions). No formal sample size calculation was performed due to the explorative character of the study and because no efficacy testing was to be performed.[44]

RESULTS

In total, 41 patients were screened for eligibility and 15 (36%) were enrolled in the study (Figure 2). Reasons for exclusion before the surgery were not meeting the inclusion criteria (n = 13) or declining to participate (n = 13). Of the 15 patients enrolled, eight were excluded after the surgery due to tiredness post-surgery (n = 2), non-cardiac related hospital readmission (n = 2), fluctuating health (n = 1), death during hospital stay (n = 1), and finally, two patients were excluded after the introductory home visit due to problems with managing the tablet. Both patients had a MMSE score of 24 points, with difficulties in the areas of spatial visualization and

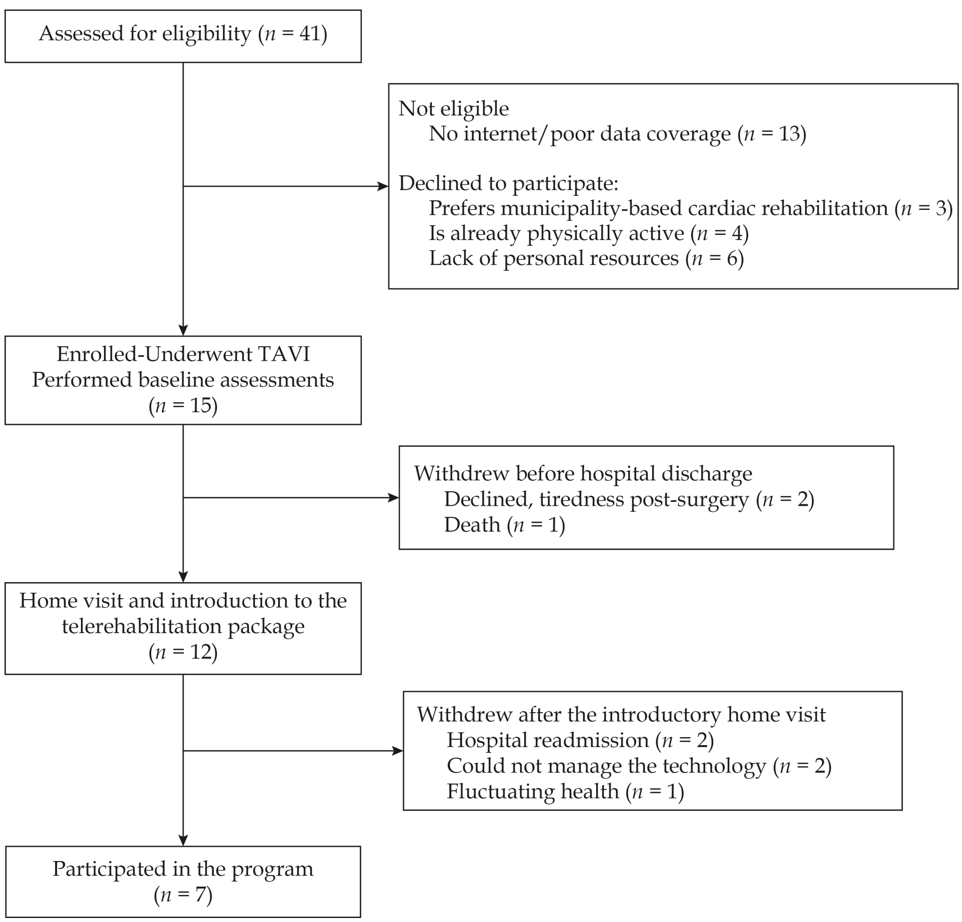

Figure 2 Study flow-chart.

short-term memory, among others (individual MMSE results are not shown). Thus, seven patients completed the study, corresponding to a retainment rate of 47% (7/15). Table 1 depicts the demographic and surgical characteristics of all included patients, where the median [IQR] age is 84 years [82; 87]. Frailty according to the TFI was present in four of the patients completing the study, while a single patient not completing the study was deemed frail. A gait speed < 7 m/s was detected in three patients (two completing the study and one not completing the study).

Table 2 depicts compliance with the supervised training sessions and daily steps. Six out of the seven patients completing the study reached the 60% pre-established success rate for adherence to the web-based supervised training sessions. Patients' exertion levels during the exercise sessions varied from five to ten. After the completion of the first 8-week program, three patients reported returning to usual community-based training sessions. None accessed the training videos at the project´s website.

Process and Delivery of IT Support

Home visits for introduction of the technology took place for twelve patients (Figure 2), lasting from 90 to 150 min. The distance traveled for the health professional (HP) varied from 3 to 56 km. All in all, the HP spent between 150 and 240 min in total on each home visit. Additional home visits for technical support were necessary three times and were delivered to two patients. Among the patients who attended the web-based exercise sessions, seven needed IT support to connect to the web-based sessions. The time spent by the HP for IT support varied from 10 to 30 min per session. The uploading of data on daily steps to the OTH platform installed on the tablet fluctuated a lot, mostly due to missing Bluetooth connections between the activity tracker and the platform, which resulted in incomplete records for all patients.

Changes in Outcome Measurements

We found a median (IQR) improvement in the 6MWT of 82.5 [26, 97] meters, $P = 0.03$, measured before surgery and three months postoperative. Also, the percentwise of expected handgrip strength was significantly increased, median (IQR) of 4% [-1, +8], $P = 0.03$. Changes in the MRC scores, HeartQol, EQ-VAS, gait speed, and 30STS were all non-significant (Table 3).

Daily Steps

The median [IQR] number of steps per day during the first 8-week program period was 1509 [933, 2635] steps (Table 4). Four patients reached over 5,000 steps per day at least once. The number of entries in either the OTH application or manual registration in personal diaries varied from 12 to 43 (21% to 77%). Six patients preferred to register their daily number of steps in their personal diary, while a single patient uploaded data to the OTH application. Two patients agreed to continue wearing the activity tracker after the first eight weeks. Since both patients did not use the activity tracker in the meantime, no data on daily steps was available at twelve weeks.

Adverse Events

No adverse events associated with the web-based exercise intervention occurred.

DISCUSSION

This feasibility study emphasizes the practical difficulties in recruiting and implementing a web-based, supervised telerehabilitation program in the elderly population who has undergone TAVI. The TeleTAVI program was feasible in its current form and in the population as included in the study. In the small number of patients completing the intervention, we found a significant increase in the walked distance of 82.5 m, measured before and three months post-surgery. Meanwhile, a low recruitment rate of 36% (15/41), compounded by a low retainment rate of 47% (7/15), were major barriers for running the study. No access to internet at home or poor local data coverage were the main causes for patients not meeting the inclusion criteria; tiredness post-surgery and hospital readmission were common reasons for patient withdrawal after the surgery. Thus, the optimal set-up, target population, and effectiveness of telerehabilitation in the elderly population who has undergone TAVI still needs to be established.

Cardiac rehabilitation is recommended following

Table 2 Demographics and surgical characteristics of participants.

Variables	Included (n = 15)	Completed the study (n = 7)	Did not complete the study (n = 8)	P-value
Age, yrs	84 (82–87)	83 (81–87)	84 (82–89)	0.61
Male gender	6 (40%)	3 (43%)	3 (37%)	1.0
BMI, kg/m^2	27 (22–30)	27 (22–30)	26 (22–31)	1.0
*Two or more comorbidities	6 (40%)	3 (43%)	3 (37%)	1.0
EF	60 (50%–60%)	60 (45%–60%)	60 (55%–60%)	0.54
NYHA				0.45
I	1 (7%)	0	1 (13%)	
II	5 (33%)	2 (28%)	3 (37%)	
III	8 (53%)	5 (72%)	3 (37%)	
IV	1 (7%)	0	1 (13%)	
ASA				0.57
3	4 (27%)	1 (14%)	3 (37%)	
4	11 (73%)	6 (86%)	5 (63%)	
FEV$_1$ %	71 (65%-108%)	68 (65%–120%)	71 (48%–102%)	0.62
Hæmoglobin	7.4 (5.9–9.0)	7.9 (6.0-9.4)	6.1 (5.8–6.1)	0.40
**Length of hospital stay, days	4 (3–6)	3 (3–7)	4 (3–5)	0.81
Aortic peak gradient	69 (60–93)	64 (60-93)	70 (61–101)	0.61
Postoperative pacemaker implantation	9 (60%)	4 (57%)	5 (63%)	1.0
Measurements				
6MWT, m	400 (199–457)	262 (199–463)	308 (234–449)	0.96
6MWT, % expected	97 (58%-109%)	61 (58%-104%)	81 (61%-111%)	0.78
Gait speed 4 meter, seconds, median (IQR)	3.90 (3.94–5.50)	4.02 (3.85–5.82)	4.73 (4.25–5.24)	0.69
Sit-to-stand (30 s)	10 (8–12)	10 (8–12)	12 (8–12)	0.20
Hand strength % expected, median (IQR)	123 (100%–123%)	110 (100%–128%)	110 (83%–121%)	0.96
MRC	3 (2–4)	4.0 (2–5)	3 (2–3)	0.07
MMSE	29 (28–29)	29 (29–29)	28 (24–30)	0.15
HeartQol	1.36 (0.79–2.07)	2.07(1.07–2.43)	1.43 (0.67–1.51)	0.12
EQ VAS	60 (50–70)	50 (20-90)	75 (53–88)	0.28
Socio demographics				
Living alone	7 (46%)	3 (43%)	4 (50%)	1.0
Educational level				0.03
Public school or short education	6 (40%)	1 (14%)	5 (63%)	
Medium or vocational education	9 (60%)	6 (64%)	3 (37%)	
Information technology skills				0.569
Novice	4 (27%)	1 (14 %)	3 (37%)	
#Acquainted with tablet or PC	11 (73%)	6 (86%)	5 (63%)	
TFI, total score, median (IQR)	4 (2–6)	6 (2;9)	4 (2–4)	0.15
Not frail	10 (66%)	4 (80%)	6 (75%)	0.06
Frail (≥ 5 points)	5 (34%)	4 (57%)	1 (13%)	

Data are presented as median (IQR) or n (%). *Comorbidities: arterial hypertension; ischemic heart disease; diabetes mellitus; atrial fibrillation; **Includes operative day, n = 14; #Patient or next of kin. ASA: American Society Anesthesiology Score; BMI: Body mass index; EF: ejection fraction; EQ VAS: EuroQol visual analog scale; FEV$_1$: Forced expiratory value first second %; MRC: medical research council score; MMSE: mini mental state examination; NYHA: New York Heart Academy functional class; 6MWT: 6-minute walk test; HeartQol: quality of life questionnaire; TFI: tilburg frailty indicator.

Table 3 Differences in outcome measurements in patients completing the TeleTAVI program.

Variable	Before surgery (n = 7)	3 months after surgery (n = 7)	Difference (3 mths min baseline)	P-value
6MWT, m	262 [199, 463]	381 [267, 521]	82.5 (+26, +97)	0.03*
Handgrip % expected	110 [80, 128]	118 [99, 137]	4 [-1, +8]	0.03*
MRC dyspnea	4 [2,5]	2 [1,5]	-1 (-1, +3)	0.14
EQ5D VAS	50 [20, 90]	70 [50, 90]	0.0 [-10, +44]	0.22
HeartQol	2.07 [1.07, 2.43]	1.64 [0.29, 1.79]	-0.58 [-0.28, 0.64]	0.31
Gait speed 4 m, s	04.02 [03.85, 05.82]	04.06 [03.65, 04.65]	-00.32 [-01.29, +00.21]	0.17
‖30STT	10 [8,12]	11 [7,14]	2.5 [-1, +3]	0.19

Data are presented as median [IQR]; P-value based om Mann Whitney test. *$P \leq 0.05$. N = 6 at 3 months after surgery ‖Includes modified STT. EQ VAS: EuroQol visual analog scale; HeartQol: quality of life questionnaire; MRC: Medical Research Council Score; 6MWT: 6-minute walk test; 30STT: sit-to -stand 30 s test.

Table 4 Compliance to the intervention.

ID	Age	Supervised training sessions	Borg exertion min; max	Daily steps Median (min, max)	Activity tracker Number of days
1	85	12 (75%)	5–9	3222 (1698; 5043)	13
2	90	12 (75%)	6–9	1062 (462; 6247)	35
3	84	11 (69%)	5–8	3250 (1732; 5452)	36
4	87	07 (43%)	6–10	353 (216; 520)	12
5	82	10 (62%)	6–9	1236 (424; 4569)	25
6	74	10 (62%)	6–9	2096 (772; 5068)	25
7	81	13 (81%)	6–9	1368 (556; 2564)	43

Overall daily steps median (IQR): 1509 [933, 2635] steps.

TAVI to improve functional capacity, quality of life,[9–11] and to reduce mortality.[12] Since referral to or participation in center- or community-based CR in this particular population is low, reported to be 20%–30%,[13–15] different settings for CR need to be considered. In this context, home-based CR, including CTR, may be a useful strategy to improve recruitment and adherence to CR.[24,45–47] Six out of the seven patients completing the study reached the pre-established adherence rate to the program of 60%, showing a significant improvement in the walked distance (median 82.5 m) measured by the 6MWT from before to three months post-surgery. This improvement is beyond the 14.0 to 30.5 m clinically relevant change described in the literature for older adults with pathology.[48] Of note, the walked distance in our cohort at baseline was higher (median 400 m) than the distance reported in studies investigating the effects of CR following TAVI, probably because we assessed 6MWT prior to the surgery, while the assessment in most studies was performed after the surgery.[7,9-10,15,49–51] Assessing the walked distance after the surgery may be negatively influenced by inactivity or tiredness post-surgery.

In a previous research from our group, we found that the TeleTAVI program was highly appreciated by the participants,[25] due to the web-based setting with provision of supervised exercised training with real-time feedback, without need of transportation. Meanwhile, we were challenged by a 60% study dropout rate due to unstable data coverage at patients´ homes as well as participants' limited IT skills.[25] Thus, for the present study, we added no internet at home or poor data coverage at patients´ home as an exclusion criterion. Furthermore, we adapted the TeleTAVI program to last twelve weeks post-TAVI, with provision of additional IT support throughout the intervention period, to ensure adherence to the program. Previous research has shown that, although the majority of older patients (i.e., aged 80 years and over) are information and communication technology users, they have limited use of eHealth.[52] This is in line with findings from our parallel qualitative study that was conducted to gain knowledge of patients´ experiences with using heath technologies and in participating in the program.[26] Although CTR has been proven to be cost effective in cardiac disease in general,[21] there are particular challenges regarding its use in the aged population. In Denmark, the group of "digitally challenged" persons aged 65 years or older is 18%, and 80% among those aged 75 or older. Further, 20% of persons aged 75 years or older still do not have access to the internet at their homes.[53] This poses a challenge to offering digital home-based rehabilitation at present in the elderly and frail population who has undergone TAVI.

Future Perspectives

The challenge of securing continuous rehabilitation after TAVI is not yet solved and the knowledge from our feasibility study is an important contribution to understanding the challenges that older patients with complex health issues face, in particular regarding the use of telerehabilitation and general eHealth solutions to improve outcomes after surgery.

Efforts to increase referral to and enrollment in phase 2 rehabilitation after TAVI are still needed, in particular for patients who are deemed frail, and a multidisciplinary approach is recommended.[54] In this light, different delivery modalities of rehabilitation, tailored to patients´ individual interests and needs are necessary.[46] CTR may be an alternative to optimize access to different components of CR, including the delivery of exercise training,[55,56] provided that the patients have the required IT skills. Furthermore, future research should consider when to start CR, along with the appropriate setting.

Strengths and Limitations

Several limitations of the present feasibility study need to be addressed. First, the study was performed in a single-center study with a small number of participants included and completing the intervention. Meanwhile, we screened all patients scheduled for TAVI at our unit, which resulted in a recruitment rate similar to the study published by Rogers, *et al*.[57] Furthermore, our cohort is comparable to studies investigating the effects of CR after TAVI regarding age, the presence of comorbidities, ejection fraction, and NYHA.[51,57–61] Second, since we had no control group, we cannot exclude a natural improvement in outcomes due to benefits from the surgery. However, the findings of this study can inform researchers and clinicians on important issues to be addressed in future studies investigating the effects of CTR in the population who has undergone TAVI.

Conclusion

Web-based telerehabilitation including supervised exercise training in older adults who have recently undergone TAVI was feasible for a small number of patients who completed the eight-week intervention. This was reflected in significant and clinically relevant improvement in their walked distance three months after the surgery. However, the low recruitment and retention rates do question the overall feasibility of this intervention in a frail older population of post-TAVI patients. Further research is needed to find a way of securing CR in prefrail or frail patients following TAVI so they can benefit the most from the surgery in their daily life.

DISCLOSURE

Funding

This study was funded by the Danish Heart Foundation (19-R136-A9035-22130), AP Møller Fund, North Denmark Region's Research Fund, North Denmark Region´s Innovation Fund, and Jørgen Moellers Fund.

Acknowledgements

We thank all the clinical personnel involved in the clinical management of the patients.

Declaration of Conflicts

None.

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Please cite this article as: Brocki BC, Andreasen JJ, Aarøe J, Andreasen J, Thorup CB. Exercise-based real-time telerehabilitation for older patients recently discharged after transcatheter aortic valve implantation: An extended feasibility study. *J Geriatr Cardiol* 2023; 20(11): 767−778. DOI: 10.26599/1671-5411.2023.11.003