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A survey of physical activity in dialysis patients in Northern Norway.

An observational study

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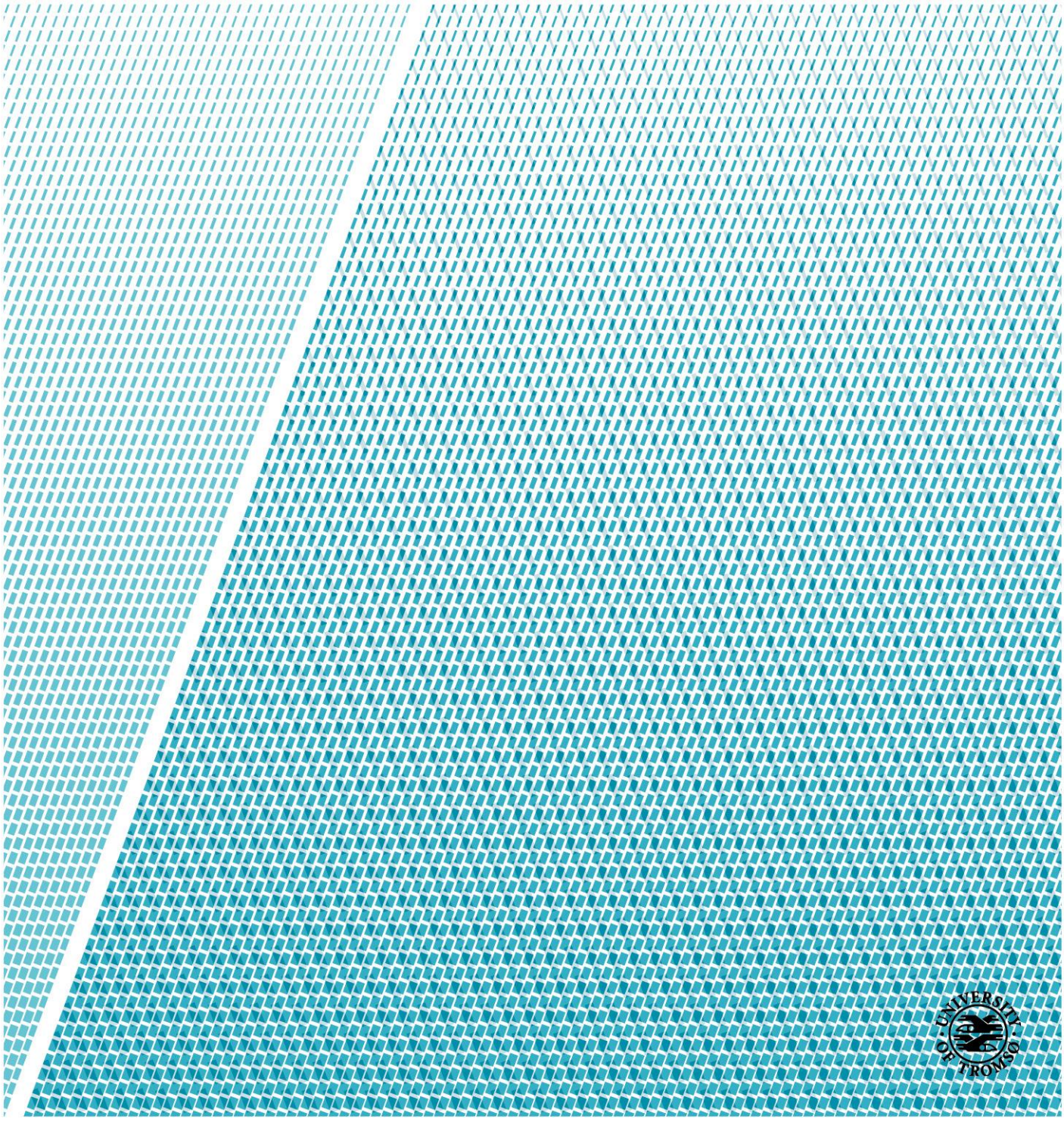

Preface

This paper has been quite a journey to write. An interesting, fun and challenging journey indeed. The process began fall 2017, and this paper has been part of my life ever since. It is fun to look back at all the work that has been put into this paper, because I can truly say the result is one of my biggest achievements during my academic career. This achievement would not be possible without help from people around me, especially my supervisor Marit Dahl Solbu has been outstanding during this process. Always responding fast and kindly to any question of mine, she has guided me through the process from day one. I sincerely thank her for all help with the paper, but also her reassurance when I came across obstacles. Thank you!

I would also mention my assistant supervisor Randolf Hardersen and Doctoral Research Fellow at School of Sport Science Edvard Hamnvik Sagelv for their contributions during this paper. I would like to thank Landsforeningen for nyresyke og transplanterte (LNT) for their financial support.

The purpose of this paper was to get valuable insight and knowledge about physical activity and health-related quality of life in dialysis patients. Hopefully, this paper can contribute to a higher focus on this patient group and to kickstart future studies. All with the aim of making a positive difference in dialysis patients' lives.

Kjell-Gunnar Vangen

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Abstract

Background: Patients in advanced stages of chronic kidney disease (CKD), especially patients treated with dialysis, have reduced physical capacity. The main objective of this project was to study and compare the degree of physical activity (PA) in patients in haemodialysis (HD) and peritoneal dialysis (PD) in Nordland, Troms and Finnmark. To our knowledge this is the first study to include accelerometer recordings of patients in both HD and PD.

Methods: An observational study was conducted during 15. November to 15. December 2018. Patients were recruited in hospitals and dialysis satellites by mainly nephrologist and dialysis nurses. Each patient participated voluntarily and signed a written consent. The study consisted of a self-administered questionnaire about PA and health-related quality of life, and accelerometer recordings for seven days for objective measurements of PA.

Results: Thirty patients out of 181 on chronic dialysis participated in the study, whereas 22 in HD and 8 in PD. Twenty-eight percent of all invited patients consented and were included in the study. Median wear time for ActiGraph accelerometer was significantly higher ($P < 0,05$) in the HD group with 9194,5 (8501-9733) minutes compared to PD 7509 (6400-9134) minutes. Seven out of 22 HD patients (31,8%) and five out of eight PD patients (62,5%) reached the recommended weekly goal of ≥ 150 minutes moderate-to-vigorous physical activity (MVPA). Only one patient had an active lifestyle in terms of average steps daily (≥ 7500), three patients classified to somewhat active (5000-7499 steps/day), whereas 26 were categorised as sedentary. Haemoglobin was significantly associated with daily MVPA at or above vs. below median (OR 0,39 (95% CI 0,15-0,99) per 1 g/dL increase; $P = 0,047$). Most patients reported that they had never been informed by their nephrologist about the potential benefit of being physically active, but a desire to be more active was commonly found.

Conclusion: Results from this study indicate that dialysis patients have a low level of PA based on average daily MVPA and step count, compared to healthy people. We found no significant differences between patients on the two different dialysis modalities. A high haemoglobin level was associated with less daily MVPA. There seems to be a potential for increased level of PA in dialysis patients, and efforts should be made by health care personnel to get more patients to reach the recommended levels of PA.

Abbreviations

APD	Automatic Peritoneal Dialysis
AV	Arteriovenous
CAPD	Continuous Ambulatory Peritoneal Dialysis
CKD	Chronic Kidney Disease
CVC	Central Venous Catheter
ESRD	End-Stage Renal Disease
GFR	Glomerular Filtration Rate
HD	Haemodialysis
HRQOL	Health-Related Quality of Life
IPAQ	International Physical Activity Questionnaire
KDGIO	Kidney Disease Improving Global Outcomes
KDQOL	Kidney Disease and Quality of Life
MVPA	Moderate to vigorous Activity
PA	Physical Activity
PD	Peritoneal Dialysis
RRT	Renal Replacement Therapy
WHO	World Health Organization

1 Background

Patients in advanced stages of chronic kidney disease (CKD), especially patients treated with dialysis, have reduced physical capacity. The causes are complex. A high share of patients in chronic dialysis have comprehensive comorbidity, often cardiovascular disease, diabetes mellitus and frequent infections (1). Many patients on dialysis are prescribed and use numerous drugs, making them susceptible for side effects that may impair quality of life. CKD includes retention of uraemic toxins that affect other organs (cardiovascular system, bone marrow, endocrine organs, cognitive functions) and the disease is also associated with subjective symptoms such as nausea, impaired quality of sleep, depression and reduced general well-being (2, 3). Finally, dialysis treatment itself is associated with several adverse effects and a high risk of complications. Moreover, the treatment is time consuming and exhausting for patients over time. Patients undergoing treatment with dialysis have reduced exercise tolerance compared with age-matched sedentary controls (4). There are also indications that patients undergoing dialysis have difficulties being physically active, and therefore may often have a sedentary lifestyle. The reasons behind the low amount of physical activity (PA) is not fully known, but the above-mentioned factors may contribute to a low activity lifestyle.

1.1 Definition of chronic kidney disease (CKD) and end-stage renal disease (ESRD)

According to the Kidney Disease: Improving Global Outcomes (KDIGO, 2012) CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health (5). The period of three months is set to distinguish between acute kidney diseases and CKD. CKD is diagnosed if one or more of the following criteria are present >3 months; markers of kidney damage and/or decreased glomerular filtration rate (GFR). Albuminuria is often used as marker of kidney damage, being an indicator of increased glomerular permeability and/or dysfunction of proximal tubular reabsorption. KDGIO guidelines recommend CKD classified into stages based on measurements of GFR and albuminuria (5). By applying categories of GFR, CKD can be staged from category G1 (normal/high, i.e. GFR

>90 ml/min/1.73 m^2) to G5 (GFR <15 ml/min/1.73 m^2, or kidney failure)(5). End-stage renal disease (ESRD) is generally acknowledged as kidney failure treated with renal replacement therapy (RRT) (1).

1.2 Treatment of ESRD

ESRD is generally treated with dialysis or renal transplantation, both included in the term RRT (6). Kidney transplantation has been shown to be the most desired and cost-effective treatment for suitable patients with ESRD (7). Dialysis is divided in peritoneal dialysis (PD) and haemodialysis (HD).

1.2.1 Peritoneal dialysis (PD)

The principles of PD are based on the use of the peritoneal membrane as the dialyzing surface. Waste and excess fluids are removed from the vascular system, through the peritoneal capillary blood, into the dialysis solution instilled in the peritoneal cavity through a catheter(8). The dialysis solution contains an osmotic agent, usually glucose, creating the osmotic gradient that moves fluid from the capillaries to the peritoneal cavity, while solute removal is the result of diffusion and convective transport over the membrane (6). Most PD patients use one form of continuous dialysis, implying that the dialysis solution is always present in the peritoneal cavity except during the out- and in-flow of the fluid. In continuous ambulatory PD (CAPD) the solution is exchanged 4-5 times a day, usually by the patient, whereas a machine takes care of fluid exchanges in automatic PD (APD), mainly during the night. Thus, PD is the most common modality of home dialysis. Most patients carry out the treatment themselves, whereas other patients need additional help from homecare personnel (assisted PD). Treatment with PD allows patients to participate in normal daily activities between the exchanges of the peritoneal fluid.

1.2.2 Haemodialysis (HD)

Haemodialysis is an extracorporeal treatment based on a dialyzer with a semipermeable membrane. HD requires a vascular access, either an arteriovenous (AV-)fistula or a central venous catheter (CVC), to allow blood to be transported from the patient through the dialyzer, where the exchange of uremic toxins, fluids and electrolytes is performed (8). The

principle of HD involves diffusion and convection of solutes across the dialyser membrane. Diffusion refers to the movement of solutes from higher concentrations in the blood to the lower concentrations in the dialysate fluid, whereas convection is the mass transport of fluid and solutes driven by a higher hydrostatic pressure in the blood compartment, generated by the blood pump of the dialysis machine (8). The treatment usually takes place 2-5 times per week at a hospital centre or in a dialysis satellite unit in sessions of 3-5 hours (9). HD requires patients to travel to treatment and use a considerable amount of time during each session, which is demanding for the patient. However, home HD treatment is also available for adherent and motivated patients.

1.2.3 Kidney transplantation

Kidney transplantation is associated with better observed mortality and morbidity rates, quality of life and participation in activities than dialysis (7, 9, 10) and therefore is the preferred RRT in patients with ESRD. Due to the high prevalence of comorbidity in ESRD, as well as to the need for life-long therapy with immunosuppressive drugs, all patients considered for kidney transplantation must go through a thorough evaluation to rule out malignant diseases, chronic infections and extensive cardiovascular disease that must be treated before transplantation, or that may rule out transplantation as a treatment of choice. Also, non-adherent patients are not eligible for transplantation. We should aim for early referral of patients who need kidney transplantation, and who do not have known contraindications, to an evaluation program to assess if they are suitable for the treatment. In kidney transplantation, the source of the graft may be either a living donor, which is preferred due to an even better prognosis, or a deceased donor (11). In Norway the waiting list for organs is relatively short, indicating that most patient eligible for transplantation eventually are transplanted within 1-2 years (12). Thus, in Norway patients on long term dialysis in general are older and have more comorbidity than patients on the waiting list for transplantation.

1.3 Physical activity and kidney disease

The positive effects of PA in the general population is well documented. The World Health Organisation (WHO) concludes that participation in regular PA has been shown to reduce

the risk of coronary heart disease and stroke, diabetes, hypertension, colon cancer, breast cancer and depression in the general population (13). Studies have also shown that PA is positively correlated with psychological wellbeing, weight control, building and maintenance of healthy bones, muscles and joints (14). Regardless of the positive effects of PA, some data show that 31-32% of the world's adult population do not meet the minimum recommendations for PA (15, 16). Current recommendations suggest moderate PA for 150 minutes a week or 75 minutes' vigorous PA during a week in bouts of minimum 10 minutes, or an equivalent of moderate-to-vigorous intensity activity. For example, 30 minutes of moderate-to-vigorous physical activity (MVPA) 5 times a week is sufficient for people between 18-64 years old (13). This also applies to people over 65 years old.

1.3.1 Existing knowledge and knowledge gaps regarding physical activity in ESRD.

Even if some observational studies have shown that the level of PA among patients on dialysis is low, results from observational studies (17-19) and small intervention studies have demonstrated that increased physical exercise in this patient group is associated with better outcome(20, 21), in terms of proxy measures as arterial stiffness and health-related quality of life (HRQOL). One systematic review has shown that aerobic exercise made an improvement in physical fitness, muscular strength and quality of life in ESRD patients (21). In 2017 a retrospective cohort study concluded that high levels of PA was associated with favourable results in HRQoL scale scores, including frailty, disability and exhaustion (18). Therefore, some do think that patients on dialysis should be recommended the same amount of PA as people > 65 years (22).

To counsel the patients and to implement targeted intervention more knowledge about the type and quantity of PA applied by patients in this group is necessary. Most of the published observational studies on quantification of PA have used questionnaires. Today we know only of two small studies in which activity monitors were used to assess the type and amount of PA in patients in HD treatment (23, 24). We do not know of equivalent studies on patients in PD treatment, and therefore we do not have data that compare the two groups of patients. As far as we know, no activity measurements within patients in ESRD in HD or PD treatment has ever been carried out in Scandinavia.

1.3.2 Methods to assess physical activity

1.3.2.1 Questionnaires

The use of questionnaires in studies regarding PA and health-related quality of life are broad. Many earlier studies have used standardised questionnaires due to their easy-to-use properties, economically favourable and acceptably validated qualities. Scoring manuals allow the results to be compared to other studies. Well renowned questionnaires do have weaknesses because information is self-reported from the patients, and therefore allow subjective interpretations of questions, communication barriers, and overestimating/underestimating to happen. Overestimating PA, especially in moderate intensity, are shown in different countries (24). There are also studies that show a weak relationship between self-reported PA in questionnaires and objectively measured PA with heart rate monitor and movement sensor (24). Therefore, self-reported data should be interpreted with caution.

1.3.2.2 IPAQ

IPAQ is a questionnaire designed to classify individuals in activity categories related to current recommendations for PA (16). The questionnaire is validated in 12 countries, mainly in populations between 18-65 years old in diverse settings, with acceptable measurement properties (25). The short form consists of seven questions about PA during the last seven days, with questions about amount of activity and intensity, walking and time spent sitting. IPAQ short form has been tested and used in many international studies (26). The IPAQ short form has previously been used to assess PA in patients with CKD not requiring dialysis and in patients with CKD undergoing haemodialysis (27, 28).

1.3.2.3 KDQOL-SF 1.3

KDQOL-SF is a self-reporting instrument to assess particular concerns of people with kidney disease and dialysis (23). The Norwegian translated questionnaire has thirty-three questions related to the kidney disease, including symptoms, effect of kidney disease on daily life, burden of kidney disease, work status, cognitive function, sexual function, sleep, social support, dialysis staff encouragement and patient satisfaction (29, 30).

KDQOL-SF have been used in international studies of HRQOL in ESRD patients (30), and the reliability of the Danish version has been tested in Denmark with the same internal consistency as the original U.S English version (31).

1.3.3 Accelerometers

Accelerometers are useful in collecting body movement objectively and may so contribute with information about total amount, intensity, duration and frequency of PA (32). Thus, the use of accelerometers has lately become more regular in epidemiologic and clinical studies. Accelerometers are motion sensors that measure movement accelerations in one or more directions to calculate movement in the subject wearing them. Today, we often use electronic uniaxial (usually vertical plane) and triaxial accelerometers (anteroposterior, mediolateral and vertical directions). The electronic motion sensors consist of piezo-resistive or piezo-electric sensors. Piezo-resistive accelerometers require an external power source due to registration of accelerations by change in resistance of silicon resistors, which is then transformed to a voltage proportional to the amplitude and frequency of the acceleration. This will also allow them to respond to constant acceleration such as gravity (33). Piezo-electric accelerometer will not respond to constant gravity as they generate an electric charge in response to a mechanical force. However, they will not be dependent on an external power supply to operate (33). Some accelerometers have additional features such as the ability to measure heart rate, lighting, body temperature etc.

2 Beneficial value of the study

It is presumed that the level of PA of patients in dialysis is significantly lower than recommended. Some studies have shown favourable effects of a higher PA level in this group of patients. However, we know little about the actual activity level of dialysis patients in general, and in Northern Norway in particular, which we want to assess in this study. We believe this is essential and basic knowledge to better implement targeted and effective measures to increase the amount PA and therefore increase quality of life while reducing morbidity in this patient group. Therefore, we claim our project has an obvious beneficial value.

3 Hypotheses and aims of the study

3.1 Hypotheses

Our hypothesis is that the general level of activity in dialysis patients, assessed using an accelerometer, is low; lower than the general population within the same age group. We also hypothesise that patients in PD have a higher level of activity compared to patients in HD. Finally, we believe that the degree of comorbidity has a negative influence on the amount of PA exercised in this group of patients.

3.2 Aims of the study

In the present project, we aimed to:

- examine if registration with the accelerometer is a suitable method for studying PA in dialysis patients.
- study the degree of PA of patients in HD and PD in Nordland, Troms and Finnmark.
- To map out biological factors that are associated with the amount of PA in dialysis patients.
- To study potential factors that limit the amount of PA carried out by patients in HD and PD.

4 Material and methods

4.1 Ethics

This is an observational study where PA was measured through an unharmful and painless method. Participation in the study was based on written informed consent from all patients included. The Data Protector Officer of involved institutions have approved the protocol.

The Regional Committee for Medical and Health Research Ethics has evaluated the protocol and concluded that the Health Research Act does not apply due to the scope and design of the project. Therefore, their approval was not necessary.

4.2 Study population

The study is an observational pilot study aimed to measure PA objectively, and to collect information about the quality of life in prevalent dialysis patients treated with either HD or PD in Northern Norway. Northern Norway consists of three counties (Finnmark, Troms and Nordland), cover an area of 112 973 square kilometres and have 486 001 inhabitants (01.01.2018) (34). There are four hospital trusts (Finnmarkssykehuset, Universitetssykehuset Nord-Norge (UNN), Nordlandssykehuset, Helgelandssykehuset) in Helse Nord's regional health authority. The two main hospital dialysis centres are in Bodø and Tromsø, for HD and PD. These centres initiate HD-treatment and PD-treatment in Northern Norway. Specialists in nephrology are also located in Sandnessjøen (Helgelandssykehuset), Kirkenes (Finnmarkssykehuset) and Harstad (UNN). Furthermore 15 dialysis satellite units, situated in local hospitals as well as in primary care centres, contribute with HD (35).

Patients in HD treatment were invited to participate when they arrived at their treatment centre, either by a project partner or collaborating doctor or nurse. Patients established in PD were invited to participate during a regular visit to the hospital, or per letter or telephone by a project collaborator/partner. All eligible participants interested in the project received written information. Project partners made sure the written information was understood, and we obtained a written consent from all included patients. Participants gave their consent to the collection of data mentioned below, and to project partners to access their patient records to collect relevant background information, and to the collection of follow-up data in a potential follow-up-project relevant for this study.

4.2.1 Inclusion and exclusion criteria

All patients >18 years old, able to give their written consent and who had been on treatment with HD or PD > 3months and received follow-up by a nephrologist in Nordland, Troms or Finnmark were eligible for the study.

Exclusion criteria were;

- Non-cooperative patients

- Admittance to hospital during the last 4 weeks due to acute illness (patients may be included in the study 4 weeks after discharge from the hospital)
- Patients considered by a nephrologist as not suitable due to a high load of physical and/or mental comorbidity
- Patients unable to walk

4.3 Health-related quality of life and physical activity questionnaires

Immediately after the receipt of their written consent, each patient was given a self-administered questionnaire. The questionnaire was composed with the use of questions from the following validated questionnaires; KDQOL-SF^{TM} 1.3 (Norwegian short form) (29) and IPAQ (Norwegian short form) (16).

Data from KDQOL SF-questions were scored from 0-100, where a higher score reflects a better quality of life, in following domains; physical functioning, role limitations due to physical health problems, role limitations due to emotional health problems, emotional well-being and energy/fatigue.

Data from IPAQ questions were summarized to quantify self-reported PA into three levels; High (equivalent to ≥ 1-hour moderate/vigorous activity daily), moderate (equivalent to half an hour of ≥ moderate/vigorous intensity PA on most days) and low (not meeting any of the criteria of moderate or high levels of PA). In addition, we composed questions to study what the patient acknowledges as barriers towards participating in more PA. These questions were scored in four categories (“no barrier”, “low barrier”, “moderate barrier”, “high barrier”) to give an indication of the challenges our patients must face. The questionnaire used in the study is included in the appendix (Appendix 1).

4.4 Objective assessment of physical activity

Objective measurements of PA were collected with ActiGraph GT3X accelerometer, which is among the best validated devices (32, 36) and has recently been used in The Tromsø Study 2015-2016. The ActiGraph GT3X is a piezo-electric device that is small (4.6 x 3.3 x 1.5 cm), weighing 19 grams and use sample rate 30-100Hz. The battery life is up to 25 days. During

the study, the subjects placed the ActiGraph on their right hip with 100Hz sampling rate for 8 days with a recording time of 7 full calendar days.

We used the ActiLife v6.13.3 software to extract data from ActiGraph monitors. Data were extracted into 10 seconds EPOCH. EPOCH are essentially raw data that have been filtered and summed up into chunks of data. The raw data can then be viewed in time-defined chunks of 10, 15, 30 or 60 seconds, and so on. Dividing raw data into EPOCH data is necessary to use algorithms to produce outputs. Wear-time validation was performed using the Choi 2011 algorithm; 1) zero-count threshold during a non-wear time interval, 2) 90-min time window for consecutive zero/nonzero counts, and 3) allowance of 2-min interval of nonzero counts with the up/downstream 30-min consecutive zero counts window for detection of artifactual movements (37). Sedentary bouts were defined from a minimum length of 10 minutes, with minimum count value 0 and maximum count value 99 in the ActiGraph. Average time per sedentary bouts during a period is given in minutes. Freedson Adult VM3 algorithm uses all three of ActiGraph's axes to calculate motion and was used to calculate minutes of light activity (< 2690 counts per minute), moderate to vigorous activity (MVPA ≥ 2691 counts per minute). Light activity and MVPA are also measured in percent of total time. ActiGraph measured the daily number of steps, and we classified subjects into three categories based on average daily step count: sedentary (< 5000 steps/day), somewhat active (5000-7499 steps/day), or active (≥ 7500 steps/day) (38).

4.5 Data collection

We collected the following data from patient records:

- Demographical data (age, gender, marital status)
- Type and duration of RRT
- Travel distance and time spent for travelling to dialysis centre/nephrologist
- Comorbidity (Carlson's comorbidity index)
- Current drug use
- Smoking (never smoked, previous smoker, current smoker; pack years)
- Height and dry weight at inclusion

- Laboratory test (blood samples measured in timeframe +/- 4 weeks from inclusion): Haemoglobin, leucocyte count, albumin, ionised calcium, phosphate, parathyroid hormone, bicarbonate, creatinine, carbamide, HbA1c, cholesterol. For patients on HD, we used predialytic values.

4.6 Statistical Analysis

Statistical analyses were performed using SPSS version 25 for Windows. Frequencies and percentages were calculated using descriptive statistics. Data are given in median (interquartile range). To show comparison between groups, the nonparametric independent samples test Mann-Whitney U test was used. Chi-Square test was used for between-group comparisons of dichotomous variables, and these are expressed in percentages. Univariate correlation was performed for the variables; age, body mass index (BMI), diabetes, number of drugs, haemoglobin, albumin and creatinine, and *r* values are listed with Spearman correlation coefficient. Logistic regression analysis was used to check for predictors for higher activity. The following predictors were included in models: age, BMI, diabetes, number of drugs, haemoglobin, albumin and creatinine. The level of significance was set at $P < 0,05$.

4.6.1 Power calculation

We recognise this pilot project as a descriptive survey of PA of dialysis patients in Northern Norway Regional Health Authority. PA measurement has never previously been accomplished using this method in a comparable cohort. Therefore, precise power calculations cannot be done. Study of factors associated with the amount of activity are secondary objectives. At the time of inclusion, the total number of patients in HD summarised to 134, whereas 42 patients were on PD in the region.

5 Results

5.1 Study population

The selection of participating patients is shown in Figure 1. Of 42 patients on PD and 139 HD patients, 74 were not invited to participate in the study, for various logistic reasons, or because they fulfilled one or more of the exclusion criteria. A total of 37 patients consented to participate in the study, but seven were excluded due to dialysis vintage < 3 months (n=1), acute illness (n=3) or withdrawal of consent to participation (n=3), resulting in a total of 30 patients in the study. Twenty-eight percent of all asked patients participated in the study and were analysed.

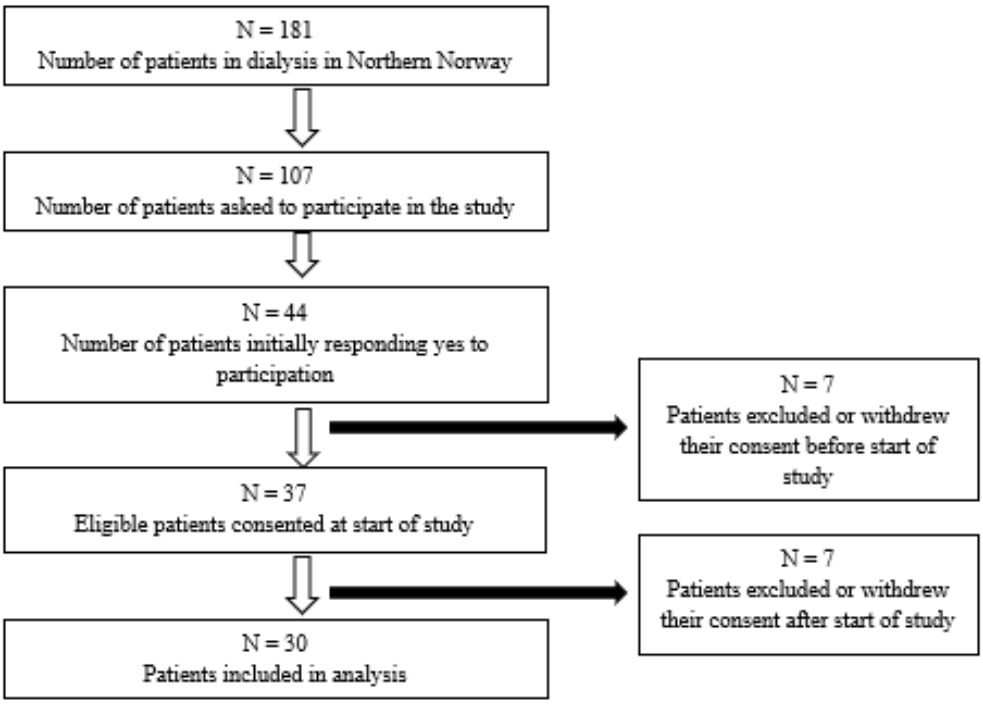

Figure 1: Flowchart of patients included in study.

The characteristics of the HD patients and PD patients in the study are shown in Table 1. Median age, gender distribution, marital status, percentage of transplantation candidates, number of medications, comorbidities, BMI and laboratory data were all similar between the HD-patients and PD-patients. The distance to dialysis centre in kilometres was significantly higher in the PD-patients group ($P < 0,05$).

Table 1: Characteristics of haemodialysis (HD) patients and peritoneal dialysis (PD) patients.

Characteristics	HD patients (n=22)	PD patients (n=8)	*P*
Age (years)	69 (55,5-78,5)	64 (61,3-76)	0,945
Male (%)	15 (68,2%)	5 (62,5%)	0,77
Marital status			0,43
Single	2 (9,1%)	1 (12,5%)	
Widowed or divorced	4 (18,2%)	0 (0%)	
Married/domestic relationship	16 (72,7%)	7 (87,5%)	
Duration of treatment (months) [1]	25 (13-43,5)[1]	16,5 (6,3-27,8)	0,168
Transplantation candidate – yes (%)	13 (59,1%)	6 (75%)	0,424
Number of drugs	12,5 (10-17,3)	13 (11,5-15)	0,621
Distance to dialysis centre (km) [9]	16 (6-65) [7]	255 (75,9-362,5) [2]	0,01
Comorbidities			
Diabetes - yes (%)	9 (40,9%)	1 (12,5%)	0,144
Heart attack - yes (%)[1]	3 (13,6%)[1]	1 (12,5%)	0,901
Congestive heart failure - yes (%)	4 (18,2%)	0 (0%)	0,195
COPD - yes (%)[1]	3 (13,6%)[1]	0 (0%)	0,259
Ulcus ventriculi/duodeni - yes (%)	4 (18,2%)	1 (12,5%)	0,712
BMI (kg/m^2)	25,9 (23,1-30,4)	29,2 (25-30,1)	0,534
Laboratory			
Haemoglobin (g/dL)[1]	10,9 (10-11,8)	11,5 (10,3-13,9)[1]	0,328
Leucocytes (x 10^9/mL)[1]	5,8 (4,9-6,6)	6,5 (5,4-10)[1]	0,211
Albumin (g/L)[1]	41 (39-42,1)	40 (38-41,5)[1]	0,258
Ionized Calcium (mmol/L)[2]	1,2 (1,08-1,21)[1]	1,2 (1,08-1,28)[1]	0,376
Phosphate (mmol/L)[2]	1,6 (1,4-2,3)	1,7 (1,35-2,15) [2]	0,806
PTH (pmol/L) [2]	42,6 (27,3-66,5)	28,1 (14,9-71,8) [2]	0,401
Creatinine (µmol/L) [1]	711 (571,5-867,8)	651 (440-712) [1]	0,271
Carbamide (mmol/L) [1]	20 (15,4-22,6)	20,1 (18,5-22) [1]	0,784
HbA1c (mmol/mol) [5]	37,0 (29,3-59,3) [2]	36,0 (33,5-39,5) [3]	0,683
Cholesterol (mmol/L) [8]	3,7 (2,9-4,2) [3]	3,8 (3,1-.)[5]	0,415

Data are shown in median (interquartile range) and number (percent). Numbers in [xx] indicates missing cases.

5.2 Physical activity

5.2.1 Self-reported recordings

Table 2 shows the results for self-reported PA and HRQOL for both patient groups. There were no significant differences between the groups in self-reported PA or SF-questionnaire domains. For role limitations due to physical health, between-group difference reached borderline significance (p=0,053) No patients performed vigorous training during the last week, and no patients were scored in the high physical category by IPAQ.

Table 2: Self-reported physical activity (PA) of HD patients and PD patients.

Physical activity	HD patients (n=22)	PD patients (n= 8)	*P*
IPAQ PA categories			0,820
- Low	15 (68,2%)	7 (87,5%)	
- Moderate	1 (4,5%)	0	
- High	0	0	
- Missing	6 (27,3%)	1 (12,5%)	
Days during last week with vigorous activity?			0, 896
- None	17 (77%)	6 (75%)	
- 1 or more days	0	0	
- Missing	5 (23%)	2 (25%)	
Days during the last week with moderate activity?			0,86
- None	13 (59,1%)	5 (62,5%)	
- 2 days	1 (4,5%)		
- 4 days	1 (4,5)		
- 5 days	1 (4,5)		
- Missing	6 (27,3%)	3 (37,5%)	
Days during the last week with 10 minutes walking?			0,455
- None	7 (31,8%)	4 (50%)	
- 1 day	2 (9,1%)		
- 2 days	2 (9,1%)		
- 3 days	3 (13,6%)		
- 4 days	1 (4,5%)		
- 5 days	1 (4,5%)	1 (12,5%)	
- 7 days	1 (4,5%)	1 (12,5%)	
- Missing	6 (27,3%)	2 (25,0%)	
Time spent sedentary during a normal day?			0,527
- No of patients responding in minutes	8 (36,4%)	5 (62,5%)	
- How many minutes?	420 (435)	300 (150)	0,222
- Do not remember	8 (36,4%)	2 (25%)	
- Missing	6 (27,3%)	1 (12,5%)	
KDQOL-SFTM 1.3 domains (0-100)			
Physical functioning	50 (42,5-67,5) [17]	65 (22,5-92,5) [6]	0,516
Physical role functioning	0 (0-12,5) [17]	75 (0-100) [7]	0,053
Emotional wellbeing	80 (73-84) [16]	86 (58-97) [6]	0,590
Emotional role functioning	41,7 (16,7-66,7) [16]	66,7 (0-66,7) [7]	0,734
Energy/fatigue	37,5 (30-50) [16]	47,5 (11,2-70) [6]	0,590

Data are shown in median (interquartile range) and number (percent). Numbers in [xx] indicates valid cases.

5.2.2 Accelerometer recordings

All participants wore their accelerometer during the study. Range for wear time: 5h 9min to 7 days). Median wear time for ActiGraph accelerometer was significantly higher ($P < 0,05$) in the HD group compared to PD (Table 3). In total, participants contributed with ActiGraph recordings spread out over a total of 206 days, 137 in the HD group and 39 in the PD group, with a total wear time of 176 full days. There were no further significant differences in the ActiGraph measurements between the HD and the PD patients. Total MVPA time and MVPA as percent of wear time were not significantly different between the two groups. Time in light activity have the lowest non-significant P-value ($P = 0,070$). In total, 7 out of the 22 HD patients (31,8%) 5 out of 8 PD patients (62,5%) reached the recommended goal of ≥ 150 minutes MVPA a week during the study.

Table 3: ActiGraph registered wear time and physical activity (PA).

ActiGraph	HD patients (n = 22)	PD patients (n = 8)	*P*
Wear Time Accelerometer (min)	9194,5 (8501-9733)	7509 (6400-9134)	0,024
Daily Average of Sedentary Bouts (min)	676,2 (565,1-770,4)	680,1 (631,3-788,9)	0,475
Daily Average of Sedentary Breaks (min)	742,4 (653,2-837,2)	710,3 (641-787,5)	0,344
Time in light activity (min)	8596,4 (7285-9185,3)	9145,3 (8709,2-9918,3)	0,070
- Percent in light activity	98,8% (2,2%)	98,4% (1,6%)	0,945
Time in MVPA total (min)	98,9 (37,6-203,5)	157,7 (51,4-197,2)	0,534
- Percent in MVPA	1,2% (2,2%)	1,6% (1,6%)	0,945
- Subjects with ≥ 150 min MVPA weekly	7 (31,8%)	5 (62,5%)	0,129
Average MVPA per Day (min)	13,3 (5,4-29,1)	22,5 (8,1-28,2)	0,504
Average Steps per Day	1972,5 (1160,3-3673)	2687,3 (1265-3798)	0,730

Data are shown in median (interquartile range) and number (percent). Abbreviations: MVPA – Moderate to vigorous activity

Figure 2 shows that only one patient who was treated with dialysis had an active lifestyle in terms of average steps daily (≥ 7500), three patients classified to somewhat active (5000-7499 steps/day), whereas 26 were categorised as sedentary. In total, >7500 steps per days ("active") were recorded for 10 days, 5000-7500 steps ("somewhat active") for 22 days, whereas number of steps per day were classified as sedentary for 174 of the 206 accelerometer recording days.

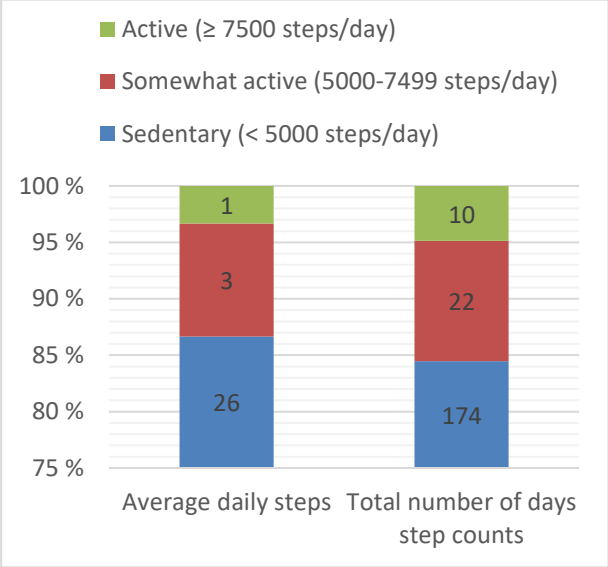

Figure 2: Frequency of patients with average daily steps and total number of days with step counts qualified to categories.

5.2.3 Correlation coefficients

In Table 4 , Spearman correlation coefficients between covariates believed to affect physical condition and average steps per day, as well as average daily MVPA, are shown. There were no significant correlations. However, there is a borderline non-significant negative correlation between haemoglobin and the dichotomous variable of daily average of MVPA above median (r = -0,359, P = 0,56).

Table 4: Correlations

Variable	*r – steps per day above median.*	*P*	*r – daily MVPA above median.*	*P*
Age *years*	- 0,320	0,085	- 0,359	0,052
BMI *kg/m²*	0,062	0,746	0,100	0,598
Diabetes *yes*	- 0,283	0,130	- 0,236	0,209
No drugs	- 0,101	0,597	- 0,167	0,379
Haemoglobin *g/dL*	- 0,276	0,147	- 0,359	0,056
Albumin *g/L*	- 0,091	0,639	0,021	0,915
Creatinine *µmol/L*	- 0,058	0,766	-0,049	0,799

Univariate correlations (r=Spearman's rho) of baseline variables with the dichotomous variables average steps per day above median and average daily moderate to vigorous activity (MVPA) above median combined for HD and PD patients.

In a multivariable logistic regression analysis, haemoglobin was significantly associated with the dichotomous variable average daily MVPA at or above vs. below median (OR 0,39 (95% CI 0,15-0,99) per 1 g/dL increase; p = 0,047). None of the other variables in the model (age, BMI, diabetes, number of drugs, albumin, creatinine) were significantly associated with any of the two outcome variables.

5.2.4 Knowledge about barriers against physical activity

Figure 3 shows that 16 patients reported that they had not been informed by their nephrologist about the importance of PA (13 patients did not respond to the question). Nineteen patients claimed that they wanted to be more physically active than they were at the time of registration, whereas three stated that they did not wish they were more active (two patients responded "do not know"; six did not respond).

Figure 3: Information about physical activity and number of patients wanting to be more active.

Figure 4 shows that complications from comorbidities was the barrier/obstacle 12 patients considered to be moderate/high. Time used on dialysis treatment, complications from dialysis treatment and complications from their kidney disease were the next on the list.

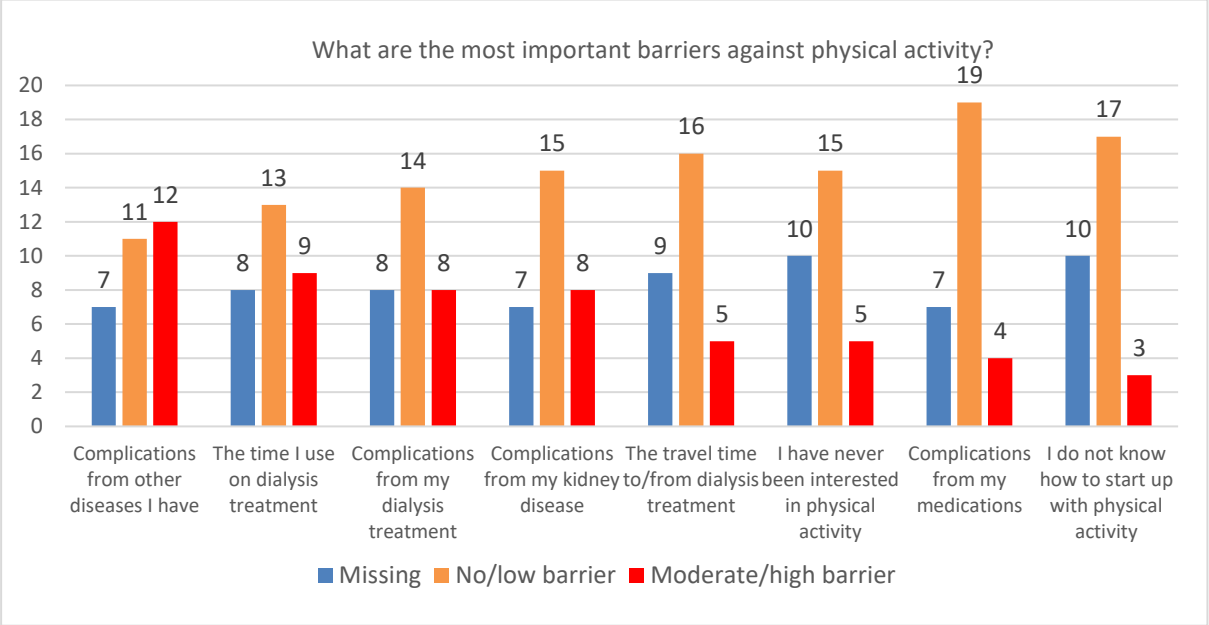

Figure 4 Survey of barriers related to amount of physical activity.

6 Discussion

In the present study we assessed PA and HRQOL among patients in HD and PD dialysis. We measured PA with a questionnaire and an accelerometer worn during a week, and according to our knowledge, this has never been done previously in HD and PD patients simultaneously.

6.1 Physical activity in dialysis patients and differences in HD and PD

The results of this study did not show any significant differences between HD and PD patients in the amount of self-reported and objectively measured PA. For HRQOL scores only role limitations due to physical health were significantly higher among PD patients compared to patients in HD. This may indicate that our group of HD patients have more severe physical health obstacles to overcome in terms of filling their role in everyday life. PD patients may experience fewer health problems that interfere with them doing what is expected from others or themselves. However, this is only one domain in the SF-questionnaire, and we found no significant differences between the groups in other domains. Moreover, self-reported, subjective data should be interpreted with caution. Numerically, both the average daily MVPA and the average number of steps performed by PD patients exceeded the measurements done in patients on HD. However, the differences did not reach statistical

significance. The lack of between-group differences may be due to the low sample size and selection bias. The objective measurements, using an accelerometer, gives an indication that dialysis patients mostly perform light PA, and are more restrictive in moderate to vigorous PA This is an interesting finding, because 30 minutes MVPA a day 5 times a week or 150 minutes MVPA a week is the recommended amount of PA also in dialysis patients. Vigorous training may be too comprehensive to conduct for many patients in these groups, but a focus on moderate activity may be needed.

6.2 Selection of patients and other study limitations

Although the number of asked patients were 107, only 30 subjects participated in the study, 22 HD and 8 PD patients. This is a relatively small number of subjects, below the number we expected. There may be many reasons for that. First, the study was carried out in multiple centres, varying in size and staff. HD satellites are typically run by skilled dialysis nurses only, whereas in hospitals both nephrologists, nephrology trainees and dialysis nurses are directly involved in patient treatment. All the centres were informed orally and by written material about the aims and scope of the project. However, the actual project period was short, and limited spare time in a busy clinical setting, as well as the lack of at least one dedicated project collaborator at each site, probably affected patient information and recruitment. Also, PD patients in the region have a long distance to the dialysis centre, and therefore infrequent visits. Therefore, some eligible patients were not informed and invited to participate, or they were recruited too late. Furthermore, as one of the exclusion criteria was open to individual clinical judgement (“Patients considered by a nephrologist as not suitable due to a high load of physical and/or mental comorbidity”), it could not be ruled out that the various health workers (doctors and nurses, respectively) would influence the recruitment by evaluating this criterion differently.

Second, in the recruiting process there may have been a spread of negative mentality between patients in the same dialysis unit, and this may be a partial reason why a lower number of patients than expected joined our study. Third, some patients expressed that their main reason for rejecting study participation, was that revealing their low PA level made them feel uncomfortable. However, a low attendance rate is not uncommon in clinical

studies. Based on the baseline characteristics presented in Table 1, which is similar to the mean values provided in the Norwegian Renal Registry, we believe that our cohort was fairly representative for eligible patients (12). The characteristics of included HD and PD patients, respectively, were similar, except a significantly longer median distance to the nearest dialysis centre for PD patients. This was expected since some of patients are treated with PD are offered this treatment modality mainly due to a long distance to the dialysis centre.

6.3 Comparison of physical activity to other studies on dialysis patients

According to our knowledge, few other studies on dialysis patients have assessed PA using an accelerometer, and most are only conducted on HD patients. However, a study from Japan with 202 eligible HD patients wearing an uniaxial accelerometer for seven days showed a median (interquartile range) daily steps of 3925 (2287-6244)(39). This is a considerably higher number of steps compared to the findings in our study. In the Japanese study, median age of the included patients was 64 (57-72) and 52% were women. Our HD study population consisted mostly of men, and this may be a factor potentially explaining the difference in step counts. In terms of comorbidity, 38,6% of the subjects had diabetes mellitus, which is similar to our percentage.

A study conducted on 19 HD patients aged ≥ 18 and < 65 years with a triaxial accelerometer worn 12 hours daily for four days showed a mean ±SD of daily steps 5648 ± 2870 (40). This Brazilian study also showed a higher number of steps taken compared to our study. However, an important difference compared to our study was a lower mean age of the subjects (47,5 ± 12,5 years). Furthermore, the percentage of diabetes was considerably lower in the Brazilian study (10,5% of the subjects) compared to our study.

In another study from Brazil, ActiGraph GT3X was used to register PA in 79 HD patients for one full week. Whereas 22 patients (35,5%) in this study achieved ≥ 150 minutes MVPA per week (41). In our study, seven out of the 22 HD patients (31,8%) managed to get ≥ 150 minutes MVPA in total during the study. The methods are quite similar between the studies and this may indicate that MVPA registered in our study is representative for HD patients. However, because we do not have many studies to compare our results with, and since all

observational studies so far suffer from low numbers of participants, both differences and similarities should be interpreted with care. Moreover, differences in daily step count may be affected not only by exercise patterns, but also by logistic differences such as differences in availability of transportation etc.

6.4 Comparison of physical activity with other patient groups

This study focused on differences between HD and PD patients, and we did not have any control group. However, our results may be compared to historical data published in the literature. By comparing our data to measurements made in a general population, the impact from a serious chronic disease on PA may be illustrated. On the other hand, it is also of interest to compare the results from dialysis patients with similar measurements done in patients with other chronic conditions, such as heart failure.

An American study conducted in 2018 with accelerometer measurements of PA among 182 patients with heart failure, used the same device, ActiGraph GT3X, as we did for 7 full days of measurement, with a minimal wear time of 4 days in total and 10 hours daily to be included in the results (42) However, they applied the Freedson 1998 et al cut points, that uses the vertical axis of movement alone to calculate time in different activity categories, whereas we used Freedson Adult VM3 cut points with three axes in our study. Regardless of the methodological differences, it is interesting to compare groups in terms of average minutes daily of MVPA and steps. Participants in our study had median (interquartile range) average MVPA per day (min) 13.3 (5,4-29,1) patients in HD and 22.5 (8,1-28,2) patients in PD. However, mean SD average daily minutes of MVPA in patients with heart failure classified as New York Heart Association (NYHA) class I was 13.0 (9.4), 12.4 (11.9) in NYHA class II and only 6.4 (6.8) in NYHA class III and IV (42). Although our measurements are listed as medians, and the results in the heart failure study are given as means, we get the impression that time is spent on MVPA in HD and PD patients in Northern Norway is comparable to MVPA in this group of American heart failure patients with the least symptom load (NYHA class I). This was somewhat unexpected as patients on chronic dialysis are recognised as a group with a high burden of symptoms. However, there may be several reasons for this discrepancy. Cultural differences in PA habits in the population may play a

role, but the fact that our study included a smaller number of subjects than the heart failure study, and a selection bias towards healthier patients may be the most important factors. However, for indication purposes we think it is a suitable comparison.

6.5 Comparison of physical activity with healthy people

A study conducted in Norway, with focus on self-reported PA and objectively measured PA, i.e. data from The Tromsø Study, gives us a valid basis for comparison of our patient group to the general population with regards to average daily MVPA and steps. The objective PA data was collected with ActiGraph GT1M during 7 consecutive days with 15-second epochs and a minimum of 10-hour activity daily for at least 3 days to be included in the analysis. Women (n = 136) achieved mean daily average MVPA of 37,6 minutes, and men 36,8 minutes (43). Compared with our results, we saw a considerably higher amount of MVPA in the healthy cohort. This difference was expected. In terms of steps daily, women in the healthy cohort had a mean of 8727 steps daily and men 8109 (43). Comparison with the median steps in our study shows that there is a big difference between daily step count among dialysis patients and persons from the general population. This may indicate that dialysis patients have a potential to move more during the day.

6.6 Possible predictors of physical activity

In our aim to map out biological factors that may be associated with the amount of PA, we only found a borderline non-significant small negative correlation of -0,359 (*P* = 0,056) between haemoglobin and average MVPA. However, our study was small and not powered to assess predictors of PA, and therefore the results of this study should be interpreted with caution. However, whether biological factors are associated with PA is an important question that needs to be assessed in larger studies with less missing data.

6.7 Attitudes and barriers

Factors and barriers that limit PA were an interesting area of our survey. Our patients gave a clear indication that nephrologists working with them did not focus on the importance of PA. Only one patient reported that he/she had been informed about this from his/her nephrologist, and 16 had not. Although 13 of the 30 included patients did not respond to

this question, we believe that this is an area where nephrologists and other health professionals can – and should - improve. The fact that as many as 19 patients expressed a wish to become more active underlines the need for improvement in this area. Diseases other than kidney disease was the factor most frequently ranked by the participants as a moderate/high barrier to PA. This may indicate that many patients on chronic dialysis struggle with co-morbidities that are limiting in terms of exercising. Dialysis patient populations are complex and may need a broad approach to help them become more physically active. The results of our study can be used in a constructive way as a reminder to us that we are dealing with patients who want, but do not necessarily manage or know how to become more physical active. A combination of better information and motivation from health workers in contact with dialysis patients may contribute to a higher percentage of the patients understanding the benefits of PA and getting the right tools to start. Another suggestion is to offer activities specifically suited for patients on dialysis. We do clearly see from our study that patients want to be more active, so starting up training groups for dialysis patients may be an interesting interventional study in the future. In this regard, the long time spent on treatment as well as considerable travel distances to the dialysis unit may be challenging; these factors were also mentioned by a number of patients as a barrier to PA.

6.8 The use of accelerometer measurements in dialysis patients

We do believe that ActiGraph registration a suitable method for studying PA in dialysis patients. We did not receive negative feedback from the subjects wearing them, and the devices were considered user friendly with instructions that were easy to understand. Patients were instructed to wear the device for one week, and therefore median wear time in minutes HD 9194,5 (8501-9733) and PD 7509 (6400-9134), was satisfactory. Only one subject had a wear time <4 days, which is often seen as an exclusion criterion in other studies. The fact that registrations are poor for upper limb movements makes the ActiGraph devices less useful in patients with walking disabilities, such as patients who have had limb amputations. However, despite this limitation, we believe that ActiGraph is well suited to use in future studies on PA in this group.

7 Conclusion

Our main objective was to study the degree of PA of patients on HD and PD in Northern Norway, and, as far as we are aware of, an accelerometer was used for the first time to measure activity in both HD and PD patients. Study results indicate that dialysis patients have a low level of PA based on average daily MVPA and step count, compared to healthy persons. We found no significant differences between patients on the two different dialysis modalities, but small group sizes limit firm conclusions. A high haemoglobin level was associated with less daily MVPA. Most patients reported that they had never been informed by their nephrologist about the potential benefit of being physically active, but a desire to be more active was commonly found. Barriers to PA included comorbidities and time spent on treatment. We believe there is potential to raise awareness of PA in health workers being involved in dialysis treatment, and to increase PA levels in dialysis patents. We hope this study can be used as a catalysator for future observational and interventional studies on PA in patients on dialysis.

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References

1. Inker LA, Levey AS. 53 - Staging and Management of Chronic Kidney Disease A2 - Gilbert, Scott J. In: Weiner DE, editor. National Kidney Foundation Primer on Kidney Diseases (Sixth Edition). Philadelphia: W.B. Saunders; 2014. p. 458-66.
2. Kasper DL. Harrison's principles of internal medicine. 19th edition / editors, Dennis L. Kasper, MD, William Ellery Channing, Professor of Medicine, Professor of Microbiology, Department of Microbiology and Immunobiology, Harvard Medical School, Division of Infectious Diseases, Brigham and Women's Hospital, Boston, Massachusetts and five others . ed. New York: McGraw Hill Education; 2015. 1 volume (various pagings) p.
3. Chikotas N, Gunderman A, Oman T. Uremic syndrome and end-stage renal disease: Physical manifestations and beyond. Journal of the American Academy of Nurse Practitioners. 2006;18(5):195-202.
4. Johansen KL, Chertow GM, Ng AV, Mulligan K, Carey S, Schoenfeld PY, et al. Physical activity levels in patients on hemodialysis and healthy sedentary controls. Kidney Int. 2000;57(6):2564-70.
5. Chapter 1: Definition and classification of CKD. Kidney Int Suppl (2011). 2013;3(1):19-62.
6. Vardhan A, Hutchison AJ. 59 - Peritoneal Dialysis A2 - Gilbert, Scott J. In: Weiner DE, editor. National Kidney Foundation Primer on Kidney Diseases (Sixth Edition). Philadelphia: W.B. Saunders; 2014. p. 520-33.
7. Abecassis M, Bartlett ST, Collins AJ, Davis CL, Delmonico FL, Friedewald JJ, et al. Kidney Transplantation as Primary Therapy for End-Stage Renal Disease: A National Kidney Foundation/Kidney Disease Outcomes Quality Initiative (NKF/KDOQI™) Conference. Clinical Journal of the American Society of Nephrology : CJASN. 2008;3(2):471-80.
8. Hakim RM. 58 - Hemodialysis A2 - Gilbert, Scott J. In: Weiner DE, editor. National Kidney Foundation Primer on Kidney Diseases (Sixth Edition). Philadelphia: W.B. Saunders; 2014. p. 508-19.
9. Mehrotra R, Kalantar-Zadeh K. 60 - Outcomes of Kidney Replacement Therapies A2 - Gilbert, Scott J. In: Weiner DE, editor. National Kidney Foundation Primer on Kidney Diseases (Sixth Edition). Philadelphia: W.B. Saunders; 2014. p. 534-41.
10. Purnell TS, Auguste P, Crews DC, Lamprea-Montealegre J, Olufade T, Greer R, et al. Comparison of Life Participation Activities Among Adults Treated by Hemodialysis, Peritoneal Dialysis, and Kidney Transplantation: A Systematic Review. American journal of kidney diseases : the official journal of the National Kidney Foundation. 2013;62(5):10.1053/j.ajkd.2013.03.022.
11. Bunnapradist S, Danovitch GM. Evaluation of Adult Kidney Transplant Candidates. American Journal of Kidney Diseases. 2007;50(5):890-8.
12. Reisæter AV, Åsberg A. Annual report 2017 from The Norwegian Renal Registry. Oslo: The Norwegian ESRD and Transplant Registry 2017 31.12.2017.
13. Global Recommendations on Physical Activity for Health. Global Recommendations on Physical Activity for Health. WHO Guidelines Approved by the Guidelines Review Committee. Geneva2010.

14. Peterson DM. The benefits and risks of exercise. 2017 [cited November 12, 2017]. In: UpToDate [Internet]. Waltham, MA, [cited November 12, 2017]. Available from: http://www.uptodate.com.
15. Hallal PC, Andersen LB, Bull FC, Guthold R, Haskell W, Ekelund U, et al. Global physical activity levels: surveillance progress, pitfalls, and prospects. Lancet. 2012;380(9838):247-57.
16. Klepp K. Nasjonale landsrepresentative kartlegginger av fysisk aktivitet, fysisk form og tid i ro. Rapport fra arbeidsgruppen. Folkehelseinstituttet. 2017.
17. Aucella F, Valente GL, Catizone L. The Role of Physical Activity in the CKD Setting. Kidney and Blood Pressure Research. 2014;39(2-3):97-106.
18. Kang SH, Do JY, Jeong HY, Lee SY, Kim JC. The Clinical Significance of Physical Activity in Maintenance Dialysis Patients. Kidney and Blood Pressure Research. 2017;42(3):575-86.
19. Lopes AA, Lantz B, Morgenstern H, Wang M, Bieber BA, Gillespie BW, et al. Associations of self-reported physical activity types and levels with quality of life, depression symptoms, and mortality in hemodialysis patients: the DOPPS. Clin J Am Soc Nephrol. 2014;9(10):1702-12.
20. Mustata S, Groeneveld S, Davidson W, Ford G, Kiland K, Manns B. Effects of exercise training on physical impairment, arterial stiffness and health-related quality of life in patients with chronic kidney disease: a pilot study. Int Urol Nephrol. 2011;43(4):1133-41.
21. Barcellos FC, Santos IS, Umpierre D, Bohlke M, Hallal PC. Effects of exercise in the whole spectrum of chronic kidney disease: a systematic review. Clinical Kidney Journal. 2015;8(6):753-65.
22. Johansen KL. Exercise and dialysis. Hemodial Int. 2008;12(3):290-300.
23. Hays RD, Kallich JD, Mapes DL, Coons SJ, Carter WB. Development of the kidney disease quality of life (KDQOL) instrument. Qual Life Res. 1994;3(5):329-38.
24. Steene-Johannessen J, Anderssen SA, van der Ploeg HP, Hendriksen IJ, Donnelly AE, Brage S, et al. Are Self-report Measures Able to Define Individuals as Physically Active or Inactive? Med Sci Sports Exerc. 2016;48(2):235-44.
25. Craig CL, Marshall AL, Sjostrom M, Bauman AE, Booth ML, Ainsworth BE, et al. International physical activity questionnaire: 12-country reliability and validity. Med Sci Sports Exerc. 2003;35(8):1381-95.
26. Hagstromer M, Oja P, Sjostrom M. The International Physical Activity Questionnaire (IPAQ): A study of concurrent and construct validity2006. 755-62 p.
27. Nah R, Robertson N, Niyi-Odumosu FA, Clarke AL, Bishop NC, Smith AC. Relationships between illness representations, physical activity and depression in chronic kidney disease. J Ren Care. 2019.
28. Rosa CS, Gracia-Marco L, Barker AR, Freitas IF, Jr., Monteiro HL. Assessment of Physical Activity by Accelerometer and IPAQ-Short Version in Patients with Chronic Kidney Disease Undergoing Hemodialysis. Blood Purif. 2015;40(3):250-5.
29. Østhus TBH. Health-related quality of life in patients with end-stage renal disease receiving chronic dialysis treatment. A population based study. Series of dissertations submitted to the Faculty of Medicine, University of Oslo. 2012(1467).
30. Fukuhara S, Lopes AA, Bragg-Gresham JL, Kurokawa K, Mapes DL, Akizawa T, et al. Health-related quality of life among dialysis patients on three continents: The Dialysis Outcomes and Practice Patterns Study. Kidney International. 2003;64(5):1903-10.

31. Molsted S, Heaf J, Prescott L, Eidemak I. Reliability testing of the Danish version of the Kidney Disease Quality of Life Short Form. Scand J Urol Nephrol. 2005;39(6):498-502.
32. Plasqui G, Bonomi AG, Westerterp KR. Daily physical activity assessment with accelerometers: new insights and validation studies. Obesity Reviews. 2013;14(6):451-62.
33. Plasqui G, Westerterp KR. Physical Activity Assessment With Accelerometers: An Evaluation Against Doubly Labeled Water. Obesity. 2007;15(10):2371-9.
34. Thorsnæs G. Nord-Norge. Store Norske Leksikon [Internet]. 2019 10.04.2019 [cited 2019 10-04]. Available from: https://snl.no/Nord-Norge.
35. Brevik KE, B. O. Fagerheim, A. K. Mikkelsen, T. Skår, S. Stefansen, D. Tjeldnes, K. Åsvang, G. Julsrud, J. . Nyreerstattende behandling i Helse Nord2011 10.04.2019 [cited 2019 10.04.]. Available from: https://helse-nord.no/Documents/Fagplaner%20og%20rapporter/Fagplaner/Nyreerstattende%20behandling%20i%20Helse%20Nord.pdf.
36. John D, Freedson P. ActiGraph and Actical physical activity monitors: a peek under the hood. Med Sci Sports Exerc. 2012;44(1 Suppl 1):S86-9.
37. Choi L, Liu Z, Matthews CE, Buchowski MS. Validation of accelerometer wear and nonwear time classification algorithm. Medicine and science in sports and exercise. 2011;43(2):357-64.
38. Tudor-Locke C, Craig CL, Thyfault JP, Spence JC. A step-defined sedentary lifestyle index: <5000 steps/day. Applied Physiology, Nutrition, and Metabolism. 2012;38(2):100-14.
39. Matsuzawa R, Matsunaga A, Wang G, Kutsuna T, Ishii A, Abe Y, et al. Habitual Physical Activity Measured by Accelerometer and Survival in Maintenance Hemodialysis Patients. Clinical Journal of the American Society of Nephrology. 2012;7(12):2010-6.
40. Gomes EP, Reboredo MM, Carvalho EV, Teixeira DR, Carvalho LF, Filho GF, et al. Physical Activity in Hemodialysis Patients Measured by Triaxial Accelerometer. Biomed Res Int. 2015;2015:645645.
41. da Costa Rosa CS, Nishimoto DY, Freitas Junior IF, Ciolac EG, Monteiro HL. Factors Associated With Levels of Physical Activity in Chronic Kidney Disease Patients Undergoing Hemodialysis: The Role of Dialysis Versus Nondialysis Day. J Phys Act Health. 2017;14(9):726-32.
42. Pozehl BJ, McGuire R, Duncan K, Hertzog M, Deka P, Norman J, et al. Accelerometer-Measured Daily Activity Levels and Related Factors in Patients With Heart Failure. J Cardiovasc Nurs. 2018;33(4):329-35.
43. Emaus A, Degerstrøm J, Wilsgaard T, Hansen BH, Dieli-Conwright CM, Furberg A-S, et al. Does a variation in self-reported physical activity reflect variation in objectively measured physical activity, resting heart rate, and physical fitness? Results from the Tromsø study. Scandinavian Journal of Public Health. 2010;38(5_suppl):105-18.

Appendix

Appendix 1: Questionnaire

Spørreskjema til deltakerne i studien «Kartlegging av fysisk aktivitet hos dialysepasienter i Nord-Norge – en observasjonsstudie»

Dette spørreskjemaet handler om hvordan du ser på din egen helse, hvordan du vurderer din egen fysiske aktivitet og hvilke forhold som eventuelt hindrer deg fra å være mer aktiv. Sammen med aktivitetsmålingen vi gjør i denne studien, bidrar dine svar til å og oss mer kunnskap om sammenhengen mellom dialysebehandling og fysisk aktivitet hos personer som har langt kommet kronisk nyresykdom.

Du trenger ikke å svare på alle spørsmålene på én gang, men det er fint om du er ferdig med å fylle ut skjemaet før du skal levere ActiGraph tilbake.

Hvis du er i tvil om ordlyden i spørreskjemaet eller har andre spørsmål eller kommentarer, kan du kontakte dialyselegen eller –sykepleieren du vanligvis forholder deg til, så formidler de kontakt til prosjektmedarbeiderne.

Takk for at du svarer på spørsmålene!

Studie-ID:

……

Skjema mottatt

……..

Sted/dato **Prosjektmedarbeider**

1. Stort sett, vil du si at din helse er:

1 Utmerket ☐ **2** Meget god ☐ **3** God ☐ **4** Nokså god ☐ **5** Dårlig ☐

2. Sammenliknet med for ett år siden, hvordan vil du si at din helse stort sett er nå?

1 Mye bedre nå enn for ett år siden ☐ **2** Litt bedre nå enn for ett år siden ☐

3 Omtrent den samme som for ett år siden ☐ **4** Litt dårligere enn for ett år siden ☐

5 Mye dårligere enn for ett år siden ☐

3. De neste spørsmålene handler om aktiviteter du kanskje utfører i løpet av en vanlig dag.
Er din helse slik at den begrenser deg i utførelsen av disse aktivitetene nå? Hvis ja, hvor mye?

AKTIVITETER	Ja, begrenser meg mye	Ja, begrenser meg litt	Nei, begrenser meg ikke i det hele tatt
a. Anstrengende aktiviteter som å løpe, løfte tunge gjenstander, delta i anstrengende idrett	☐	☐	☐
b. Moderate aktiviteter som å flytte et bord, støvsuge, gå en tur eller drive med hagearbeid	☐	☐	☐
c. Løfte eller bære en handlekurv	☐	☐	☐
d. Gå opp trappen flere etasjer	☐	☐	☐
e. Gå opp trappen en etasje	☐	☐	☐
f. Bøye deg eller sitte på huk	☐	☐	☐
g. Gå mer enn to kilometer	☐	☐	☐
h. Gå noen hundre meter	☐	☐	☐
i. Gå hundre meter	☐	☐	☐
j. Vaske eller kle på deg	☐	☐	☐

4. I løpet av de siste 4 ukene, har du hatt noen av følgende symptomer i ditt arbeid eller i andre av dine daglige gjøremål på grunn av din fysiske helse?

	Ja	Nei
a. Du har måttet redusere tiden du har brukt på arbeid eller andre gjøremål	☐	☐
b. Du har **utrettet mindre** enn du har hadde ønsket	☐	☐
c. Du har **vært** hindret i å utføre **visse typer** arbeid eller gjøremål	☐	☐
d. Du har hatt **problemer** med å gjennomføre arbeid eller andre gjøremål (f.eks. fordi det krevde ekstraanstrengelser)	☐	☐

5. I løpet av de siste 4 ukene, har du hatt noen av følgende symptomer i ditt arbeid eller i andre av dine daglige gjøremål på grunn av følelsesmessige problemer (som f.eks. å være deprimert eller engstelig)?

	Ja	Nei
a. Du har måttet **redusere tiden** du har brukt på arbeid eller andre gjøremål	☐	☐
b. Du har **utrettet mindre** enn du har hadde ønsket	☐	☐
c. Du har hatt utført arbeid eller andre gjøremål mindre **grundig** enn vanlig	☐	☐

6. I løpet av de siste 4 ukene, i hvilken grad har din fysiske helse eller følelsesmessige problemer hatt innvirkning på din vanlige sosiale omgang med familie, venner, naboer eller foreninger?

Ikke i det hele tatt ☐ Litt ☐ En del ☐ Mye ☐

7. Hvor sterke kroppslige smerter har du hatt i løpet av de siste 4 ukene?

Ingen ☐ Meget svake ☐ Svake ☐ Moderate ☐ Sterke ☐ Meget sterke ☐

8. De neste spørsmålene handler om hvordan du har følt deg og hvordan du har hatt det de siste fire ukene. For hvert spørsmål vennligst velg det svaralternativ som best beskriver hvordan du har hatt det. Hvor ofte i løpet av de siste fire ukene har du:

	Hele tiden	Nesten hele tiden	Mye av tiden	En del av tiden	Litt av tiden	Ikke i det hele tatt
a. Følt deg full av tiltakslyst	☐	☐	☐	☐	☐	☐
b. Følt deg veldig nervøs	☐	☐	☐	☐	☐	☐
c. Vært så langt nede at ingenting kunne muntre deg opp	☐	☐	☐	☐	☐	☐
d. Følt deg rolig og harmonisk	☐	☐	☐	☐	☐	☐
e. Hatt mye overskudd	☐	☐	☐	☐	☐	☐
f. Følt deg nedfor og trist	☐	☐	☐	☐	☐	☐
g. Følt deg sliten	☐	☐	☐	☐	☐	☐
h. Følt deg glad	☐	☐	☐	☐	☐	☐
i. Følt deg trett	☐	☐	☐	☐	☐	☐

9. Hvor RIKTIG eller GALT er hver av de følgende påstandene for deg?

	Helt riktig	Delvis riktig	Vet ikke	Delvis galt	Helt galt
a. Min nyresykdom forstyrrer for mye i livet mitt	☐	☐	☐	☐	☐
b. Jeg bruker for mye av tiden min på nyresykdommen min	☐	☐	☐	☐	☐
c. Det er frustrerende å beskjeftige seg med nyresykdommen min	☐	☐	☐	☐	☐
d. Jeg føler meg som en belastning for min familie	☐	☐	☐	☐	☐

10. I løpet av de siste 4 uker, hvor mye har du vært plaget av følgende (Sett kryss i én boks på hver linje)

mye	Ikke plaget i det hele tatt	Litt plaget	Noe plaget	Mye plaget	Veldig plaget
a. Ømme muskler	☐	☐	☐	☐	☐
b. Brystsmerter	☐	☐	☐	☐	☐
c. Kramper	☐	☐	☐	☐	☐
d. Hudkløe	☐	☐	☐	☐	☐
e. Tørrhud	☐	☐	☐	☐	☐
f. Kortpustethet	☐	☐	☐	☐	☐
g. Svimmelhet eller nesten besvimelse	☐	☐	☐	☐	☐
h. Mangel på appetitt	☐	☐	☐	☐	☐
i. Utkjørt eller utbrent	☐	☐	☐	☐	☐
j. Nummenhet i hender og føtter	☐	☐	☐	☐	☐
k. Kvalme eller brekninger	☐	☐	☐	☐	☐

(Besvares kun av pasienter i hemodialyse):

l. Problemer med dialysetilgangen (fistel, graft, kateter)	☐	☐	☐	☐	☐

(Besvares kun av pasienter i peritoneal dialyse):

m. Problemer med kateterinngangen?	☐	☐	☐	☐	☐

11. Noen personer er plaget av nyresykdommen i det daglige liv, mens andre ikke er det. Hvor mye plaget er du av din nyresykdom innen hvert av de følgende områder? (Sett i én boks på hver linje)

	Ikke plaget i det hele tatt	Litt plaget	Noe plaget	Mye plaget	Veldig mye plaget
a. Begrensninger i hvor mye du kan drikke	☐	☐	☐	☐	☐
b. Kostrestriksjon	☐	☐	☐	☐	☐
c. Din evne til å klare arbeid i huset	☐	☐	☐	☐	☐
d. Din evne til å reise	☐	☐	☐	☐	☐
e. Din avhengighet av leger og annet helsepersonell	☐	☐	☐	☐	☐
f. Stress og bekymring forårsaket av din nyresykdom	☐	☐	☐	☐	☐

12. Hvor ofte de siste 4 uker har du... (Sett kryss i én boks på hver linje)

	Ikke i det hele tatt	Litt av tiden	En del av tiden	Mye av tiden	Nesten hele tiden	Hele tiden
a. Våknet om natten og hatt problemer med å sovne igjen	☐	☐	☐	☐	☐	☐
b. Fått den mengden søvn som du trenger	☐	☐	☐	☐	☐	☐
c. Hatt problemer med å holde deg våken om dagen	☐	☐	☐	☐	☐	☐

13. a. Hvor mange dager i løpet av den siste uka har du drevet med meget anstrengende fysiske aktiviteter som tunge løft, gravearbeid, aerobics eller sykle fort? Tenk bare på aktiviteter som varer minst 10 minutter i strekk

☐ dager per uke
☐ ingen (gå til spørsmål 14.a)

13.b. På en vanlig dag hvor du utførte meget anstrengende fysiske aktiviteter, hvor lang tid brukte du da på dette?

☐☐ timer ☐☐ minutter ☐ Vet ikke/husker ikke

14. a. Hvor mange dager i løpet av den siste uka har du drevet med middels anstrengende fysiske aktiviteter som å bære lette ting, sykle eller jogge i moderat tempo eller mosjonstennis? Ikke ta med gange, det kommer i neste spørsmål.

☐ dager per uke
☐ ingen (gå til spørsmål 15.a)

14.b. På en vanlig dag hvor du utførte middels anstrengende fysiske aktiviteter, hvor lang tid brukte du da på dette?

☐☐ timer ☐☐ minutter ☐ Vet ikke/husker ikke

15. a. Hvor mange dager i løpet av den siste uka gikk du minst 10 minutter i strekk for å komme deg fra ett sted til et annet? Dette inkluderer gange på jobb og hjemme, gange til buss, eller gange som du gjør på tur eller som trening i fritiden

☐ dager per uke
☐ ingen (gå til spørsmål 16)

15.b. På en vanlig dag hvor du gikk for å komme deg fra et sted til et annet, hvor lang tid brukte du da totalt på å gå?

☐☐ timer ☐☐ minutter ☐ Vet ikke/husker ikke

16. Dette spørsmålet omfatter all tid du tilbringer i ro (sittende) på jobb, hjemme, på kurs, og på fritiden. Det kan være tiden du sitter ved et arbeidsbord, hos venner, mens du leser eller ligger for å se på TV.

I løpet av den siste uka, hvor land tid brukte du vanligvis totalt på å sitte på en vanlig hverdag?

☐☐ timer ☐☐ minutter ☐ Vet ikke/husker ikke

17. Har nyrelegen noen gang snakket med deg om viktigheten av å være fysisk aktiv?

Ja ☐ Nei ☐ Vet ikke/husker ikke ☐

18. Har du et ønske om å være mer fysisk aktiv enn du er i dag?

Ja ☐ Nei ☐ Vet ikke ☐

19. Hvis du svarte "ja" på forrige spørsmål, hvilke forhold tenker du er dine viktigste hindre for fysisk aktivitet?

	Ikke et hinder	Litt hinder	Middels stort hinder	Stort hinder
a. Tiden jeg bruker på dialysebehandlingen	☐	☐	☐	☐
b. Tiden jeg bruker på å reise til og fra dialysebehandlingen	☐	☐	☐	☐
c. Plager jeg får av dialysebehandlingen	☐	☐	☐	☐
d. Plager jeg får av medisiner jeg tar	☐	☐	☐	☐
e. Plager jeg får av nyresykdommen	☐	☐	☐	☐
f. Plager jeg får av andre sykdommer jeg har	☐	☐	☐	☐
g. Jeg har aldri tidligere vært interessert i fysisk aktivitet	☐	☐	☐	☐
h. Jeg vet ikke hvordan jeg skal komme i gang	☐	☐	☐	☐

Annet:

……

……

……

20. Til deg som behandles med hemodialyse: Kunne du tenke deg:

	Ja	Nei	Vet ikke
a. Å trene mens du får dialysebehandling?	☐	☐	☐
b. Å trene før dialysebehandlingen?	☐	☐	☐

21. Til deg som behandles med peritoneal dialyse: Kunne du tenke deg:

	Ja	Nei	Vet ikke
a. Å trene i gruppe på sykehuset der du går til kontroll, sammen med andre som behandles med PD?	☐	☐	☐
b. Å trene i gruppe på mitt hjemsted?	☐	☐	☐

22. Har du andre innspill om forhold som med bedre tilrettelegging kunne ha bidratt til at du var mer fysisk aktiv?

……

……

23. Hvor mange kilometer er det fra ditt hjem til ditt dialysesenter (evt. det sykehuset der du går til PD-kontroll)?

☐☐☐☐ kilometer

24. Når du skal til dialyse eller dialysekontroll, hvilket klokkeslett reiser du vanligvis hjemmefra?

Klokken: ☐☐☐☐

25. Hvilket klokkeslett er du vanligvis hjemme igjen?

Klokken: ☐☐☐☐

26. Har du andre kommentarer til undersøkelsen eller til temaet fysisk aktivitet ved dialyse?

……

……

Tusen takk for at du tok deg tid til å svare på spørsmålene!

Appendix 2: Information to patients and written consent

FORESPØRSEL OM DELTAKELSE I FORSKNINGSPROSJEKT

«En undersøkelse av fysisk aktivitet blant dialysepasienter i Nord-Norge»

BAKGRUNN OG FORMÅL MED PROSJEKTET

Hos mange personer som behandles regelmessig med dialyse, bidrar både nyresykdommen og behandlingen til at de er mindre fysisk aktive enn andre. Forskning tyder likevel på at fysisk aktivitet kan være gunstig for fysisk helse og livskvalitet også hos personer i dialyse. Det finnes ingen tidligere forskningsstudier av fysisk aktivitet blant personer som er i behandling med dialyse i Nord-Norge. Vi vil med dette spørre deg om du vil være med på den aller første.

Hensikten med studien er å undersøke om økt fysisk aktivitet har sammenheng med økt livskvalitet. For å undersøke dette vil vi gjennomføre en spørreundersøkelse med spørsmål rundt dine aktivitetsvaner. Vi vil også be deg om å gå med en aktivitetsmåler i sju dager for å måle mengden fysisk aktivitet i denne perioden.

Forskningsstudien kom i stand som et studentprosjekt ved medisinutdanningen, UiT Norges Arktiske Universitet. Den er utformet av leger og studenter ved Universitetssykehuset i Nord-Norge/UiT og Nordlandssykehuset Bodø. Vi har også viktige samarbeidspartnere blant nyrelegene ved Finnmarkssykehuset og Helgelandssykehuset. Videre støttes prosjektet økonomisk av Landsforeningen for Nyresyke og Transplanterte (LNT).

HVA INNEBÆRER DET Å DELTA?

Dersom du samtykker til å delta, vil du få utdelt et spørreskjema med spørsmål rundt dine aktivitetsvaner og din livskvalitet. Det er ønskelig at du svarer så godt du klarer på flest mulig av spørsmålene.
Videre vil du gå med en liten aktivitetsmåler rundt høyre hofte i sju dager. Dette er en liten databrikke som festes ved høyre hofte og som kun vil registrere hvor mye du beveger deg. Brikken registrerer ikke hva du holder på med eller hvor du er. Sammen med brikken leverer vi ut en god beskrivelse av hvordan den skal festes og brukes. Vi vil avtale nærmere med deg hvor og hvordan du aktivitetsmåleren blir utdelt og tilsvarende hvor og hvordan du skal levere den inn igjen. Bruk av ActiGraph vil forekomme i tidsrommet mellom 15. november - 15.desember.

For å få et best mulig bilde av det fysiske aktivitetsnivået hos personer i dialyse, og hva som eventuelt begrenser aktiviteten, ønsker vi å registrere noen opplysninger om din sykdom (type nyresykdom, medisiner du bruker, hvilke andre sykdommer du har og enkelte

blodprøvesvar) og dialysebehandling (type dialysebehandling, hvor lenge du har vært i behandling, reiseavstand og –tid til dialysen eller nyrelegen). Opplysningene ønsker vi å hente fra din medisinske journal. Vi vil be om ditt samtykke til innsyn i journalen for å finne disse spesifiserte opplysningene.

MULIGE FORDELER OG ULEMPER

Deltagelse vil innebære noe tidsbruk for deg i utfyllingen av spørreskjemaet. Det vil også ta litt tid å betjene aktivitetsmåleren (av/på under dusj/bad o.l). Aktivitetsmålerne som brukes i studien, vil ikke medføre ubehag eller smerter, og vil kunne sammenlignes med et belte når den er i bruk.
Kunnskapen vi får fra denne studien vil kunne bidra til å forbedre framtidige anbefalinger om fysisk aktivitet blant personer som behandles med dialyse.

HVA SKJER MED INFORMAJSONEN OM DEG?

All informasjon som innhentes om deg i denne forskningsstudien, vil kun bli brukt for å besvare de spørsmålene vi har skissert over (se «Bakgrunn og formål med prosjektet» over). Data som innhentes, vil samles og lagres på en sikker måte, i samsvar med nasjonale forskrifter og slik det kreves av Personvernombudet ved hvert av de fire involverte helseforetakene. Det er kun autorisert personell knyttet til prosjektet som har adgang til navnelisten der ditt ID-nummer er konstruert, og som kan finne tilbake til deg.
Det vil ikke være mulig å identifisere deg i resultatene av studien når denne publiseres.

Studien har vært vurdert av Regionale komiteer for medisinsk og helsefaglig forskning avdeling Nord (REK Nord), som ikke har stilt spesielle krav til forskningen.

FRIVILLIG DELTAKELSE

Det er frivillig å delta i studien. Du kan når som helst og uten å oppgi noen grunn trekke ditt samtykke om deltakelse. Dersom du ønsker å delta i studien, ber vi om at du undertegner samtykkeerklæringen på siste side. Dersom du har spørsmål til studien kan du kontakte:
Kjell-Gunnar Vangen, Medisinstudent Universitetet i Tromsø, Tlf: xxxxxxxx

Marit Dahl Solbu, overlege og spesialist i nyresykdommer, Universitetssykehuset Nord-Norge, Tlf: xxxxxxxx

Du kan også stille dine spørsmål til din nyrelege eller dialysesykepleier, som kan formidle spørsmålet videre til oss.

SAMTYKKE TIL DELTAKELSE I FORSKNINGSSTUDIE:

«En undersøkelse av fysisk aktivitet blant dialysepasienter i Nord-Norge»

Jeg har fått muntlig og skriftlig informasjon om forskningsstudien.

……

Lege/sykepleier bekrefter å ha informert om studien (sted/dato/navn/underskrift)

Jeg samtykker herved til å delta i studien. Mitt samtykke omfatter også innhenting av medisinske opplysninger som er nødvendige for dette forskningsprosjektet fra min pasientjournal.

……
……..

Sted/dato Signatur, prosjektdeltaker

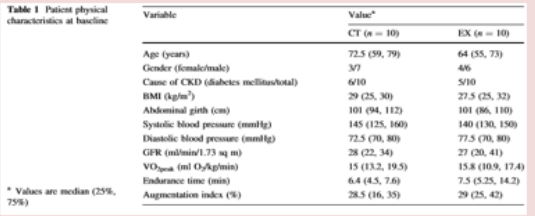
Navnelapp

GRADE

Reference: Barcellos FC, Santos IS, Umpierre D, Bohlke M, Hallal PC. Effects of exercise in the whole spectrum of chronic kidney disease: a systematic review. Clinical Kidney Journal. 2015;8(6):753-65.			Study design: systematic review. Level of evidence: Ia GRADE: High
Aim of study	**Patients and Methods**	**Resultater**	**Discussion/comments/check-list**
The objective of the study was to search for and appraise evidence on the effectiveness of exercise interventions on health endpoints in CKD patients. **Conclusion** The strongest evidence is for the effects of aerobic exercise on improving physical fitness, muscular strength and quality of life in dialysis patients. The benefits of exercise in dialysis patients are well established, supporting the prescription of physical activity in their regular treatment. RCTs including patients in earlier stages of CKD and after kidney transplantation are urgently required, as well as studies assessing long-term outcomes. The best exercise protocol for CKD patients also remains to be established. **Country** Brazil **Year of data collection** June 2015	Population: CKD patients. The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement for the conduct of meta-analyses of intervention studies was followed. Inclusion criteria: Eligibility criteria were randomized controlled trials (RCT) evaluating any type of exercise intervention, including advising for physical activity practice, in CKD patients, regardless of their disease stage. The studies based on the same sample, but with different outcomes were included. Only studies with adults (≥18 years) were selected. Exclusion criteria: Studies on the acute effects of exercise (intervention lasting <8 weeks) and/or quasi-experimental studies were excluded. Literature search: A search for articles up to and including June 2015 was made from MEDLINE (accessed via PubMed) and EMBASE; we combined these search results with searches of the Cochrane Central Register, and clinical trials registry databases. Conference proceedings abstracts also were handsearched (American Society of Nephrology from 2003 to 2014, European Renal Association–European Dialysis and Transplant Association from 2002 to 2014 and World Congress of Nephrology from 2001 to 2012). Data extraction: The articles identified in the literature search were screened by two independent extractors (F.C.B and M.B) who were blinded to authorship. The initial screening was based on only titles and abstracts. After that, the full text of potentially eligible articles was evaluated. Data extraction of selected RCTs was performed by two independent reviewers (F.C.B and M.B). Discrepancies between the two extractors were discussed until consensus was reached. Primary outcomes: 1. Physical fitness: aerobic capacity, muscular strength; 2. Health-related quality of life (measured through well-established, reliable and validated instruments); 3. Cardiovascular dimensions: heart rate variability (HRV) index, mean RR, mean standard deviation of normal-to-normal intervals (SDNN), pulse wave velocity (PWV) and arterial stiffness; 4. Nutritional measures: body composition (visceral fat, waist circumference and leg lean mass), body mass index, waist circumference); 5. Depression; 6. Systemic inflammation: interleukin 6, C-reactive protein. Secondary outcomes: 1. Blood lipids: total cholesterol, high-density lipoprotein (HDL) cholesterol, low-density lipoprotein (LDL) cholesterol, triglycerides; 2. Progression of CKD: determined as glomerular filtration from serum creatinine and/or cystatin C and/or radioisotope tracing Assessment of risk of bias: The quality of RCTs was judged by selection bias (method of recruitment, proper method of randomization at baseline, concealment of treatment allocation, similarity of groups at baseline and provision of eligibility criteria), detection bias (use of masked outcome assessment, blinded administrator and blinded patients) and attrition bias (level of adherence to the intervention, completeness of follow-up and use of intention-to-treat analysis). Each item was rated by assigning a judgment of high, low or unclear risk of material bias.	Literature search: We retrieved 5489 articles in searches. 486 duplicated articles were excluded initially. 5003 articles examined for eligibility, 4861 were excluded based on the title or abstract. 142 potentially eligible studies full text were evaluated. 59 fulfilled inclusion criteria and included in the review. 2858 randomized participants overall within these 59 studies. Selected trails: Number of participants ranging from 11 to 297. 38 studies (67%) with sample size less than 50 participants. Three studies uses a healthy control group in addition to a CKD control group. Six trails lasted over a year, most other lasted from 8 to 24 weeks. Twenty-eight of the 59 studies were published after 2009. Assessment of the quality of studies: *Allocation:* 23 studies had adequate randomization and concealment of the allocation sequence was describes in only 14 RCTs. *Blinding:* process of participants, care providers and assessors was described in six studies. Three studies blinded outcomes. *Dropout rates*: 41 of 59 studies reported dropout rates. 32 had dropout rate between 0-30%. *Intention-to-treat analysis:* Ten studies. *Adherence to interventions:* Nine RCTs reported on compliance, which was from 70-89%. Overview of the most important findings: - Consistent evidence of the positive effects of aerobic exercise on physical fitness, muscular strength and quality of life in ESRD patients. - Evidence regarding exercise effects on other health outcomes and/or in earlier stages of CKD are weaker and heterogenous. - Heart rate variability – six of the seven studies assessing HRV found significant improvements in this variable after exercise.	1. Is the review based on a focused question that is adequately formulated and described? YES. 2. Were eligibility criteria for included and excluded studies predefined and specified? YES 3. Did the literature search strategy use a comprehensive, systematic approach? YES 4. Were titles, abstracts, and full-text articles dually and independently reviewed for inclusion and exclusion to minimize bias? YES 5. Was the quality of each included study rated independently by two or more reviewers using a standard method to appraise its internal validity? YES 6. Were the included studies listed along with important characteristics and results of each study? YES 7. Was publication bias assessed? YES 8. Was heterogeneity assessed? (This question applies only to meta-analyses.) NOT APPLICABLE Discussion: Strength: - Systematic review - Strict exclusion criteria. - Many articles reviewed. - Findings in accordance with meta-analysis for the Cochrane Collaboration, by Heiwe and Jacobsen, published in 2011, and updated in 2014. Authors discuss the possible benefits of engaging exercise in earlier stages of CKD, and the problem that many articles did not include subjects in these stages.

Reference: Mustata S, Groeneveld S, Davidson W, Ford G, Kiland K, Manns B. Effects of exercise training on physical impairment, arterial stiffness and health-related quality of life in patients with chronic kidney disease: a pilot study. Int Urol Nephrol. 2011;43(4):1133-41.

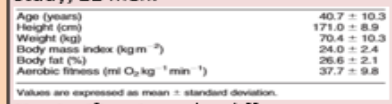
Study design: RCT
Level of evidence: Ib
GRADE: High/moderate

Aim of study	Patients and Methods	Results	Discussion/comments/check-list
Patients with chronic kidney disease (CKD) have impaired performance in physical tasks, lower health-related quality of life and high cardiovascular morbidity and mortality. Moderate intensity exercise has been shown to provide cardiovascular and metabolic benefits in healthy individuals and patients without CKD. Long-term exercise training is recommended as a vital component in the management of a number of chronic diseases. This randomized controlled pilot project examined the effects of exercise in predialysis CKD patients.	Study design: Prospective randomized controlled study Ten patients were randomized to 12 months of exercise (EX) and 10 to standard care (CT). We compared the difference between the two groups in physical impairment (VO2peak and endurance time [ET]), arterial stiffness (augmentation index [AI]) and health-related quality of life (EuroQol EQ-5D and Short Form-36 questionnaires) (all measured at baseline and 12 months). Population: Eligible patients were invited to attend an information session outlining all aspects of the study before agreeing to participate. Following completion of baseline exercise testing, subjects were randomly assigned to exercise in addition to standard care (EX) or standard care alone (CT) using a computer generated randomization list and sequentially numbered, sealed envelopes. Inclusion criteria: Medically stable sedentary patients with Stage III–IV CKD (GFR 15–60 ml/min/1.73 m2) were recruited from outpatient Nephrology clinics in the Calgary Health Region. Exclusion criteria: Patients were excluded if any of the following had occurred within the month prior to enrolment: acute cardiorespiratory disease (acute coronary syndrome, congestive heart failure or severe pneumonia), uncontrolled diabetes (plasma glucose[20 mmol/l or\4 mmol/l on at least two occasions) or uncontrolled hypertension (systolic blood pressure[180 mmHg or diastolic blood pressure[110 mmHg on at least two occasions), persistent hyperkalaemia (K[5.5 mmol/l) or musculoskeletal abnormalities precluding or exacerbated by exercise. Method: Forty-five eligible patients were invited to attend the study information sessions, and 20 agreed to participate, with 10 randomized to exercise in addition to standard care (EX) and 10 to standard care alone (CT). Outcome: The primary study outcome was the difference in physical impairment between EX and CT at 12 months. Physical impairment was assessed by measuring exercise capacity (VO2peak) and endurance time (ET). Secondary outcomes included arterial stiffness and health-related quality of life. Variables: The training program was of 1-year duration, combining supervised and home-based exercise. Supervised training consisted of twice-weekly in-centre sessions throughout the study period and included choice of treadmill, stationary cycle and elliptical trainer. Home training (walking) was initiated in the second month and progressed over 3 months to a frequency of 3 days/ week. Exercise prescriptions were individualized, with an initial intensity of 40–60% of VO2peak and duration of 5–20 min. Exercise duration was increased by 5–10% weekly (to a maximum of 60 min), and patients used heart rate monitors (Polar) and ratings of perceived exertion (12–15 on the Borg RPE scale) to guide exercise intensity. Stastical analysis: As this was a pilot study, no sample size calculation was completed. Subject characteristics were described using descriptive statistics and expressed as median values. The difference between the measurements obtained at baseline and 12 months in each group was found to have a normal distribution and comparison of the difference between the two groups was analysed using the unpaired t-test. A P-value of <0.05 was considered statistically significant. Analysis was intention to treat. Approvals: The study protocol was approved by the University of Calgary Conjoint Health Research Ethics Board, and written informed consent was obtained from each participant.	The difference between EX and CT was statistically significant for VO2peak (3.59 ml O2/kg/ min; 95% CI 0.92, 6.26; P = 0.01), ET (10.97 min; 95%CI4.34,17.59;P = 0.003) and AI(-11.7%;95% CI -18.79, -4.61; P = 0.003). Main results: The major findings of this study are that 1 year of supervised aerobic exercise training significantly improves physical impairment and arterial stiffness in patients with predialysis CKD. Incidence/RR/risk reduction/aRR The differences between EX and CT at 12 months were statistically significant for VO2peak (3.59 ml O2/kg/min; 95% CI 0.92, 6.26; P = 0.01), endurance time (ET) (10.97 min; 95% CI 4.34, 17.59; P = 0.003) and augmentation index (AI) (-11.7%; 95% CI -18.79, -4.61; P = 0.003). Other results: The exercise modality most commonly chosen in the EX group was walking. Adherence to prescribed training frequency was 80% for supervised sessions and 20% for home sessions, with a median weekly total aerobic exercise time of 43.4 min. There were no significant changes for BMI or waist circumference in EX or CT. Other factors with potential to alter exercise capacity, arterial stiffness and HRQOL (i.e., systolic and diastolic blood pressure, haemoglobin A1C, fasting lipid profile, GFR, serum haemoglobin, albumin, potassium, calcium and phosphorus) showed no significant differences between the two groups. Differences were noted in the baseline EQ-5D index score between CT and EX; however, the significance is unknown. Although the difference at 12 months in the EQ-5D score did not reach statistical significance (P = 0.08), a clinically important improvement was demonstrated in the EX group. **Table 1** Patient physical characteristics at baseline  * Values are median (25%, 75%)	Checklist 1. Was the study described as randomized, a randomized trial, a randomized clinical trial, or an RCT? Prospective randomized controlled trail. 2. Was the method of randomization adequate (i.e., use of randomly generated assignment)? YES 3. Was the treatment allocation concealed (so that assignments could not be predicted)? YES 4. Were study participants and providers blinded to treatment group assignment? CANNOT DETERMINE. 5. Were the people assessing the outcomes blinded to the participants' group assignments? YES 6. Were the groups similar at baseline on important characteristics that could affect outcomes (e.g., demographics, risk factors, co-morbid conditions)? YES 7. Was the overall drop-out rate from the study at endpoint 20% or lower of the number allocated to treatment? YES 8. Was the differential drop-out rate (between treatment groups) at endpoint 15 percentage points or lower? NO 9. Was there high adherence to the intervention protocols for each treatment group? YES, 80% for supervised sessions and 20% for home sessions. 10. Were other interventions avoided or similar in the groups (e.g., similar background treatments)? YES. 11. Were outcomes assessed using valid and reliable measures, implemented consistently across all study participants? YES. 12. Did the authors report that the sample size was sufficiently large to be able to detect a difference in the main outcome between groups with at least 80% power? NO, this is a pilot study. 13. Were outcomes reported or subgroups analysed prespecified (i.e., identified before analyses were conducted)? YES. 14. Were all randomized participants analysed in the group to which they were originally assigned, i.e., did they use an intention-to-treat analysis? YES. Strength: RCT, 1 year follow up, mostly significant results and only two people dropped out during 1 year. Weakness: Small population. Not used gold standard for measuring arterial stiffness.
Conclusion This study suggests that long-term exercise training improves physical impairment, arterial stiffness and health-related quality of life in patients with predialysis CKD. A larger randomized trial is required to examine the impact of exercise on markers of cardiovascular risk and quality of life in predialysis CKD patients.			
Country Canada			
Year of data collection 2010			

Variable	Value*	
	CT (n = 10)	EX (n = 10)
Age (years)	72.5 (59, 79)	64 (55, 73)
Gender (female/male)	3/7	4/6
Cause of CKD (diabetes mellitus/total)	6/10	5/10
BMI (kg/m^2)	29 (25, 30)	27.5 (25, 32)
Abdominal girth (cm)	101 (94, 112)	101 (86, 110)
Systolic blood pressure (mmHg)	145 (125, 160)	140 (130, 150)
Diastolic blood pressure (mmHg)	72.5 (70, 80)	77.5 (70, 80)
GFR (ml/min/1.73 sq m)	28 (22, 34)	27 (20, 41)
VO_{2peak} (ml O_2/kg/min)	15 (13.2, 19.5)	15.8 (10.9, 17.4)
Endurance time (min)	6.4 (4.5, 7.6)	7.5 (5.25, 14.2)
Augmentation index (%)	28.5 (16, 35)	29 (25, 42)

Reference: Kang SH, Do JY, Jeong HY, Lee SY, Kim JC. The Clinical Significance of Physical Activity in Maintenance Dialysis Patients. Kidney and Blood Pressure Research.			Study design: Cohort Level of evidence: IIb GRADE: Moderate
Aim of study	Patients and Methods	Results	Discussion/comments/check-list
Evaluate the effects of physical activity on various aspects in Asian dialysis patients. Conclusion High physical activity was associated with favorable results for most HRQoL scale scores, including frailty, disability, and exhaustion, in Korean dialysis patients. Patients on dialysis should be encouraged to increase their physical activity, which may improve their prognosis. Country Korea Year of data collection July – December 2012	Study design: Retrospective cohort study. Population: Study participants were recruited from 27 hospitals or dialysis centres in Korea (n = 1611) from a previous study. between July and December 2012. The participants were divided into 3 groups according to the degree of regular exercise: Inactive group, Intermediate group, and Active group. A total of 2737 participants who underwent dialysis were included. Exclusion criteria: Participants were excluded from the present study if they met the following criteria: age < 20 years (n = 12), hospitalization during the previous 3 months except for vascular access problems (n = 351), dialysis duration < 6 months (n = 164), inability to walk with or without an assistive device (n = 79), lack of laboratory findings (n = 117), refusal to participate (n = 254), or inability to communicate with interviewers (n = 149). As a result, 1611 participants were ultimately included in this study. Method: Demographic and laboratory data collected at enrolment included the following: age, sex, body mass index (BMI; kg/m2), DM, CAD, cerebrovascular disease (CVD), dialysis vintage (years), education level, and levels of haemoglobin (mg/dL), blood urea nitrogen (BUN; mg/dL), creatinine (mg/dL), calcium (mg/dL), phosphorus (mg/dL), total cholesterol (mg/dL), intact-parathyroid hormone (i-PTH; pg/mL), and high sensitivity CRP (hs-CRP; mg/dL). Assessment of HRQoL was assessed by Kidney Disease Quality of Life (KDQOL)-SF 1.3 Korean version. Disability was evaluated using 4 questions regarding activities of daily living (ADLs). Exhaustion was measured using 2 questions from the Center for Epidemiological Studies Depression Scale. Physical activity was defined as the presence of regular exercise during leisure time for the past 3 months. Frailty was defined using modified criteria including components of slowness, poor endurance, physical inactivity, and unintentional weight loss. Statistical analysis: The data were analysed using the statistical software SPSS version 21. The level of statistical significance was set at P < 0.05. Approvals: The hospitals ethics committee approved the study protocol. The study was conducted in accordance with the principles originating from det Declaration of Helsinki.	Total number of participants in inactive (N=728), intermediate (N=520) and Active (N=363) groups. Number of participants in HD (N=1247 - 77,4%) and in PD (364 – 22,6%). The proportions of patients with frailty and the presence of each component decreased as physical activity increased. The presence and numbers of disabilities decreased as physical activity increased. The number of participants with a history of fall during the last 12 months was 149 (20.5%) in the Inactive group, 88 (16.9%) in the Intermediate group, and 48 (13.2%) in the Active group. Physical component scale and mental component scale scores increased as physical activity increased. The survival rate for all-cause death at 500 days was 95.5% in the Active group, 95.2% in the Intermediate group, and 93.5% in the Inactive group.	Was the population well defines? Yes, they were recruited from 27 clinics in Korea. Are the groups recruited from the same population? Yes, they are recruited from Korea in clinics treating CKD-patients. Are the population representative for a defined population? Yes. Are those who evaluated the results blinded? Uncertain, do not say in the paper. Was it a prospective study? No Did a high enough amount of people in the cohort get follow-up? (Attrition bias/follow-up-bias) Uncertain. Is the follow-up time adequate? Uncertain. Are confounding factors analysed during the study? Yes. Do you believe in the results? Yes. Can the results be transferred to the general population? No. Discussion: Strength: High number recruited patients. Other studies have shown many of the same results. Other studies back up these results. The results can be used to implement better routines/guidelines in terms of recommendation of physical activity among dialysis patients. Weakness: Retrospective study and uses participants enrolled in a previous study. Physical activity assessed only by using self-reported questionnaire, and may be associated with overestimation or underestimation of physical activity. The study have not evaluated medications that may affect physical activity; opioids, antihistamine and antidepressants.

Reference: Nah R., Robertson N., Niyi-Odumosu F.A., Clarke A.L., Bishop N.C., Smith A.C. (2019). Relationships between illness representations, physical activity and depression in chronic kidney disease. Journal of Renal Care 45 (2), 74-82.			Study design: cross sectional Level of evidence: III GRADE: Moderate
Aim of study	Patients and Methods	Results	Discussion/comments/check-list
Explore the relationship between physical activity, depression and illness representations in CKD. Conclusion Facets of illness representations had significant relationships with levels of physical activity. Country United Kingdom Year of data collection August 2016–January 2017	Study design: Cross-sectional study. Population: A total of 164 patients were approached, of these, 100 patients consented, but 30 did not return the survey booklet and were withdrawn from the study. Inclusion criteria: 1) Diagnosis of CKD and not on dialysis. 2) Male or female aged 18 years or above. 3) Were willing and able to give informed consent for study participation. 4) Were able to complete the measures in English. Method: 70 patients (43% participation rate) with CKD but not requiring dialysis from a UK renal outpatient clinic completed the Revised Illness Perception Questionnaire (IPQ-R), Beck Depression Inventory (BDI-II) and Short-Form International Physical Activity Questionnaire (IPAQ-SF). Demographic information was obtained via medical records. The participants were given a study survey booklet to take away, complete and return within 10 days. All participants provided informed consent. Statistical methods: Data analysis were performed using IBM SPSS statistics for Windows, version 24. Descriptive statistics were used on patients characteristics. Correlation and regression analyses were conducted to determine the relationship of illness representations with levels of physical activity. Moderation and mediation analyses were performed to investigate the role of depression in any relationship between illness representations and physical activity levels.	Seventy respondents, 60% male, with a mean age of 60±16years, took part in the study. Physical activity: - 35% of participants were sedentary. - 39% of participants were «minimally active» - 26% of participants met the active category. - Median level of physical activity per week was 1386 MET-min, which meets the category «minimally active». Depression severity: - 63,2% of participants scored «minimal depression» - 17,6% of participants scored «mild depression» - 11,8% of participants scored «moderate depression» - 7,4% of participants scored «severe depression» Association of illness representations with levels of physical activity: - Positive correlation between personal control and level of physical activity (r = .288, p = .034). Regression analysis: - Timeline cyclical (a subscale of the IPQ-R relating to patient beliefs about the nature of their illness) was a significant predictor (Beta = -.423, p = .008). Moderation and mediation analyses: Moderation analysis was conducted with levels of physical activity (IPAQ-SF) as the dependent variable, timeline cyclical as the independent variable and severity of depression (BDI-II) as the moderator variable. Severity of depression was neither a moderator nor a mediator of illness representations and levels of physical activity (b= .021,BCaCl [-.082,.008],p =.33).	Checklist 1. Was the research question or objective in this paper clearly stated? YES 2. Was the study population clearly specified and defined? YES 3. Was the participation rate of eligible persons at least 50%? NO, 43% 4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants? YES 5. Was a sample size justification, power description, or variance and effect estimates provided? YES 6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured? NO 7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed? NO 8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)? CANNOT DETERMINE 9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants? YES 10. Was the exposure(s) assessed more than once over time? NO 11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants? NO 12. Were the outcome assessors blinded to the exposure status of participants? NOT APPLICABLE 13. Was loss to follow-up after baseline 20% or less? NOT APPLICABLE 14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)? ? NOT APPLICABLE Discussion Strength: correlations between personal control and levels of physical activity are consistent with one meta-analysis, a systematic review with meta-analysis and cardiovascular disease research studies. Furthermore, timeline cyclical dimension predicted levels of physical activity are parallels with a study conducted on CVD patients. Weakness: Only two of seven domains of CSM were statistically significant. Self-report measures are prone to recall bias. Small sample size.

Reference: Hagstromer M, Oja P, Sjostrom M. The International Physical Activity Questionnaire (IPAQ): A study of concurrent and construct validity2006.			Study design: Cross-sectional Level of evidence: III GRADE: Moderate
Aim of study	Patients and Methods	Results	Discussion/comments/check-list
The International Physical Activity Questionnaire (IPAQ) was developed to measure health-related physical activity (PA) in populations. The short version of the IPAQ has been tested extensively and is now used in many international studies. The purpose of the present study was to further evaluate the concurrent and construct validity of the self-administered, last 7 days, long form version of the IPAQ in a Swedish sample of adult men and women. Conclusion Results from the present study show that the long-version, self-administered, last 7 days IPAQ instrument has acceptable validity properties for assessing different domains of PA, PA intensities and total PA in healthy adults. Country Sweden Year of data collection 2005	Study design: A cross-sectional study was performed, comparing measures of PA by the long, self-administered, last 7 day version of the IPAQ with those obtained by a log book and an activity monitor for concurrent validity, and with aerobic fitness and body composition for construct validity. Population: A total of 50 healthy volunteers (24 men) living in the Stockholm metropolitan area of Sweden participated in the study. Four subjects (two men) were excluded from the analyses due to incomplete log book activity recordings or failure to test aerobic fitness. The remaining 46 subjects had a higher level of education than the average Swedish population, as indicated by the high prevalence of university education. Inclusion: Healthy volunteers Method: On day 1 the participants were invited to the clinic and were provided with detailed instruction on how to use the activity monitor and how to fill in the activity log book. Data on anthropometric and demographic characteristics were collected. Starting on day 2 the participants wore the activity monitor for seven consecutive days and filled in the log book at the end of each day. On day 8 the subjects returned to the clinic, filled in the IPAQ and performed an aerobic fitness test. Statistical analyses: All statistical analyses were performed using the Statistical Package for the Social Sciences for Windows, version 10.0. The characteristics of subjects and outcomes from the IPAQ, log book and activity monitor are described as mean ^ standard deviation (SD). Non-parametric Spearman correlation coefficient(r) used to assess the relationship between MET-h week-1 from IPAQ data and MTI counts, log book outcomes, aerobic capacity and BF (%). Bland-Altman method used to provide an indication of systematic and random error and heteroscedasticity of data. Variables used for the Bland–Altman analysis were weekly time spent in moderate and vigorous activity according to IPAQ versus MTI and the weekly total amount of PA (MET) according to IPAQ versus the logbook. The level of significance was set at P , 0.05. Approvals: The ethics committee of Huddinge University Hospital approved the study protocol and the subjects provided written informed consent.	Forty-six volunteers, 92% response, age range 19-62, participated in the study, 22 men.  Values are expressed as mean ± standard deviation. No significant gender differences regarding age, BMI or time spent in different intensities of PA measured with the accelerometer. IPAQ versus the activity monitor: Reported time spent in vigorous-intensity PA and total amount of PA from the iPAQ were significantly correlated with the time spent I vigorous-intensity PA from the MTI activity monitor (p=0.55, P < 0.001). It was not a significant correlation between reported moderate PA by IPAQ and the MTI activity monitor. Not significant absolute difference between reported time for total PA from IPAW and measured time with MTI activity monitor. IPAQ versus the log book: Significant correlation between calculated MET-h per day from PA log book and IPAQ (p=0.77, P<0.001). Significant relationship between three of four domains from IPAQ and log book; “work PA, p=0.64; home/garden PA p=0.47; leisure-time PA p=0.58”. Time spent sitting were also significant p=0.75, P<0.05. Aerobic fitness Weak positive correlation with total amount of PA and time spent in moderate-intensity PA from IPAQ p=0.21, P<0,05). No significant relationship between aerobic fitness and time spent in vigorous activity from IPAQ.	1. Was the research question or objective in this paper clearly stated? YES 2. Was the study population clearly specified and defined? CANNOT DETERMINE 3. Was the participation rate of eligible persons at least 50%? YES 4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants? YES 5. Was a sample size justification, power description, or variance and effect estimates provided? NO 6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured? NO 7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed? NOT APPLICABLE 8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)? CANNOT DETERMINE 9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants? YES 10. Was the exposure(s) assessed more than once over time? NO 11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants? YES 12. Were the outcome assessors blinded to the exposure status of participants? NOT APPLICABLE 13. Was loss to follow-up after baseline 20% or less? NOT APPLICABLE 14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)? NOT APPLICABLE Discussion Strength: - No missing data. - MTI activity measurements were performed for the same time period as the questionnaire. This gives no reason to believe that the respondents did not refer to the same day when answering the questionnaire. Weakness: - Uniaxial activity monitor – known to underestimate PA levels in specific activities. - Self-reported questionnaires overestimates of high-intensity activities are known, while underestimating light-moderate intensity activities. - Cut-off points for vigorous and moderate PA obtained from experimental study. Different cut-off points have been suggested more recently.

Reference: Fukuhara S, Lopes AA, Bragg-Gresham JL, Kurokawa K, Mapes DL, Akizawa T, et al. Health-related quality of life among dialysis patients on three continents: The Dialysis Outcomes and Practice Patterns Study. Kidney International. 2003;64(5):1903-10.

Study design: cross sectional observational

Level of evidence	III
GRADE	Moderate/low

Aim of study	Patients and Methods	Results	Discussion/comments/check-list
The goal of the study was to document international differences in HRQOL among dialysis patients and to identify possible explanations of those differences. **Conclusion** On all three continents, ESRD and haemodialysis profoundly affect HRQOL. In the United States, the effects on mental health are smaller than in other countries. Japanese haemodialysis patients perceived that their kidney disease imposes a greater burden, but their physical functioning was significantly higher. Different distributions of socioeconomic factors and major comorbid conditions could explain little of this difference in physical functioning. Other possible factors, such as quality of dialysis and related health care, deserve careful study. **Country** USA, France, Germany, Italy, Spain, United Kingdom and Japan. **Year of data collection** 2003	Study design: Cross-sectional observation study. We examined data from the Dialysis Outcomes and Practice Patterns Study (DOPPS), a prospective, observational, international study of haemodialysis patients. Population: It was performed a cross-sectional analysis of DOPPS data from the United States, five countries in Europe (France, Germany, Italy, Spain, and the United Kingdom), and Japan. Method: Random samples of 20 to 40 haemodialysis patients were selected from each facility. At study entry a medical questionnaire completed by the nurse coordinator in the dialysis unit provided information about the patients and the practice pattern of the facility. Within 60 days of completion of the medical questionnaire, the study participants filled out a patient questionnaire, which included the questions of the Kidney Disease Quality of Life Short Form (KDQOL-SFTM). Scores on all eight subscales of the SF-36 were examined. Demographic and comorbidity data were abstracted from patients medical records at their entry into the study; age, gender, race, primary cause of ESRD, haematocrit, number of years on dialysis, complications of ESRD, annual household income, employment status, and 15 comorbidities. Statistical methods: Simple means and frequencies for the crude baseline scores. Linear mixed models were used to take into account possible influences on the comparisons of HRQOL scores among continents, including the effects of demographic characteristics, comorbidities, cause of ESRD, haematocrit, time on dialysis, employment status, and annual household income. Sensitivity analyses were conducted to investigate the choice of adjustment variables. We also used the linear mixed models to determine adjusted HRQOL scores and to compare average values among the continents, taking into account clustering at the facility level. Mixed models were also used to compare simple means among the continents, adjusting for facility clustering. All statistical analyses were performed with SAS, version 8.2.	A total of 7378 patients were included in the analyses; 2406 in Europe, 2087 in Japan and 2885 in United States. HRQOL data were obtained from approximately 60% of the eligible patients. Average age 59,4 years, 57,3% males. Results. In all generic HRQOL subscales, patients on all three continents had much lower scores than their respective population norm values. Patients in the United States had the highest scores on the mental health subscale and the highest mental component summary scores. Japanese patients reported better physical functioning than did patients in the United States or Europe, but they also reported the greatest burden of kidney disease. Overall, these differences remained even after adjusting for possible confounders. Table 1: Almost all comorbid conditions were most common among the US patients, and least common among the Japanese patients, except diabetes which was least common among Euro-DOPPS patients. Highest annual income most common among Japanese patients, least common in Euro-DOPPS patients. Unemployment and disability most common in US patients, least in Japanese. Table 2: HRQOL scores show Japanese patients score best physical functioning. Mental component summary and mental health were significantly higher for patients in US compared to Europe. Japanese patients reported the greatest burden of kidney disease. **Table 1.** Mean demographic results, comorbid conditions, and clinical and socioeconomic variables 	Characteristic	Europe	Japan	United States
Sample size *number*	2406	2087	2885
Age *years*	59.9	58.4[a]	59.6
Male %	57.9	62.6[a]	52.8[a]
Black %	1.6	0.0	39.0[a]
Comorbidities %			
Coronary artery disease	28.7	18.7[a]	48.3[a]
Congestive heart failure	24.1	5.6[a]	43.9[a]
Other cardiac problem	36.2	23.9[a]	34.6
Hypertension	72.5	56.1[a]	83.7[a]
Peripheral vascular disease	22.0	10.9[a]	24.3
Cerebrovascular disease	13.2	11.8	16.8[a]
Diabetes (primary or contributing)	19.3	25.4[a]	44.4[a]
Lung disease	10.7	1.2[a]	12.2
Cancer (other than skin)	9.0	5.1[a]	9.2
HIV/AIDS	0.2	0.0	1.1[a]
Gastrointestinal bleeding	5.2	3.3[a]	8.9[a]
Neurological disease	5.4	3.5[a]	11.1[a]
Psychiatric disorder	23.9	2.2[a]	22.6
Recurrent cellulitis	6.2	1.9[a]	10.0[a]
Dyspnea	18.9	2.4[a]	27.5[a]
Primary cause of ESRD %			
Diabetes	13.8	22.4	36.6
Glomerulonephritis	16.2	54.7 [b]	11.9 [b]
Hypertension	10.5	3.6	28.9
Other	59.5	19.3	22.6
Hematocrit % (mean and SD)	32.5 (5.2)	30.1 (4.2)[a]	32.9 (4.7)
Years on dialysis %			
<1	22.6	11.0	29.3
1–3	37.2	28.3	41.9
4–6	16.1	20.6 [b]	16.7 [b]
7–10	10.4	14.1	7.3
>11	13.7	26.0	4.8
Complications of ESRD %			
Carpal tunnel syndrome	7.6	11.0[a]	5.3[a]
Amyloidosis (β_2-microglobulin)	7.3	14.9[a]	1.5[a]
Parathyroidectomy	8.3	4.2[a]	4.0[a]
Annual household income (US $)			
<$5000	16.6	6.3	15.8
$5000–$10,000	29.2	26.8	27.4
$10,000–$20,000	30.0	27.6 [b]	26.1 [b]
$20,000–$40,000	18.3	19.7	20.0
$40,000–$75,000	4.8	9.5	8.5
>$75,000	1.1	10.2	2.1
Employment status[a] %			
Employed	26.8	53.3[a]	16.8[a]
Disabled	20.0	4.0[a]	36.6[a]	 [a]*P* value < 0.05 vs. Europe [b]*P* value < 0.0001 vs. Europe **Table 2.** Unadjusted and adjusted health-related quality of life (HRQOL) scores 		Euro-DOPPS		Japan		United States	
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HRQOL Measure	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]
SF-36						
Physical functioning	46.9	45.0	65.3[b]	60.3[b]	40.8[b]	42.7[b]
Role (physical)	34.4	37.2	48.7[b]	46.5[b]	31.7	37.6
Bodily pain	57.9	56.4	64.6[b]	61.4[b]	59.0	57.1
General health	36.9	36.1	43.4[b]	40.7[b]	40.2[b]	41.0[b]
Physical component summary	35.5	34.7	41.8[b]	40.0[b]	33.1[b]	33.4[b]
Vitality	41.9	42.4	53.0[b]	50.8[b]	42.9	43.4
Social functioning	62.1	62.2	70.1[b]	69.2[b]	62.1	63.5
Role (emotional)	46.1	49.1	53.6[b]	48.7	51.3[b]	58.0[b]
Mental health	59.9	60.8	63.5[b]	61.8	67.3[b]	68.2[b]
Mental component summary	43.2	44.1	44.8[b]	44.0	46.6[b]	47.6[b]
KDQOL						
Symptoms, problems	69.9	70.4	75.8[b]	73.8[b]	71.1	72.5[b]
Effects	57.3	57.9	67.7[b]	66.7[b]	62.5[b]	63.1[b]
Burden	35.4	36.8	28.6[b]	27.6[b]	40.8[b]	42.4[b]
Work status	25.2	28.5	44.8[b]	33.0[b]	20.0[b]	27.0
Cognitive functioning	73.6	74.3	81.7[b]	80.0[b]	77.2[b]	78.0[b]
Quality social	77.0	77.2	60.9[b]	60.6[b]	75.9	76.0
Sexual functioning	67.7	66.7	65.2	63.3	60.7[b]	60.5[b]
Sleep	57.1	58.1	63.2[b]	61.2[b]	58.3	59.9[b]
Social support	73.0	73.0	72.4	72.0	73.1	74.1
Staff encouragement	82.8	80.5	78.5[b]	79.3	80.6[b]	78.0[b]
Satisfaction	71.3	68.9	77.1[b]	76.2[b]	70.5	69.2
Average KDQOL	62.4	62.7	65.5[b]	63.3	62.9	63.7 | [a]Adjusted for patient characteristics in Table 1 [b]*P* < 0.0001 vs. Euro-DOPPS [c]*P* < 0.05 vs. Euro-DOPPS **Table 3.** Means of norm-based scores (differences, in standard deviation units, from general-population data) |	Euro-DOPPS		Japan		United States	
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HRQOL Measure	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]	Unadjusted	Adjusted[a]
Physical functioning	−1.52	−1.65	−1.13[b]	−1.34[b]	−1.52	−1.48[c]
Role (physical)	−1.22	−1.14	−1.04[c]	−1.05	−1.16	−0.98[c]
Bodily pain	−0.57	−0.63	−0.43[c]	−0.52	−0.46[c]	−0.56
General health	−1.31	−1.37	−0.95[b]	−1.06[b]	−1.29	−1.27[b]
Vitality	−0.95	−0.94	−0.62[b]	−0.71[b]	−0.77[b]	−0.76[c]
Social functioning	−0.97	−0.97	−0.79[c]	−0.80[c]	−0.83[c]	−0.76[c]
Role (emotional)	−1.20	−1.12	−0.83[b]	−0.96[c]	−0.80[b]	−0.61[b]
Mental health	−0.63	−0.57	−0.50[b]	−0.57	−0.46[b]	−0.41[c]	 [a]Adjusted for patient characteristics in Table 1 [b]*P* < 0.0001 vs. Euro-DOPPS [c]*P* < 0.05 vs. Euro-DOPPS	Checklist 1. Was the research question or objective in this paper clearly stated? YES 2. Was the study population clearly specified and defined? YES 3. Was the participation rate of eligible persons at least 50%? YES, 60 % 4. Were all the subjects selected or recruited from the same or similar populations (including the same time period)? Were inclusion and exclusion criteria for being in the study prespecified and applied uniformly to all participants? NO, recruited from three different continents with cultural differences. Population was similar. 5. Was a sample size justification, power description, or variance and effect estimates provided? NOT APPLICABLE 6. For the analyses in this paper, were the exposure(s) of interest measured prior to the outcome(s) being measured? NO. 7. Was the timeframe sufficient so that one could reasonably expect to see an association between exposure and outcome if it existed? NOT APPLICABLE. 8. For exposures that can vary in amount or level, did the study examine different levels of the exposure as related to the outcome (e.g., categories of exposure, or exposure measured as continuous variable)? CANNOT DETERMINE 9. Were the exposure measures (independent variables) clearly defined, valid, reliable, and implemented consistently across all study participants? YES 10. Was the exposure(s) assessed more than once over time? NO 11. Were the outcome measures (dependent variables) clearly defined, valid, reliable, and implemented consistently across all study participants? YES 12. Were the outcome assessors blinded to the exposure status of participants? NOT APPLICABLE 13. Was loss to follow-up after baseline 20% or less? NOT APPLICABLE 14. Were key potential confounding variables measured and adjusted statistically for their impact on the relationship between exposure(s) and outcome(s)? ? YES. Discussion Strength: - Many subjects, high response rate. - When they studied the characteristics of non-respondents, it showed no clinically important bias. Weakness: - Healthier patients were more likely to complete the questionnaire, which might have biased the sample toward healthier respondents. - Self-administered questionnaire – over/underreporting.