

Physical activity home program in haemodialysis patients

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Foreword

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A special thanks to my friend Tristan Remy for his instrumental assistance regarding the figures.

And I am grateful to the patients, showing motivation and perseverance in this study.

Introduction

It is well known that adults with chronic kidney disease (CKD) are inactive compared to individuals with normal kidney function¹. Several studies, including from our group, have shown a massive reduction in physical activity determined by the number of daily steps^{2,3}. This observation is of importance since sedentary behaviour has been shown to be associated with a reduced survival in the CKD population⁴ (figure 1).

The link between a low physical activity (PA) and mortality has well been described in the setting of CKD⁵. In dialyzed patients, cardiovascular mortality is considered as the main cause of death which is 10 to 20 times higher in such patients than in the general population⁶. Low physical activity appears to represent a new cardiovascular risk factor in this population at high risk of mortality. In addition, physical inactivity results in long term muscle weakness and subsequent loss of autonomy with a high risk of dependence⁷. Indeed, frailty and protein energy wasting (PEW), which are both common in CKD patients, independent of age, are also associated with impaired physical performance (6 minute walk test and gait speed), disability, poor quality of life (SF-36), and reduced survival. Thus, a low physical activity interplays with frailty, PEW and CKD in order to lead to muscle weakness, low physical performance and reduced cardiovascular fitness and ultimately poor survival. Because of this complex picture, preventive management strategies in dialysed patients require a multifaceted approach. Physical deconditioning is both a cause and a consequence of frailty and thus should be targeted by nephrologists. Exercise training has demonstrated numerous benefits in CKD patients, such as an increased aerobic capacity, an increased muscle strength and physical performance and, in some studies, an increase in muscle mass^{8,9}. Physical activity during haemodialysis sessions with leg-cycling improves not only cardiopulmonary fitness and endurance but also muscle strength, power, fatigability and physical function¹⁰. As shown in figure 2, the sedentary behavior, which results from aging, CKD and dialysis treatment *per se*¹¹ has a negative impact on fitness, muscle mass and physical performance; it also increases the risk of insulin resistance, diabetes mellitus, hypertension, depression,

and endothelial dysfunction and promotes inflammation and oxidative stress. On the contrary, exercise may counteract all these effects¹².

To increase physical activity is a very difficult task in CKD patients, because they are often affected by limitations due to an important fatigue, the severity of their illness, co-morbidities and constraints of the dialysis treatment¹³. More attention should be given to exercise's practice in dialysis patients by nephrologists, especially because, for many patients with ESRD, the nephrologist serves as the primary care provider¹⁴. Numerous interventions have been tested including aerobic training, resistance exercise training and combined training programs, each reporting positive results. Patients included in such studies are usually selected, i.e. younger and fitter compared to standard dialysis patients. However, data on the feasibility of exercise programs to increase physical activity in unselected dialysis patients is poor. The ideal exercise program, endurance versus resistance, during dialysis treatment versus off dialysis treatment in such patients is also questioned. In our center, we have initiated since many years an exercise program during hemodialysis sessions. We have shown that a physical therapy program focused on endurance / strength of the lower limbs, using elastic bands applied during dialysis sessions could improve physical function tests such as the "Get Up and Go", Tinetti test (balance test) and 6-minute walking test¹⁵. Interventions during hemodialysis sessions have become more popular recently because the time spent on dialysis sessions three times a week can be used for exercising without further limiting the patient's privacy. Exercise during dialysis has indeed been showed to be safe¹⁶. However, the application of physical therapy during dialysis sessions may be limited in its intensity by the constraints of the treatment and its complications, i.e. cramps, hypotensions, for instance. Therefore, we postulated that home physiotherapy programs would be more effective.

A major problem in dialysis patients is the lack of physical and motivational drive to initiate physical activity and/or exercise programs.

Motivational/instructional approaches may be an interesting adjunct strategy in order to increase physical activity in these patients but this has been scarcely reported in dialysis patients. This is why, in this work, we wanted to add a motivational component in order to support the home physiotherapy program.

The aim of this study was to evaluate the feasibility of a home physical activity coaching program reinforced with a repeated videotape instruction designed to stimulate PA. We hypothesized that this type of intervention may increase PA in unselected dialysed patients. In the short term, an increase in physical activity may increase functional capacities, foster the patient's autonomy and improve quality of life.

From a clinical and scientific point of view, we tested our hypothesis in a pilot study of feasibility. For this purpose, we implemented a home physiotherapy program to be assisted by physiotherapists. In this interventional period, we also showed to the patients a videotape during dialysis sessions in order to stimulate PA. The aim of this pilot study was to check if this program was able to increase PA and functional capacities in these patients, using simple means. If so, the obtained data may be used to design a future randomized prospective study on a larger scale.

Methods

This study is a prospective non-randomized open pilot study from a single center. The protocol was submitted and accepted by the Cantonal Ethics Committee on research on human beings of the canton of Vaud. The only inclusion criteria was that patients should have been treated with HD since at least 3 months. Exclusion criteria were: not being able to wear the pedometer during one week (for example, patients using a wheelchair), patients with an expected survival of less than six months, those who were unable to understand the study protocol (dementia or inability to understand French or English), and those with an important physical impairment (i.e. musculoskeletal or neurological disorders) making impossible or at least doubtful the measurement of physical activity through pedometer and / or physical function tests. As shown in figure 3, included patients had a baseline assessment of their physical capacity, with 3 functional tests described below, and a test assessing quality of life. Then, they were asked to wear a pedometer for one week in order to measure the number of their daily steps. After this baseline assessment, patients followed a nine week interventional home physiotherapy program. This program was reinforced by a standardized videotape instruction, delivered during dialysis sessions, in order to stimulate daily PA. They also received a logbook in which they were asked to report PA items (attached in appendix).

At the end of the program, a final evaluation, similar to the initial assessment, was conducted to compare the parameters measured from initial and final assessments.

Pedometer

The primary endpoint was the number of steps recorded by the pedometer at the baseline and at the finish line. Secondary endpoints were the 3 functional tests, as well as quality of life assessed with KDQOL described later.

Daily steps count, as a measure of PA, was measured using a Geonate pedometer, ONSTEP 50, which was given to each participant. Participants were instructed to attach the pedometer at the waistline after getting up in the morning and to wear the pedometer throughout the day while doing usual activities, except water submerged activities. They were asked to remove the pedometer before going to bed and record

the day's step count before resetting the device to zero for the next day. Since the pedometer was distributed on a dialysis day, recording steps generally started on a non dialysis day, and therefore the recorded week generally consisted in 3 days with dialysis treatment and 4 days without dialysis.

The 3 functional tests used for the initial and final assessments were the 6 Minute Walk Test (6MWT), the Timed Up and Go Test (TUG), and the 30 Second Chair Stand Test (30CST) (see appendix 1,2 and 3). They were all performed by the physiotherapy staff (5 members), during the same day, and following a defined order, first the 6MWT, then the TUG and finally the 30CST.

6 minute walk test (6MWT)

The 6MWT measures the ambulated distance in 6 minutes. It is noninvasive, simple-to-use, valid test, used as a predictor of aerobic fitness, and associated with health outcomes¹⁷. It reflects activities of daily living better than other walking tests¹⁸, and can be used to assess the risk for cardiopulmonary morbidity and mortality¹⁹. In patients with advanced heart failure, the distance ambulated during 6MWT is a good predictor of peak VO_2 and short-term event-free survival²⁰. Furthermore, there is evidence that the 6MWT is responsive to clinical changes following cardiac rehabilitation²¹.

In this study, the 6MWT was carried out by our physiotherapy staff, according to the recommendations of the American Thoracic Society²². The patients were instructed to walk as fast as possible during 6 minutes on a flat 50-m track and the covered distance was recorded in meters. They were allowed to stop but were asked to resume walking as soon as possible.

Timed Up and Go (TUG)

The TUG test was performed according to the original protocol described by Podsiadlo and Richardson²³. It requires the patient to get up from a chair, walk 3 meters and turn around to return into a seated position. The time needed to perform this test was measured in seconds. The TUG test is recommended by the American Geriatrics Society as a screening test to assess the risk of fall and is a good test to

evaluate mobility²⁴. It seems to be a reliable and valid functional measurement in patients with chronic heart failure²⁵.

30 Second Chair Stand Test (30 CST)

To evaluate muscle strength in the lower limbs, participants were administered a 30 CST. Briefly, they were asked to perform a maximal number of transitions from the sitting to a standing position in 30 seconds.

Quality of life – the KDQOL-SF TM version 1.3

The measure of quality of life used for this study has been performed using the « KDQOL-SF TM version 1.3 » in french (appendix 4). This questionnaire was specially conceived for patients with renal disease treated or not with dialysis and validated in this population²⁶. It is a self-reported measurement's instrument with a large psychometric performance. The extent of bother of different symptoms/problems is assessed using the following terminology: not at all, somewhat, moderately, very much, extremely, or the burden of the sickness in one's life using a definitely true to definitely false response scale and other scales.

Overall, the KDQOL-SF TM includes 24 questions and 80 items distributed in two main parts (36-item health survey and specific endstage renal disease (ESRD) targeted areas plus one separate item on general estimation of health, as detailed in appendix 5,6 and 7.

The scoring procedure for the KDQOL-SF TM transforms the raw pre-coded numeric values of items to a 0-100 possible range, with higher transformed scores always reflecting better quality of life²⁷.

Videotape to stimulate physical activity

A short videotape including information on how to increase physical activity in the usual life was developed by myself. The diffused information of this videotape was inspired by a brochure from the League from the Canton of Vaud against cardiovascular diseases²⁸. The video lasts 2 minutes and 43 seconds and exposes in

its first part the effects of physical activity on the body, and in its second part concrete ways to enhance physical activity by changing certain habits, for example getting out of the bus one stop before the final destination, taking the stairs instead of the elevator or making walkshopping.

The study lasted from the 1.05.2014 to the 30.07.2016. Firstly, I personally approached all patients meeting the above inclusion/exclusion criteria and provided a verbal information and handed out an information sheet, as well as a consent form. After a minimal delay of reflection of 48 hours, I collected the consent forms of the patients who accepted to participate to the study. Recruitment took place during a first period from 1.05.2014 to 1.09.2014 and during a second period from the 1.01.2015 to the 1.03.2015. As soon as a participant had been enrolled in the study, a physiotherapist organized an appointment with him, 30 minutes before a dialysis session, in order to carry out the 3 tests of physical function. After the physical tests session, the subjects received the quality of life test to be completed alone or with help of the nurses from the dialysis center. Finally, they were given a personal pedometer and a count-sheet, with a specific information on how to use it (appendix 8) and how to report the step count. Participants were instructed to wear the pedometer during seven consecutive days and write down the daily step numbers on the established count-sheet (appendix 9), which was collected a week later. After the above assessment, the intervention was started. This included 12 physiotherapy sessions spread over 9 weeks (2 times a week during the first 3 weeks and then 1 time a week during the last 6 weeks). Physiotherapy sessions lasted 30 minutes, and mainly consisted in repetition exercises with elastic bands applied on several muscle groups of the lower limbs, with various resistance to increase muscle strength²⁹. Patients could not miss more than two weeks of physiotherapy during the interventional period. When missing less than 2 interventional weeks, sessions were replaced after the break. Above this threshold, patients could continue to exercise for their own sake but were considered as drop-out of the study. The physiotherapy program was reinforced with a standardized videotape information designed to stimulate PA in daily life. This 2-minute videotape was shown once a week during the 9 weeks interventional period. During this period, patients were asked to fill in a logbook to report their physical activity (appendix 10). These notes were checked once a week during a dialysis session by a nurse of the service, and they were only

used for motivational purpose. A lack of spontaneous physical activity did not result in any warnings and/or consequences on the general care of the subjects.. At the end of the interventional period, a final assesement, exactly identical to the initial one was performed.

Statistics

Results are expressed as mean +/- standard deviation, except for the study populations characteristics that were expressed in medians. Primary endpoint analysis was conducted by the Snedecor and Cochran test for equality of matched pairs. P-value was assessed with a bilateral test and an unilateral test. Only patients with values listed in initial and final assesement were used for the paired analysis. The same statistical tests were used for results regarding specifically dialysis and non dialysis days. For patients who did not give this information on the count sheet (N=3), the information was imputed using an arithmetic mean of all other participants values. For the physical functioning tests, a paired statistical analysis by the Student's test was conducted. P-value was assessed with a bilateral and unilateral test. Quality of life results were assessed with a paired analysis by Snedecor and Cochran test of matched pairs. This means that only patients with results before and after the intervention were kept. P-value was assessed with a bilateral and unilateral test.

Results

The recruitment process started with the examination, during the recruitment period, of the whole cohort of our dialysis patients treated with hemodialysis for more than 3 months, i.e. a total 87 patients. The patient's flow chart is summarized in figure 4. Only 27 patients could be included in the study, due to 38 exclusions and 22 refusals to participate. Out of 27 patients, 16 completed the study. The 11 drop-outs during the study were due to pain, fatigue and lack of drive (3 patients), hospitalizations or personal issues delaying physiotherapy sessions of more than 2 weeks (3 patients), the wish of stopping the study (3 patients), the impossibility to perform the baseline physical functioning tests (1 patient) and renal transplantation just before the interventional period (1 patient).

The characteristics of the participating subjects are described in table 1. The median age of the study subjects was 55 years old, which is younger than the median age of the hemodialysis population in our hemodialysis centre (61 years old in December 2014).

When comparing the number of steps before and after the intervention, we did not observe a change in mean daily steps (5742 ± 4934 steps before and 5795 ± 6896 after).

All 3 physical functional tests improved but the improvement was statistically significant for TUG test and 30CST, as shown in table 3. The 6MWT showed a small increase of 24 ± 58 meters but this failed to reach statistical significance. The TUG test was accomplished in a time reduced by 1.1 ± 0.9 seconds. A mean increase of 3.6 ± 3.8 stands was shown in the 30 CST..

Quality of life measurements/items failed to show improvements. The SF-36 health survey test tended to improve ($+ 2,5 \pm 37.1$ %), and the ESRD targeted areas tended to decrease (-3.6 ± 35.1 %). The dimensions showing the best progression were « Physical limitations » and « Effects on kidney », both with a 11 % average progression. Then comes « Energy and fatigue » ($+ 9 \pm 23$ %) and then equally « Social function » and « General health evolution » ($+ 6 \pm 28$ % and 6 ± 42 %).

Some items showed a trend to decrease : « Sexual function » ($- 29 \pm 59 \%$), « Social support » ($-23 \pm 52\%$) and « General health » ($-13 \pm 25\%$). The standard deviation before and after the intervention was quite stable (± 23.4 and $\pm 25.1 \%$).

Discussion

This pilot study showed that a 3-months structured home exercise program coached by physiotherapists and reinforced by a motivational videotape did not improve physical activity, as assessed by the number of daily steps. However, this program was shown to improve physical functional tests such as TUG and 30 CST. Quality of life items were not improved.

The discrepancy between the improvement of balance and speed of movement (TUG) and muscle strength of lower limbs (30 CST) and the inefficacy of our program to improve physical activity may be explained by the nature of the exercise program chosen in this study, i.e. mainly resistance rather than endurance exercise, the relatively short duration of the intervention and the probably insufficient frequency of the exercise sessions proposed.

In addition, we ended up with a small number of patients who could complete the study, which considerably limited the statistical power of the study.

The recruitment of the subjects of this study was difficult because patients were unfit and most were complaining of fatigue, lack of drive and/or may suffer from various comorbidities which were added to their busy schedule with 3 hemodialysis sessions per week. As shown in the flow chart, many patients were unable to participate to the study (67.8%), and even after acceptance, drop-out rate was high (40.7%), mainly because of health issues. When looking at the study population, their median age was younger than the median age of the patients in our dialysis center. In other words, older patients were more reluctant to participate. A selection of fitter patients ultimately

applied because of the nature of the study and also because participants needed to perform the 3 functional tests to be kept in the study. In addition, missing more than 2 weeks of physiotherapy (fatigue and pain were the main reasons) in a row was a criteria for drop-out.

Patients who missed physiotherapy sessions also complained of these symptoms even if they were motivated to continue the study, thus showing the ubiquitous nature of these symptoms, independent of exercise. The patients who wanted to quit after the start (3) did not give explicit reasons. We can postulate a minimum of fitness was required to finish the study.

As reported in other studies³⁰, this study tended to show the sedentary behaviour of the patients on maintenance dialysis, especially during dialysis days. Daily steps averaged around 5742 steps per day, with important variability from an individual to another (+/- 5915 steps). On days with dialysis, the participants walked less, with a mean difference of 1544 steps per day in the initial assessment. The number of steps tended to increase only during dialysis days in our study. A hypothesis is that patients tried to immediately apply the instructions shown in the videotape during HD sessions in order to convert this information into a higher number of steps.

However, measuring daily steps with a pedometer during only 2 single weeks has limitations, because of the extreme lability of these patients. If a patient was unfit during the week in which measurements were done, results may have been influenced greatly. In our pilot study, 11 out of the 16 patients were enrolled in the study at the end of summer 2014. Therefore their final assessment took place 9 weeks later, during autumn or winter. For the other 5 participants, the seasonal conditions with a winter to spring period were more likely to promote an increase of daily steps. Furthermore, weather itself was not assessed and plays a key role for clear reasons. Pedometers had already been used to increase physical activity among children and adolescents with chronic kidney disease, and did not show a significant

increase of their activity whereas physical functioning and performance had improved³¹. If the measure of increase of physical activity with a pedometer is limited for different discussed reasons, the motivational effect of the pedometer should still be acknowledged, like demonstrated in an online pedometer program in Qatar showing a significant increase in average daily steps³². Some of the participants already measured their daily steps with wrist devices or mobile applications. Those patients were generally the most active patients, and thus less likely to improve. One participant shared with us his new use of his « Health » mobile application after participating to the study. The TUG test and the 30 CST did improve. These tests are less prone to external bias and fluctuations and thus may be more representative of the actual improvement of the participant.

When interrogated at the end of the study, most patients reported an increase in their strength, mainly in the lower limbs and said to feel an impact in their daily lives. One specific patient who wasn't able to stand from a chair without help of his arms initially was able to do 4 stand-ups in the 30 CST at final assessment. He shared with us his enthusiasm and how this physiotherapy program was life-changing for him. For these patients usually so limited in their daily activities, even a small gain may represent a real change in their everyday life.

The quality of life test did not show any change, even if SF-36 which focalized on health items tended to increase. In an interesting way, the category showing the best outcome was the « Physical limitations » category. This may indicate that the physiotherapy sessions were effective and may explain why the participants noticed a decrease in physical limitations. Having less physical limitations may explain why they sensed a better general health at the end of the study. One of the categories with the most decreasing score was « social support ». At the end of the study, more patients were unhappy about the time they were able to spend with family and friends. Dialysis already

taking much time and causing exhaustion in many patients, physiotherapy sessions may have induced a supplementary burden in their reserves.

In conclusion, this pilot study in which a home exercise program was provided and a video-tape was repeatedly delivered during HD sessions did not improve physical activity. However, this showed encouraging results in terms of improving functional tests. Patients only received 12 physiotherapy sessions and it is hypothesized that the number of steps may have been improved with a more intense exercise program. The size of our study sample was small due to exclusion criteria and a high number of refusals and drop-outs.

This motivates the realisation of another study including a much greater sample of patients in a multicenterstudy. In addition, a more intense exercise program, and perhaps an in-center exercise program during HD sessions, may be needed to improve the adherence and the efficacy to improve physical activity. In-center exercise programs during HD sessions may also leave more time off to the patients. Conducting a case-control type of study could help us to determine the impact of physiotherapy itself without the motivational bias of being in a physical activity study. Furthermore, it would be interesting to compare groups that receive different sorts of physiotherapy exercises, to assess the most efficient program.

Figures

Figure 1: Survival among sedentary and nonsedentary incident dialysis patients ³³

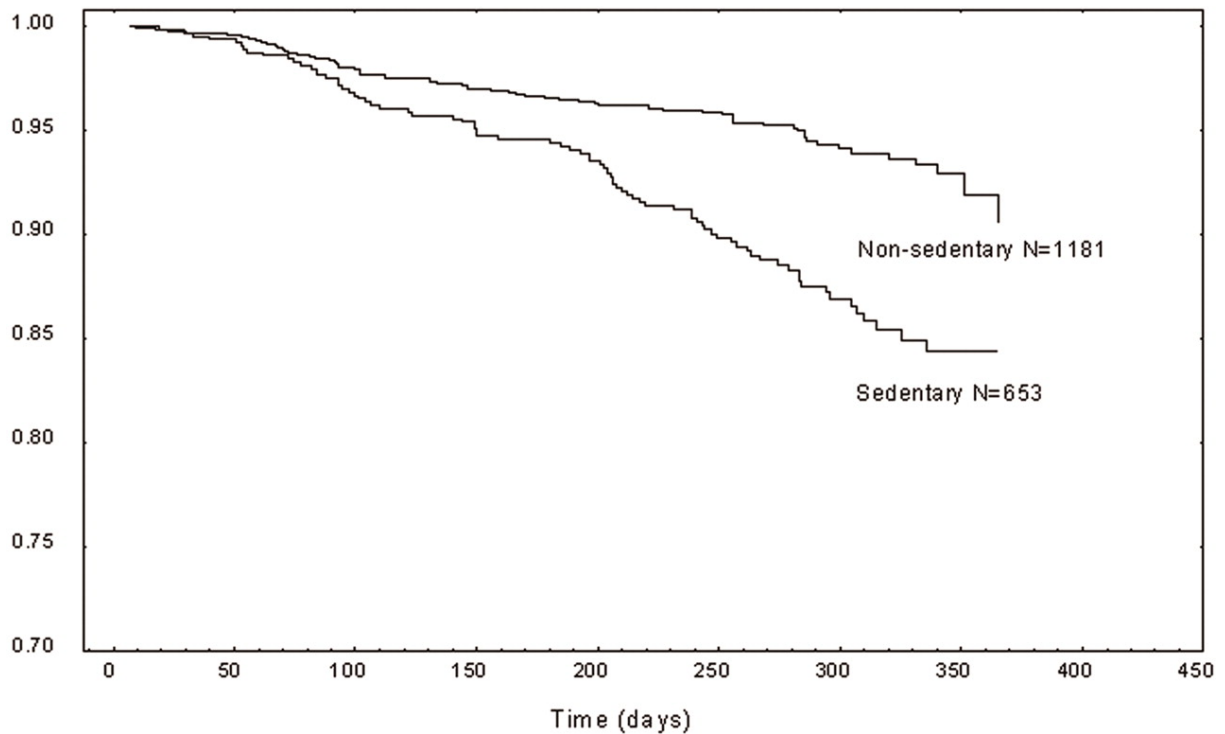


Figure 2 : Diagram of potential adverse effects of sedentary behavior and chronic kidney disease and potential beneficial effects of exercise interventions. ³⁴

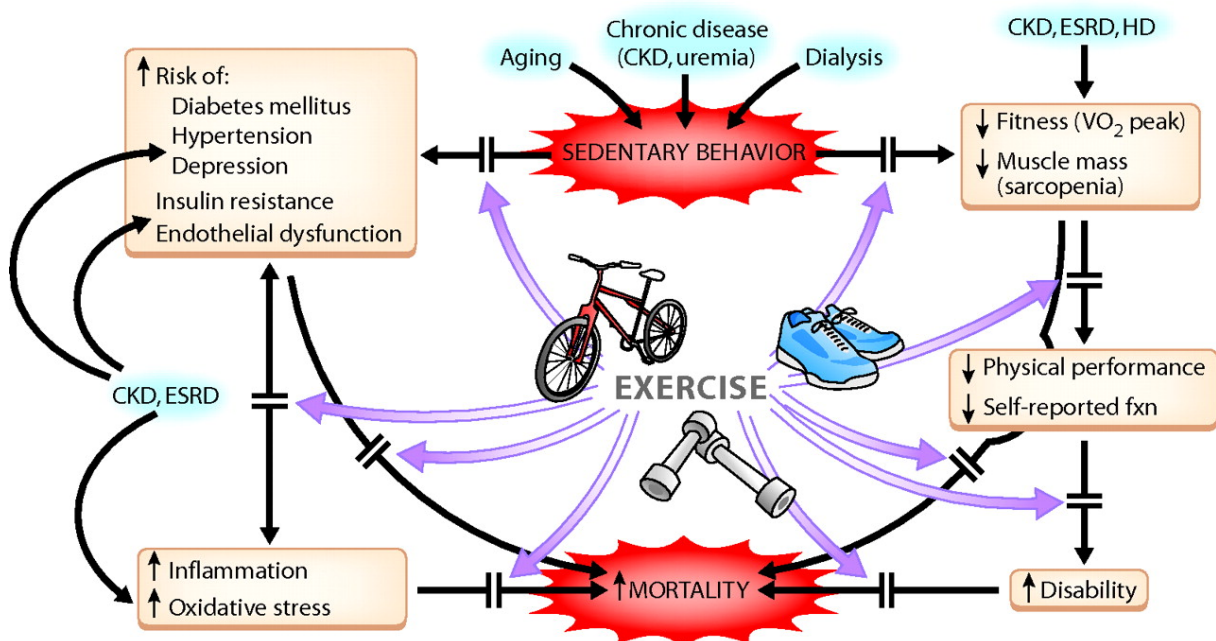


Figure 3 : Methods

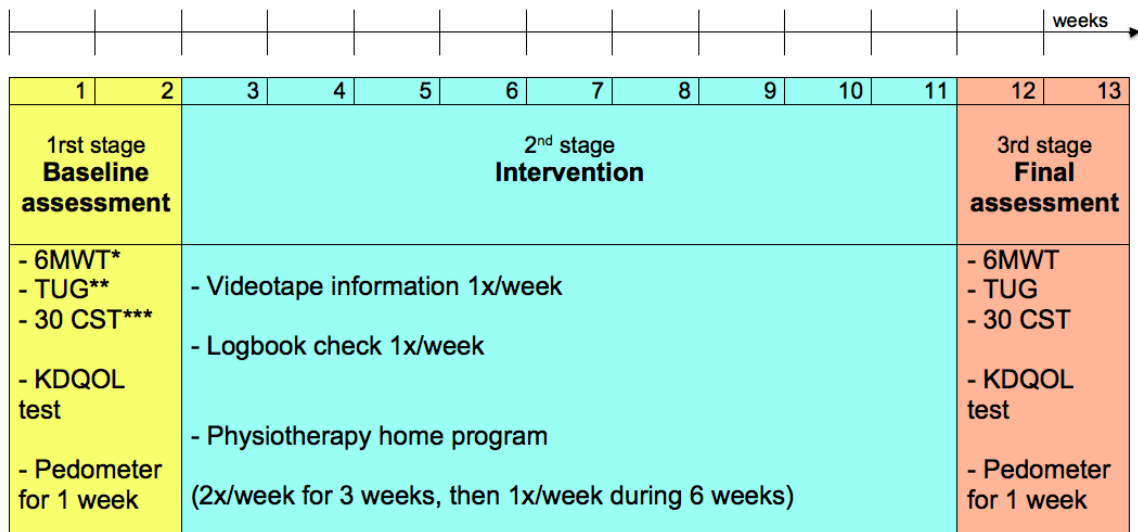


Figure 4 : Recruitment : Patient's flow chart.

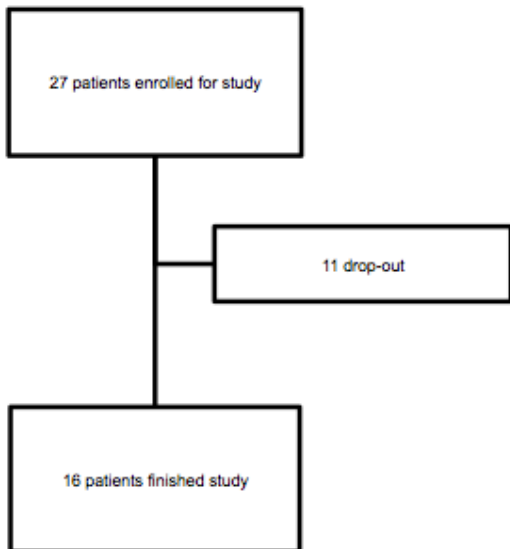
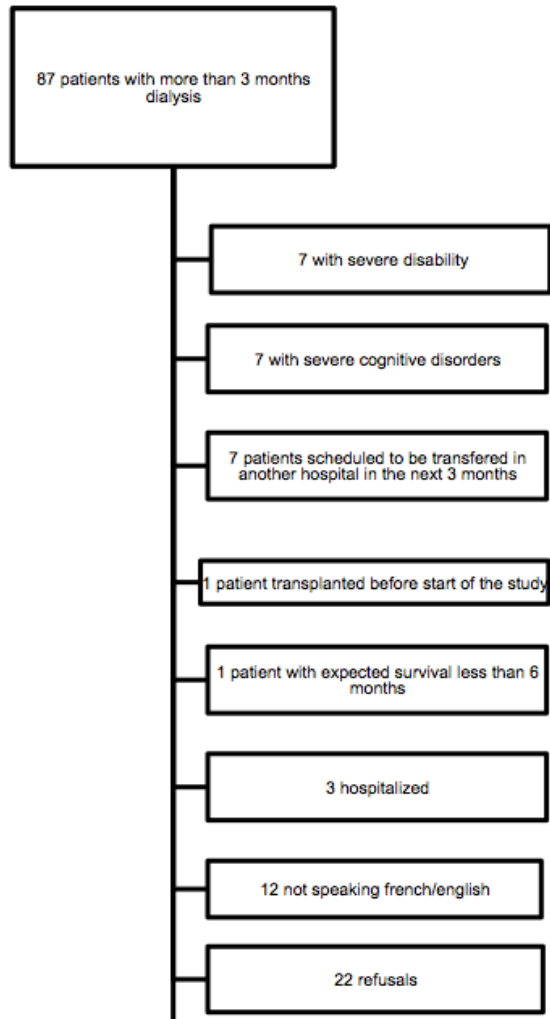
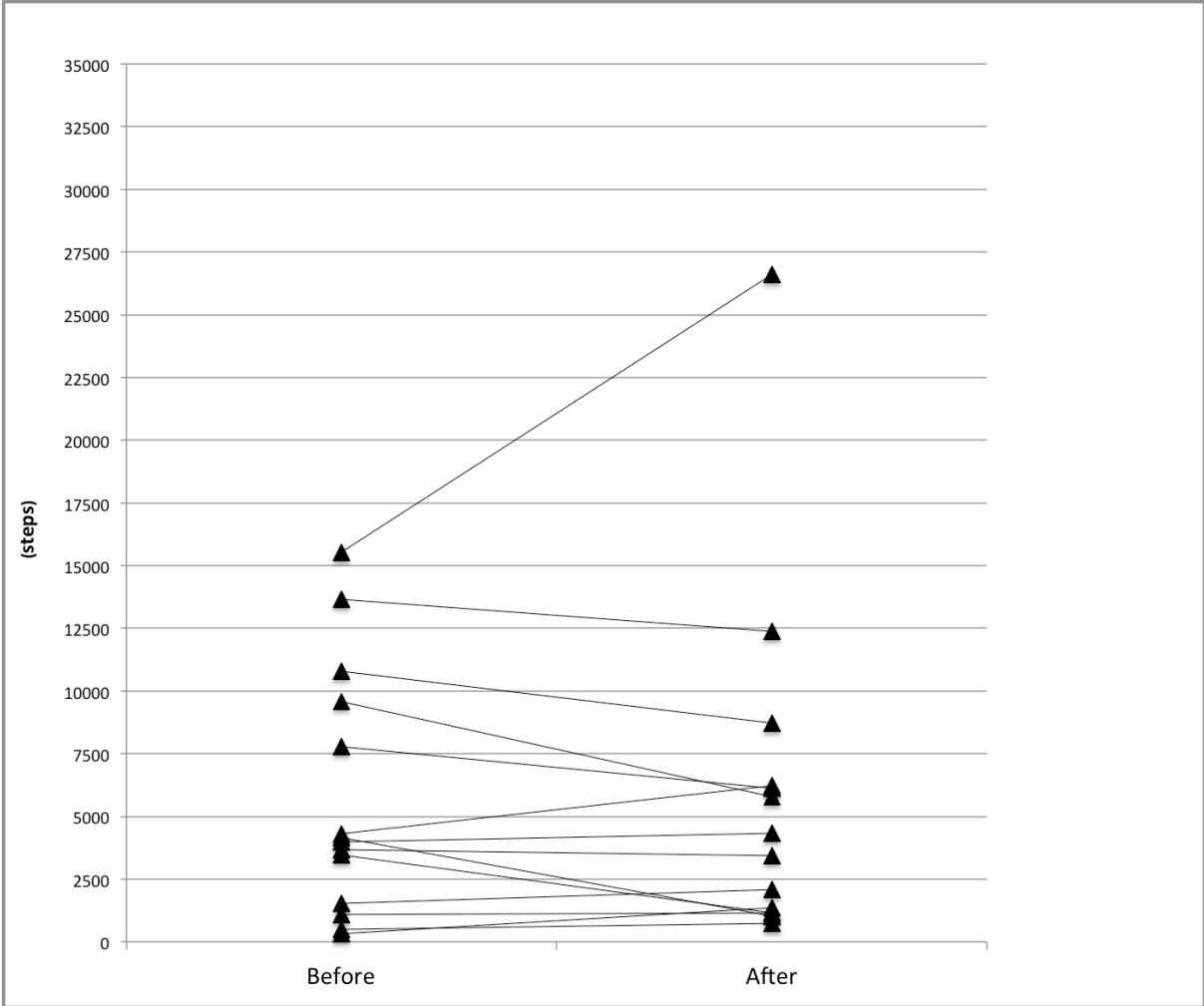
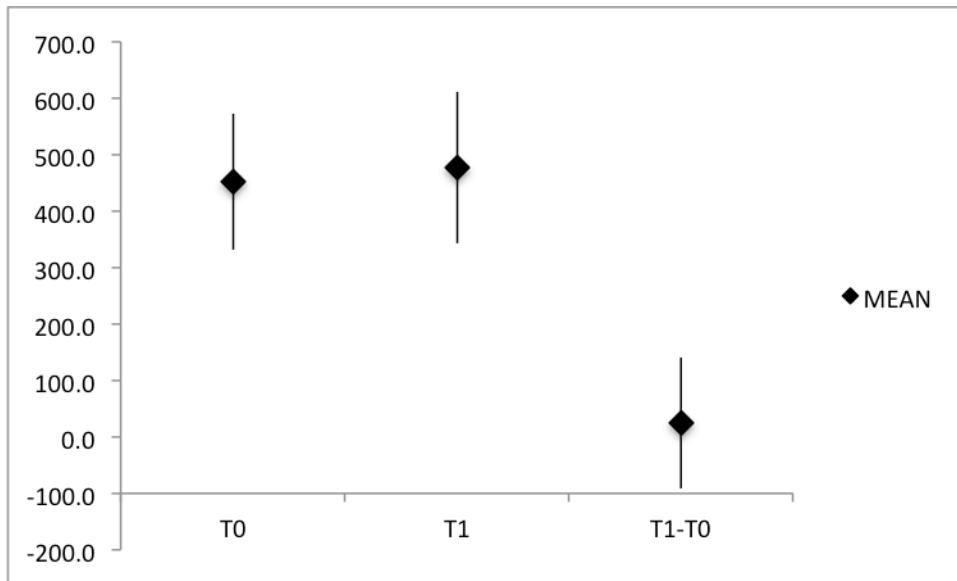


Figure 5 : Mean daily steps



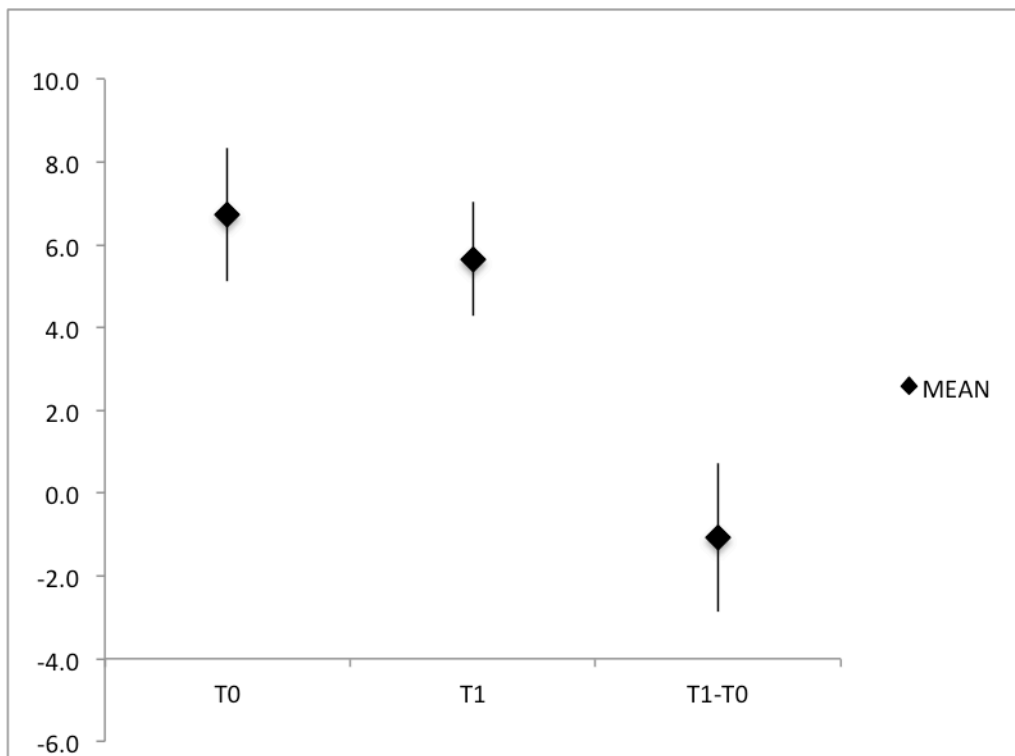
This figure shows the mean (7 days) number of steps, before and after the intervention. For this figure, only patients with values before and after the intervention are represented (N : 14). The 7 days mean consisted in 4 days without dialysis and 3 days with dialysis, before, and after the intervention.

Figure 6 : 6MWT



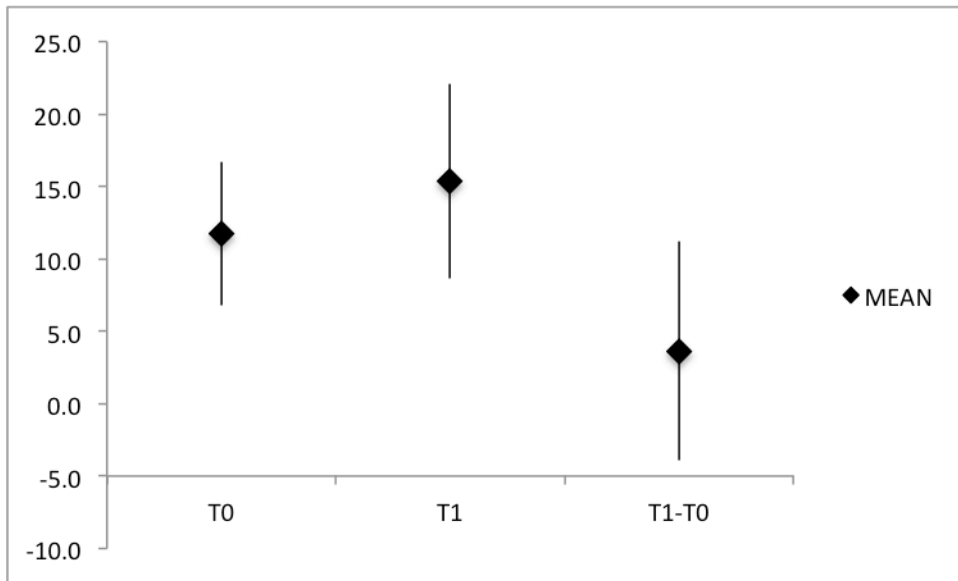
This figure shows the mean performance at T0 and T1, as well as the mean difference in performance between T0 and T1. The whiskers for T0 and T1 represent the mean performance +/- one standard deviation. The whiskers for T1-T0 represent the mean difference +/- two standard deviations, equaling the confidence interval.

Figure 7 : TUG



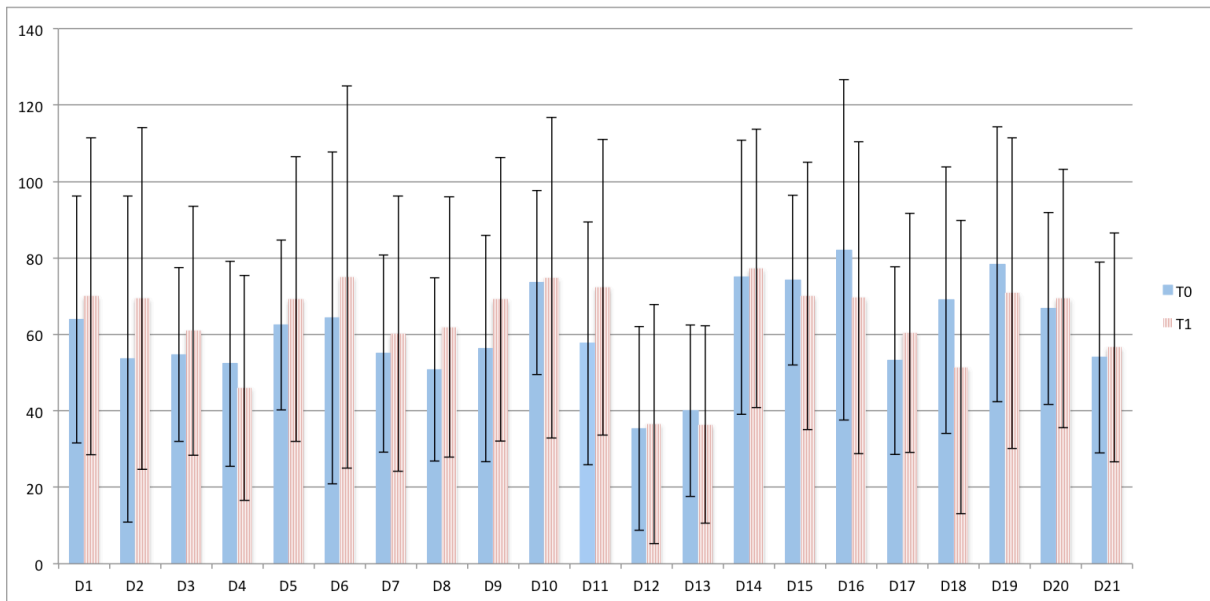
The configuration of this figure is the same as the 6MWT figure. To be noted that in this test, an increase in performance is defined by a decrease of time needed to accomplish the test. Therefore, a negative value of T1-T0 represents a favorable result.

Figure 8 : 30 CST



The configuration of this figure is the same as the 6MWT figure.

Figure 9 : SF-36 and ESRD-targeted Areas : means for each category at baseline (T0) and finish line (T1)



This figure represents the average in each category (full box) and the standard deviation (whisker from mean +/- 1 standard deviation).

Table 1 : Characteristics of the study population

	N	%	Age +/- SD*
Median age participants	16		55 +/- 10.3
Median age in the CHUV** (12.2014)	83		61 +/- 14.7
Age 30-59	13 (/16)	81.3	
Age 60-80	3 (/16)	18.7	
Women	6	37.5	
Men	10	62.5	
HD treatment	16	100	

SD* : Standard Deviation

CHUV** : Centre Hospitalier Universitaire Vaudois

Table 2 : Primary endpoint

Number of steps - Paired analysis	Before	After	Difference	p-value*	P-value**
All participants	5742 ± 4934	5795 ± 6896	53 ± 3577	1.000 †	0.605 †
No dialysis	5999 ± 5418	5850 ± 8799	-150 ± 4883	1.000 †	0.500 †
Dialysis	4184 ± 4165	5045 ± 5951	861 ± 2974	1.000 †	0.500 †

Results are expressed as mean standard deviation. Paired analysis conducted by the Snedecor and Cochran test for equality of matched pairs (†) p-value* is assessed with a bilateral test, P-value** is assessed with a unilateral test, with the hypothesis that the intervention will improve the performance.

Table 3 : Physical functioning tests

	Before	After	Difference	p-value*	P-value**
6MWT	453 ± 121	477 ± 135	24 ± 58	0.112 §	0.056 §
TUG	6.7 ± 1.6	5.7 ± 1.4	-1.1 ± 0.9	<0.001 §	<0.001 §
30CST	11.8 ± 5	15.4 ± 6.7	3.6 ± 3.8	0.002 §	<0.001 §

Results are expressed as mean standard deviation. Paired analysis conducted by Student's t-test (§).

p-value* is assessed with a bilateral test, P-value** is assessed with a unilateral test, with the hypothesis that the intervention will improve the performance.

Table 4 : KDQOL-SF TM version 1.3

	Before	After	Difference	p-value*	P-value**
SF-36 health survey					
Physical functioning	73 ± 24	70 ± 29	-3 ± 38	0.344 †	0.945 †
Physical limitations	58 ± 41	69 ± 37	11 ± 55	0.727 †	0.363 †
Pain	56 ± 23	61 ± 24	5 ± 37	0.774 †	0.387 †
General health	59 ± 22	46 ± 24	-13 ± 25	0.754 †	0.828 †
Emotional well-being	67 ± 17	69 ± 17	2 ± 24	1.000 †	0.623 †
Emotional limitations	75 ± 35	75 ± 46	0 ± 62	1.000 †	0.500 †
Social function	55 ± 24	60 ± 27	6 ± 28	1.000 †	0.746 †
Energy/fatigue	53 ± 12	62 ± 17	9 ± 23	0.688 †	0.344 †
General health evolution	63 ± 26	69 ± 27	6 ± 42	0.774 †	0.387 †
ESRD – targeted areas					
Symptoms and health issues	70 ± 13	76 ± 25	7 ± 28	0.289 †	0.145 †
Effects of kidney disease	62 ± 24	73 ± 16	11 ± 36	1.000 †	0.500 †
Burden of kidney disease	39 ± 29	34 ± 32	-5 ± 41	0.508 †	0.910 †
Work status	40 ± 21	40 ± 21	0 ± 33	1.000 †	0.688 †
Cognitive function	73 ± 14	76 ± 15	3 ± 20	1.000 †	0.500 †
Quality of social interaction	73 ± 14	68 ± 18	-5 ± 20	0.549 †	0.887 †
Sexual function	83 ± 29	54 ± 31	-29 ± 59	1.000 †	0.875 †
Sleep	55 ± 15	58 ± 19	3 ± 28	1.000 †	0.637 †
Social support	68 ± 29	45 ± 36	-23 ± 52	0.180 †	0.981 †
Dialysis staff encouragement	81 ± 29	70 ± 31	-10 ± 34	0.727 †	0.856 †
Patient satisfaction	65 ± 26	69 ± 16	4 ± 34	1.000 †	0.773 †
General estimation of health	55 ± 25	55 ± 19	1 ± 36	1.000 †	0.726 †

Results are expressed as mean standard deviation. Paired analysis conducted by Snedecor and Cochran test for equality of matched pairs (†). p-value* is assessed with a bilateral test, P-value** is assessed with a unilateral test, with the hypothesis that the intervention will improve the performance.

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