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# Exercise Program to Enhance Physical Performance and Quality of Life of Older Hemodialysis Patients: A Feasibility Study

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## Abstract

**Objective—**Evaluate the feasibility of implementing a combined in-hospital and home-based exercise program in older hemodialysis (HD) patients.

**Design—**A prospective longitudinal 12-week pilot study.

**Setting—**A university hospital HD unit and patients' homes.

**Participants—**A convenience sample of 9 older (>55years) patients undergoing HD.

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**Interventions—**An individualized exercise program performed on HD days (3/week) and at home (2–3/week), including aerobic, flexibility, strength exercises and patient education.

**Main Outcome Measures—**Feasibility measures: patient participation and satisfaction. Exercise performance: Duke Activity Status Index (DASI); 2-minute walk test (2MWT); Timed-up-and-go (TUG). Quality of life: The Illness Intrusiveness Ratings Scale (IIRS); The Kidney Disease Quality of Life questionnaire (KDQOL).

**Results—**The mean (SD) age of the patients was 68.1 (7.1). Participation in the in-hospital supervised exercise program was high, with patients exercising during 89% of HD sessions, but was lower for the unsupervised home-based component (56% exercised ≥ 2 times/week). Patients showed a gradual increase in the amount of exercise performed over 12 weeks. The 2MWT, TUG, IIRS and the KDQOL physical composite score demonstrated moderate responsiveness, while the DASI score exhibited only limited responsiveness.

**Conclusions—**This exercise program and the outcome measures were feasible for older HD patients: inhospital participation was high and physical performance and QOL measures exhibited moderate levels of responsiveness. Future, larger studies are needed to demonstrate whether intra-dialysis exercise, with or without home exercise, can lead to improved outcomes in this population.

### Keywords

Aged; Exercise; Physical fitness; Quality of Life; Renal Dialysis

## INTRODUCTION

The largest growth in individuals requiring treatment for end-stage renal disease (ESRD) is among older persons.[1] Older hemodialysis patients have numerous comorbidities and complications from ESRD that limit exercise tolerance, reduce physical capacity and increase functional impairment.[2] Exercise training in young HD patients has been shown to result in improvements in exercise and functional capacity; [3] quality of life (QOL);[4] and survival.[5] The few studies that have included older participants have also reported benefits from exercise.[6]

Despite the reported benefits of exercise, older HD patients tend to demonstrate low levels of participation or interest in exercise programs.[7] Based on findings from our research on barriers and facilitators to exercise in older HD patients,[8] we designed an exercise program to increase exercise participation in these patients. The objective of this pilot study was to evaluate the feasibility of implementing a combined in-hospital and home-based exercise program in older HD patients.

## METHODS

### Eligibility Criteria

Eligibility criteria included: a diagnosis of ESRD; requiring HD for ≥ 6 months, 3 times a week; age ≥ 55 years; ambulatory, with or without aids; not currently participating in

structured exercise; fluent in spoken and written English; and deemed medically able to participate.

## The Exercise Program

The 12-week program focused on muscular strength and flexibility, cardiovascular fitness and functional capacity; [9] was prescribed by a physical therapist; was individualized based on ability, preference for exercise activities and personal goals;[10] included 5 educational sessions; and followed safety guidelines.[11] The program was performed in-hospital during the dialysis sessions (supervised) and at home 2–3 times per week (based on verbal and written instructions). The home exercise component was similar to the in-hospital component, but exercises were based on preference and equipment availability and often incorporated their daily activities (e.g., sweeping and vacuuming).

The maximum intensity of each in-hospital aerobic exercise session performed on a pedal exerciser was based on: self-reported ratings of perceived exertion (RPE) of “light” to “somewhat hard”;[12] the ability to talk without difficulty while exercising; the training heart-rate zone based on the heart-rate reserve for a very low exercise intensity level;[13] blood pressure; and patient feedback and symptoms. Patients progressed towards a target of 20–30 minutes of aerobic exercise[11] per session, and if this duration was achieved, the power was increased by 1 to 5 Watts.

Flexibility and strengthening exercise guidelines were based on those by Painter et al.[9] The intensity of these exercises was monitored to ensure patients were exercising within a pain-free range and not exceeding an RPE of “somewhat hard”. Upper and lower extremity-strengthening components were carried out using exercise bands and 0.5–2 lb free weights, and no more than six different exercises were performed per session. Each exercise began with one set of 10 repetitions and was progressed, as tolerated to one set of 15 repetitions, and then to two and three sets of 15 repetitions. After reaching this frequency, the resistance or weight was increased by 0.5 to 2 lb. increments.

## Measures

Demographic and baseline data were obtained from the patient’s health records. Co-morbidity was measured using an ESRD-modified version of the Charlson index.[14] At baseline and 12 weeks, the following measures were administered: the Duke Activity Status Index (DASI),[15] the 2-minute walk test (2MWT), [16] the timed-up-and-go test (TUG), [17] the Illness Intrusiveness Ratings Scale (IIRS) [18] and The Kidney Disease Quality of Life questionnaire (KDQOL).[19]

## Data Analysis

Descriptive statistics (mean, standard deviation (SD)) are reported. Responsiveness of the outcome measures over the 12-week program was measured using the standardized response mean (SRM); values >0.8 are considered a large response, 0.5 to 0.8 moderate and 0.2 to 0.5 small.[20]

## RESULTS

Ninety-nine patients were assessed for study eligibility (Figure 1), 10 were enrolled, and one was withdrawn for unstable cardiac symptoms prior to the initiation of the program. The mean (SD) age of the nine participants was 68.1 (7.1) years (3 aged 57–64; 6 aged 65–77); 7 were female; mean (SD) duration of dialysis was 74.4 (19.4) years; and mean (SD) Charlson Index was 3 (3).

Participation in the in-hospital exercise program was high, with patients exercising during 89% of their HD sessions. The reasons for not exercising were symptoms prior to (e.g. knee pain) or with the initiation of exercise (e.g. leg cramps, nausea, dizziness, fatigue) (6%); unstable blood pressure (3%); or other (2%) (e.g. venous access issues, problems scheduling a supervised exercise session). Study patients showed a gradual increase in the amount of exercise performed. For aerobic exercise, most initially pedaled at 0 Watts for 5 minutes and were able to progress up to 5 Watts for over 30 minutes by 12 weeks. Three patients ceased aerobic exercise: one because of nausea (patient 5); one because of arthritic pain (patient 7) and the other because of a painful Baker's cyst (patient 8). Most were able to maintain or increase the number and repetitions of their strengthening/flexibility exercises.

Participation in the home-based exercise component was lower than for the in-hospital component and was quite variable. On average, patients exercised at home two times per week, but only five of nine (56%) exercised two days a week or more.

Results for the outcome measures are shown in Table 1. The baseline DASI scores showed the patients to be low functioning compared to healthy elderly, with a mean (SD) peak oxygen consumption ($VO_2$peak) of 17.1 ml/min/kg.[21] The SRM for the DASI $VO_2$peak was 0.21; a small response over the duration of the study. The baseline TUG scores also showed the patients to be low functioning compared to healthy elderly, with a mean (SD) of 14.2 (7.1) seconds.[22] The SRM for the TUG was 0.6; a moderate response. The baseline mean (SD) 2MWT was only 96.8 (44.2) metres (no available normative 2MWT values). The SRM for the 2MWT was 0.50; a moderate response.

Compared to Canadian age-matched norms, the baseline KDQOL Physical Composite Score (PCS) of 28.8 (6.1) was much lower than the norm of 47.2 (9.7), while the baseline KDQOL Mental Composite Score (MCS) of 52.1 (8.1) was similar to the norm of 53.7 (8.3).[23] The SRM for the PCS was 0.7; a moderate response. The mean MCS score did not change from baseline to 12 weeks. On average, baseline IIRS total scores were higher than typically observed in mixed-age hemodialysis patient populations,[24] indicating that our patients' illness was substantially intrusive to their lives. The SRM for the IIRS was 0.6; a moderate response in the direction of increased intrusiveness, but two patients had large increases in IIRS total scores over the 12-week program.

## DISCUSSION

Participation in the in-hospital exercise program was high; patients exercised during 89% of their HD sessions. A systematic review measuring exercise compliance in nine trials of exercise training in patients receiving HD, reported a compliance range from 43% to 99%.

[25] The high level of participation in intra-dialysis exercise in our study may be attributed to the following: our program supported the formal incorporation of exercise into the overall dialysis plan, signalling to patients and families that exercise is an important part of treatment; the exercise was individualized, supervised and incorporated patient's wishes and preferences; special equipment was provided that enabled patients to exercise in a reclined or supine position during HD; and exercise during dialysis provided a productive activity that did not require extra time.[8, 26]

Similar to our study, Pianta and Kutner [6] piloted an individualized exercise program with 25 older, low functioning patients. Only 48% of their patients regularly attended the exercise sessions. Their exercise program included physical therapy sessions outside patients' HD sessions. This may have contributed to their lower participation level compared to our study that had patients exercise during their HD sessions.

Unlike the high degree of participation in our intra-dialysis exercise sessions, only 56% of patients exercised two or more days per week at home. Barriers related to exercise training at home, such as lack of motivation and time, have been identified in other studies,[8, 27] and may account for our findings.

All patients were able to complete the performance measures and self-administered QOL measures. Despite the fact that the outcome measures showed that the study patients had low physical functioning and performance at baseline, the 2MWT, TUG and KDQOL PCS exhibited moderate responsiveness over the 12 week exercise program (Table 1). The DASI $VO_2$peak exhibited only limited responsiveness. These results suggest that the 2MWT, TUG and KDQOL PCS may be useful outcome measures to evaluate the effectiveness of exercise programs in this population. The 6MWT has been used previously in this population,[4] but the 2MWT has not. The 2MWT may be a more suitable measure of exercise tolerance in this population since it is shorter in duration and does not require a 30 meter corridor to administer.[4] The TUG has been used successfully with dialysis patients, including those 50 years and older.[28] We found it to be quick and simple to administer. In addition the TUG is a good predictor of the risk of falls in the elderly, an important consideration for safe functional independence in the community.[29]

IIRS total scores were generally high and showed moderate worsening from baseline to 12 weeks, with two patients reporting large increases in illness intrusiveness from baseline to 12 weeks (Table 1). This suggests that the exercise training may have been especially onerous for these patients or it may have increased their awareness of their low fitness level. In contrast, no change was documented in the KDQOL MCS over the course of the study. This may be because the exercise program disproportionately impacts on physical rather than mental aspects of health.

This pilot study has some limitations. The study was not powered to evaluate the effectiveness of the exercise program, so now that its feasibility has been established, its effectiveness needs to be evaluated. We included only patients who were ambulatory, fluent in English and medically fit to participate in an exercise program, and only 56% of eligible

patients agreed to participate, so the results are not generalizable to all hemodialysis patients over age 55.

## CONCLUSIONS

This study established the feasibility of an exercise program for low functioning HD patients over age 55. A large randomized trial is required to evaluate the effectiveness of the exercise program and to establish the incremental benefit of home exercise to exercise during HD sessions. Outcomes should include measures of physical functioning and QOL such as the 2MWT, TUG and KDQOL PCS, which this study has shown to be responsive measures in this population. In addition, the IIRS should be included to monitor the impact of the exercise program on general lifestyle and interests, and to assess the relationship between changes in IIRS scores and continued exercise participation.

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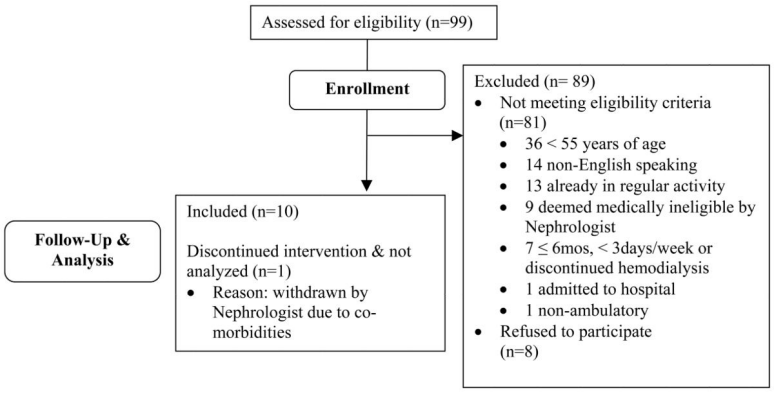


**Fig. 1.**
Flow diagram showing progress through the study

**Table 1**

Outcome Measures: Duke Activity Status Index ($VO_2$peak), Two Minute Walk, Timed-up-and-go Tests, The Illness Intrusiveness Rating Scale and Kidney Disease Quality of Life Questionnaire[1] at Baseline and 12 Weeks

| Patient | DASI $VO_2$ peak (ml/min/kg) | | 2MWT Distance (m) | | TUG Time (s) | | IIRS | | KDQOL Physical Composite Score | | KDQOL Mental Composite Score | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | B | 12wk | B | 12wk | B | 12wk | B | 12wk | B | 12wk | B | 12wk |
| 1 | 13.9 | 17.8 | 60.0 | 116.6 | 13.6 | 9.3 | 41 | 74 | 31.9 | 31.2 | 36.3 | 43.0 |
| 2 | 18.5 | 26.0 | 95.8 | 113.2 | 10.4 | 7.4 | 61 | 67 | 29.6 | 28.6 | 59.7 | 55.5 |
| 3 | 26.6 | 26.6 | 195.1 | 188.8 | 5.3 | 5.9 | 52 | 49 | 37.1 | 44.5 | 58.8 | 59.6 |
| 4 | 11.5 | 11.5 | 61.9 | 84.7 | 22.9 | 13.4 | 61 | 66 | 22.0 | 30.1 | 45.0 | 49.7 |
| 5 | 16.2 | 17.8 | 88.8 | 92.6 | 13.5 | 12.1 | 32 | 26 | 27.2 | 38.3 | 54.3 | 59.4 |
| 6 | 24.5 | 16.2 | 118.6 | 152.6 | 8.0 | 7.2 | 50 | 67 | 23.8 | 26.2 | 52.3 | 39.7 |
| 7 | 12.7 | 15.4 | 51.2 | 74.9 | 28.0 | 22.7 | 40 | 41 | 29.2 | 30.3 | 59.8 | 67.8 |
| 8 | 17.3 | 13.9 | 80.0 | 39.9 | 14.4 | 19.5 | 73 | 75 | 20.9 | 22.5 | 46.0 | 48.3 |
| 9 | 12.7 | 17.7 | 119.4 | 124.1 | 11.6 | 9.8 | 45 | 52 | 37.7 | 34.8 | 56.2 | 45.4 |
| Mean | 17.1 | 18.1 | 96.8 | 109.7 | 14.2 | 11.9 | 51 | 57 | 28.8 | 31.8 | 52.1 | 52.0 |
| SD | 5.3 | 5.1 | 44.2 | 43.8 | 7.1 | 5.8 | 13 | 17 | 5.4 | 6.9 | 8.4 | 9.4 |
| SRM | 0.2 | | 0.5 | | 0.6 | | 0.6 | | 0.7 | | 0.0 | |

[1]Scoring courtesy of UCLA Division of General Internal Medicine and Health Services Research. Kidney Disease Quality of Life Working Group Web Site 2000 [cited 2009 February 3]. Available from: URL: http://www.gim.med.ucla.edu/kdqol/downloads/download.html.

DASI=Duke Activity Status Index; $VO_2$=oxygen uptake; SD=standard deviation; diff=difference; B=baseline. 2MWT=2 minute walk test; TUG=timed up and go; IIRS=Illness Intrusiveness Rating Scale; KDQOL=Kidney Disease Quality of Life; SD=standard deviation; B=baseline; Change=12week minus baseline; SRM=standardized response mean. Higher scores for the IIRS indicate higher illness intrusiveness; higher scores for the KDQOL indicate higher quality of life