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Authors

Purnell, Tanjala S
Auguste, Priscilla
Crews, Deidra C
et al.

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Comparison of Life Participation Activities Among Adults Treated by Hemodialysis, Peritoneal Dialysis, and Kidney Transplantation: A Systematic Review

Tanjala S. Purnell, PhD, MPH[1,2], **Priscilla Auguste, MHS**[2], **Deidra C. Crews, MD, ScM**[2,3], **Julio Lamprea-Montealegre, MD, PhD**[2,4], **Temitope Olufade, PhD, MHS**[2,4], **Raquel Greer, MD, MHS**[1,2], **Patti Ephraim, MPH**[2,4], **Johanna Sheu, MS**[5], **Daniel Kostecki**[2], **Neil R. Powe, MD, MPH, MBA**[6], **Hamid Rabb, MD**[3], **Bernard Jaar, MD, MPH**[2,3], and **L. Ebony Boulware, MD, MPH**[1,2,4]

[1]Division of General Internal Medicine, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, MD

[2]Welch Center for Prevention, Epidemiology, and Clinical Research, Johns Hopkins Medical Institutions, Baltimore, MD

[3]Division of Nephrology, Department of Medicine, Johns Hopkins University School of Medicine, Baltimore, MD

[4]Department of Epidemiology, Johns Hopkins Bloomberg School of Public Health, Baltimore, MD

[5]Harvard University School of Medicine, Boston, MA

[6]Department of Medicine, San Francisco General Hospital and University of California San Francisco, San Francisco, CA

Abstract

Background—A comprehensive assessment of the association of patients' renal replacement therapy (RRT) modality on their participation in life activities (physical function, travel, recreation, freedom, work) is needed.

Study Design—Systematic review of peer-reviewed published studies.

Setting & Population—Adults undergoing RRT (hemodialysis, peritoneal dialysis, or transplantation).

Selection Criteria for Studies—We searched PubMed, Cochrane Library, and EMBASE from January 1980 through April 2012 for English-language articles that compared participation in life activities among patients receiving 1) hemodialysis compared with peritoneal dialysis, 2)

Corresponding Author: Tanjala S. Purnell, PhD, MPH, Welch Center for Prevention, Epidemiology and Clinical Research, Division of General Internal Medicine, Department of Medicine, Johns Hopkins Medical Institutions, 2024 E. Monument Street, Suite 2-600, Baltimore, MD 21205, Phone: 443-287-4683, tpurnel1@jhmi.edu.

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hemodialysis compared with kidney transplantation, or 3) peritoneal dialysis compared with kidney transplantation.

Predictor—RRT modality.

Outcomes—Reported rates of physical function, travel, recreation, freedom, and work-related activities by RRT modality.

Results—A total of 46 studies (6 prospective cohort, 38 cross-sectional, and 2 pre-post transplantation) provided relevant comparisons of life participation activities among patients treated with hemodialysis, peritoneal dialysis, and kidney transplantation. Studies were conducted from 1985 to 2011 among diverse patient populations in 16 distinct locations. A majority of studies reported greater life participation rates among patients with kidney transplants compared to patients receiving either hemodialysis or peritoneal dialysis. In contrast, a majority of studies reported no differences in outcomes between patients receiving hemodialysis and patients receiving peritoneal dialysis. These results were consistent throughout the study period, across diverse populations, and among the subset of studies that performed appropriate adjustments for potential confounding factors.

Limitations—Many studies included in the review had significant design weaknesses.

Conclusions—Evidence suggests patients with kidney transplants may experience better rates of life participation compared to patients receiving dialysis, while patients receiving hemodialysis and patients receiving peritoneal dialysis may experience similar rates of life participation. Rigorously performed studies are needed to better inform patients about the association of RRT on these important patient reported outcomes.

Keywords

dialysis; ESRD treatment; kidney transplantation; physical functioning; quality of life; social participation

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Patients initiating renal replacement therapy (RRT) for end-stage renal disease (ESRD) experience significant morbidity and limitations in quality of life[1,2]. Limitations include often-substantial decrements in patients' involvement in social and recreational activities, freedom, and abilities to work and travel, which have been associated with poorer overall health status and survival[1–7]. While their declining involvement in life activities may be attributed, in part, to patients' significant ESRD-associated morbidity[8], the extent to which patients' mode of RRT might independently influence their life participation has not been well-quantified.

The various RRT modalities (hemodialysis, peritoneal dialysis and kidney transplantation) have distinct characteristics, including different delivery methods (e.g., treatment in a center versus at home), requirements for self-care (e.g., clinician directed versus self-directed), levels of physical invasiveness (e.g., need for catheters or surgery), and associated symptoms (e.g., fatigue with dialysis or transplantation medication side effects). Each of these RRT characteristics could substantially influence patients' abilities to engage in social and recreational activities[9–12], and they are frequently presented to patients as important factors they should consider while approaching decisions regarding initiating or switching RRT modalities[13–17].

Prior studies suggested patients who undergo transplantation generally experience better quality of life than dialysis patients[18–20], while there may be no significant differences for patients on hemodialysis compared with peritoneal dialysis[21,22]. However, these studies broadly examined quality of life without a specific focus on systematically examining the

independent association of RRT modality with patients' physical activity, freedom, and their abilities to participate in key activities of daily living, such as their abilities to work, travel, and participate in social and recreational activities, all important but distinct aspects which contribute to patients' global quality of life. Patients with ESRD and their families view information about the influence of RRT selection on these life activities as important to include in educational material informing patients' RRT selection decisions[23]. Systematic reviews summarizing evidence of associations between RRT modality choice and patients' abilities to participate in these important life activities could therefore greatly enhance informed decisions about RRT selection.

We performed a systematic literature review to provide an evidence-based summary of the association of patients' RRT modality with their rates of life participation activities across a variety of outcomes measures, settings, and patient populations.

Methods

Study Design

We performed a systematic review of published, peer-reviewed studies describing differences in rates of five types of activities reflecting various aspects of life participation (i.e., physical function, travel, recreation, freedom, and work outcomes) reported by adults with ESRD receiving different RRTs. We assessed factors that could influence the validity of study findings, and we quantified the direction and magnitude of differences in life participation outcomes among patients receiving different RRTs.

Populations Studied

Eligible articles reported on adults receiving RRT (hemodialysis, peritoneal dialysis, and kidney transplantation). Hemodialysis modalities considered eligible in our study included both in-center hemodialysis and 'non-specific' hemodialysis (i.e., patients on in-center hemodialysis plus one or more alternative modes of hemodialysis, such as satellite hemodialysis, home hemodialysis, nocturnal dialysis, etc.). We included both deceased donor and living donor kidney transplantation.

Data Sources and Literature Search Strategy

We identified studies potentially eligible for inclusion in our review through a search of all studies in PubMed, EMBASE, and the Cochrane Library (trials only) from January 1980 through April 2012. An expert methodologist and content experts within our team developed comprehensive search strategies to identify relevant studies. Our search terms consisted of key words for each treatment modality and terms for each of the five life participation outcomes. We hand-searched bibliographies of all potentially-relevant studies to identify additional articles that our electronic search might have missed. Our initial hand search of bibliographies revealed that there were missed studies reporting primarily on 'quality of life' outcomes but also reporting relevant life participation outcomes as secondary outcomes. Thus, we repeated our electronic search with additional terms consisting of key words to identify studies primarily reporting on 'quality of life' outcomes. We conducted this expanded search in all three databases and screened all studies for their potential inclusion in our review. The detailed search strategies are included within Table S1 (provided as online supplementary material).

We identified studies as reporting on physical function outcomes if they reported data on patients' limitations in performing activities of daily living, patients' self-reported physical functioning assessed via quality of life sub-scales (e.g., in SF-36), or other measures of physical activity. We identified studies as reporting on travel outcomes if they reported on

patients' travel abilities or restrictions. We identified studies as reporting on recreation outcomes if they reported on patients' abilities to engage in recreational or social activities (e.g., in SF-36). We identified studies as reporting on freedom outcomes if they reported on patients' perceived independence, ability to perform usual tasks, or intrusiveness. We identified studies as reporting on work outcomes if they reported on employment status or working capacity.

Study Inclusion and Exclusion Criteria, Data Extraction

We reviewed titles and abstracts of identified citations for potential inclusion. We then reviewed the full text of any citation deemed potentially relevant. We included studies if they reported on relevant outcomes (physical function, travel, recreation, freedom, and work) as a primary or secondary outcome, and if they compared relevant outcomes for participants on at least two different ESRD treatment modalities (i.e., hemodialysis, peritoneal dialysis, or kidney transplantation). We excluded articles if they 1) were not written in English, 2) did not include relevant outcomes, 3) included only participants younger than 18 years old, 4) contained no original data (i.e. review, commentary, editorial, meeting abstract, or letter) 5) were case reports, or 6) did not compare differences in relevant outcomes among patients receiving different RRT modalities. We also excluded studies of special populations (e.g., studies including only home hemodialysis patients but not in-center hemodialysis patients) to prevent expected small study size bias. For each article that met our inclusion criteria, two reviewers independently extracted data, including information on study design, follow-up, RRT modalities compared, locations, sample sizes, participant characteristics, and outcomes. Reviewers resolved disagreements by discussion and adjudication with a third party.

Classification of Study Designs

We classified eligible studies into one of four main design types: randomized controlled trial (RCT), longitudinal cohort (prospective/retrospective), cross sectional, and pre-post transplantation[24]. We classified a study as RCT if it contained two or more groups receiving different RRT modalities, and patients were randomly allocated to RRT modality as indicated by investigators. We classified a study as cohort if there were at least two groups receiving different RRT modalities (without random allocation), and investigators reported repeated assessments of relevant outcomes. Such studies could be prospective or retrospective in nature. We classified a study as cross-sectional if there were at least two groups receiving different RRT modalities (without random allocation), and investigators assessed relevant outcomes at only one point in time. Finally, we classified a study as pre-post transplantation if there was only a single group of kidney transplant recipients, and investigators reported relevant outcomes for patients both prior to and after receiving kidney transplants (i.e., at least two assessments of relevant outcomes with participants serving as their own controls). For this design, we only included studies where investigators explicitly described which RRT modality patients received prior to transplantation.

Assessment of Studies' External and Internal Validity for Relevant Outcomes

Two reviewers used a modified version (Item S1) of a previously published instrument[25] to independently assess studies' reporting on factors which could influence the validity of findings, including studies' external validity (i.e., inclusion and exclusion criteria, recruitment response rate) and factors influencing studies' internal validity (i.e., potential for selection bias, validity and appropriateness of outcome assessment, and rigor of statistical analyses to account for potential confounding). We considered studies to have described the inclusion and exclusion criteria well if they clearly reported their criteria or if they specified that all consecutive subjects were enrolled. We also categorized studies' response rates (<45%, 45%–59%, 60%–79%, or ≥80%), and we considered adequate response rates to be

present if they reported 60% or greater response. We considered studies to have minimal potential for selection bias if investigators reported no significant or only minor differences in participant characteristics that could influence relevant outcomes. We considered assessments of relevant outcomes to be valid if studies clearly defined ascertainment of relevant outcomes using standard and previously validated instruments. We considered studies' statistical analyses to have been appropriately conducted if analyses attempted to account for factors potentially confounding the association between participants' RRT modality and relevant outcomes (e.g., using multivariable adjustment within regression models), or if important confounding was unlikely within studies. Two reviewers independently assessed study quality, and reviewers resolved disagreements with the aid of a third party.

Data Synthesis and Analysis

We decided *a priori* not to statistically combine results in a meta-analysis because we expected studies to be methodologically and clinically diverse. For instance, some studies reported outcomes as means on scales (e.g. SF-36 physical function score) while others reported the percentage of participants achieving a particular physical activity threshold or percentage of patients who were employed. Therefore, we qualitatively synthesized results for individual studies within summary evidence tables to help clarify the similarities and differences among studies that appear to address similar research questions across a variety of measures and patient populations.

In an effort to assess the magnitude and direction of reported associations in a standard manner across studies reporting these heterogeneous outcomes, we calculated Cohen's d effect size indices and 95% confidence intervals (CIs) for each treatment comparison using Microsoft Excel spreadsheets containing published formulas for calculations[26,27]. Cohen's d is an index commonly used in research synthesis that represents the sample estimate of the standardized mean difference in outcomes between groups reported within studies[26]. We classified statistically significant Cohen's d effect sizes as small (0.2–0.49), moderate (0.5–0.79), or large (≥ 0.8) using standard criteria[28]. We considered a two-sided p-value of <0.05 to be statistically significant for studies that reported p-values for results of analyses testing differences in relevant outcomes. We used the calculated 95% CI of the Cohen's d effect size to determine statistical significance for studies that did not report p-values for results[29]. We considered 95% CIs that did not contain zero to be statistically significant. We considered non-statistically significant results to indicate that RRT modalities were no different with respect to life participation outcomes.

Results

Search Results

Our electronic search of potentially relevant citations identified 2,247 in PubMed, 2,662 in EMBASE, and 356 (trials) in the Cochrane Library. After reviewing a total of 5,265 titles and abstracts identified through our electronic searches, 189 articles were eligible for full text review. We retained 36 articles that met our inclusion criteria. Our hand-search of bibliographies yielded an additional 10 articles. We included a total of 46 studies in the final review[2,7,9,19,20,30–70]. (Figure 1)

Studies' Characteristics

Eligible studies were conducted over a period of some 3 decades (1985–2011), with greater than half published since 2000. The studies were heterogeneous in design (6 cohort, 38 cross-sectional, and 2 pre-post transplantation), their sample sizes (ranging from 46 to 18,015 total participants), and their participants' demographic characteristics.

Approximately one third of studies were performed in the United States, while the remaining studies were from the United Kingdom, Malaysia, Thailand, Iran, Greece, Japan, The Netherlands, Turkey, Denmark, Taiwan, Poland, Italy, Spain, Australia, and Germany. (Table 1) We also collected data on additional patient characteristics, such as mean treatment time, primary ESRD cause, employment status, and education. Unfortunately, these data were not systematically reported within the articles, and thus we included these data within Table S2.

Factors Influencing Studies' Internal and External Validity

Most studies described their inclusion and exclusion criteria well (Table S3). A majority of studies reported response rates of 60% or greater and conducted valid outcome assessments. However, many studies were influenced by potential selection bias. Also, the comparative groups of participants within many studies were deemed to be different enough in aspects other than selection of RRT modality such that observed associations between RRT modality and life participation activities could be confounded by group differences. Few studies were judged to have performed appropriate statistical analyses to account for these differences, which could potentially confound observed associations between study participants' RRT modalities and life participation outcomes. (Table 2)

Measures Used to Assess Associations between RRT Modality and Life Participation Outcomes

Studies used a variety of measures to capture life participation outcomes. Physical function was measured using several tools, including the SF-36 physical functioning and role physical measures, author-developed difficulties in activities of daily living and physical well-being scales, and Karnofsky self-reported scores[2,7,9,20,30–32,35–38,40,43–49,51–58,60–69]. Travel was measured using the CHOICE (Choices for Healthy Outcomes in Caring for ESRD) Health Experience Questionnaire (CHEQ), and the Thai version of the CHEQ[2,30]. Recreation was measured using several tools, including the SF-36 social functioning measure, Thai CHEQ, Intrusiveness Ratings Scale, Sickness Impact Profile, and author-developed patient questionnaires [2,9,20,30,33,35,36,38,41,42,45,48,49,52,55,58,59,64–67]. Freedom was measured using several tools, including the CHEQ, Thai CHEQ, Renal Treatment Satisfaction Questionnaire, Index of Well-Being and author-developed social well-being scale[2,20,30,32,34,41,55,62]. Work was also measured using several tools, including the CHEQ, Thai CHEQ, Sickness Impact Profile, Intrusiveness Ratings Scale, and patient-reported work status[2,9,19,20,30,38,39,42,53,55,58,70]. We provide a detailed description of the included outcome measures (i.e., whether the measure is validated, outcome type, range of scores, and whether a higher score indicates a better outcome) within Table S4.

Comparison of Life Participation Activities

Patients Receiving Hemodialysis Versus Peritoneal Dialysis—A total of 39 studies evaluated life participation activities between patients receiving hemodialysis compared to patients receiving peritoneal dialysis[2,9,16,19,20,30,32–36,38,41,42,44–53,55–57,59,61–63,65–70]. Most studies reported on multiple outcomes, thus providing 41 physical function, 2 travel, 18 recreation, 8 freedom, and 13 work-related comparisons. The majority of comparisons demonstrated no significant differences in physical function outcomes (76%), recreation outcomes (78%), freedom outcomes (75%), and work outcomes (69%). (Table 3) These findings of no differences in outcomes were consistent across study designs, location, and quality ratings with 100% of comparisons from cohort studies, 81% of comparisons from US-based studies, 83% of comparisons from studies that properly adjusted for potential confounders, and 70% of comparisons from studies published after 2000 favoring neither RRT modality. (Table 4)

Patients Receiving Hemodialysis Versus Transplant Recipients—A total of 22 studies evaluated life participation activities between patients receiving hemodialysis compared to patients with kidney transplants[9,19,20,31–34,37,38,40,43–45,51–55,58,60,63,66]. Most studies reported on multiple outcomes, thus providing 26 physical function, 7 recreation, 4 freedom, and 6 work-related comparisons. The majority of comparisons demonstrated small to large differences in activities among patients with kidney transplants compared to patients receiving hemodialysis, with transplant patients having better physical function (90%), freedom (100%), and work outcomes (100%). (Table 5) These findings of better outcomes in transplant patients were observed among 71% of comparisons from cross-sectional studies, 100% of comparisons from US-based studies, 57% of comparisons from studies that properly adjusted for potential confounders, and 65% of comparisons from studies published after 2000 favoring kidney transplantation. (Table 4)

Patients Receiving Peritoneal Dialysis Versus Transplant Recipients—A total of 17 studies evaluated life participation activities between patients receiving peritoneal dialysis compared to patients with kidney transplants[9,19,20,32–34,38,43–45,51–53,55,63,64,66]. Most studies reported on multiple outcomes, thus providing 21 physical function, 7 recreation, 4 freedom, and 5 work-related comparisons. The majority of comparisons demonstrated small to large differences in activities among patients with kidney transplants compared to patients receiving peritoneal dialysis, with transplant patients having better physical function (90%), freedom (100%), and work outcomes (100%). (Table 6) These findings of better outcomes in transplant patients were observed among 76% of comparisons from cross-sectional studies, 100% of comparisons from US-based studies, 50% of comparisons from studies that properly adjusted for potential confounders, and 65% of comparisons from studies published after 2000 favoring kidney transplantation. (Table 4)

Discussion

In this systematic review, a majority of studies consistently reported better physical functioning, greater engagement in social and recreational activities, greater independence, and better ability to work among patients with kidney transplants compared to patients receiving dialysis. Included studies did not report significant differences in outcomes between patients receiving hemodialysis and patients receiving peritoneal dialysis. Studies used a variety of measures to assess outcomes and were conducted among patients from diverse demographic backgrounds and clinical settings.

To our knowledge, this is the most comprehensive and recent systematic review to explore differences in rates of life participation activities among patients receiving various RRT modalities. With a carefully designed literature search and rigorous methods, we synthesized the results of 46 studies published over nearly three decades. Our findings, which summarize evidence on a broad range of life participation outcomes, should help patients and physicians better understand the quality and quantity of evidence available to inform their RRT selection choices. Outcomes were assessed both objectively (e.g. symptom-limited graded cycle ergometry tests) and subjectively reported by patients themselves (e.g. patient-reported questionnaires). We found that the magnitude and direction of associations we observed were similar for subjective patient-reported outcomes and objective clinical outcome measures. This may provide evidence of the importance and intrinsic similarity of both subjective and objective measurements, which attempt to comprehensively capture the extent to which patients are able to assimilate normal activities after initiating therapies.

As with every systematic review, the strength of our conclusions depends on the quality of available studies. Substantial limitations in the studies we identified indicate the evidence should be interpreted with caution. First, a majority of the studies reported outcomes at a

single time point among patients often being observed for other (i.e. non-life participation) primary outcomes. Thus, we were only able to assess potential associations (versus true causal links) between RRT modality and outcomes of interest. It is possible that other important clinical characteristics influencing patients' initial selection of RRT modalities (e.g., comorbid disease burden and medical eligibility for certain RRT modalities) could have also influenced their rates of life participation. For instance, patients enrolled in these studies who had received kidney transplants could have been healthier than those who may not have received kidney transplants. Studies variably accounted for these and other related factors, such as the presence or absence of diabetes or peripheral vascular disease, which could influence observed associations between RRT modality and rates of life participation. Ideally, randomized controlled trials would be performed to quantify differences in life participation among patients randomly selected to receive different RRTs. However, the feasibility of performing such trials is low, particularly since choice of RRT is influenced by a variety of factors, including patient and provider preferences, patients' families' capacities to support certain RRTs (e.g., managing peritoneal dialysis supplies and equipment at home), and patients' medical suitability for transplants. One randomized trial conducted to compare mean quality-adjusted life-year (QALY) and survival among patients receiving hemodialysis compared to peritoneal dialysis reported statistically-equivalent QALY scores between the two groups of patients; however, the trial was prematurely stopped due to low inclusion rate[71].

Additional potential limitations deserve consideration. First, we excluded non-English articles, which could introduce potential language bias. However, only 15% of potential articles were not published in English, and our included studies were conducted among a heterogeneous patient population representing 16 distinct locations worldwide. Therefore, we anticipate that the exclusion of these non-English articles will not significantly change our observed findings. Second, our review did not fully assess some potential treatment characteristics that might influence life participation outcomes, such as treatment intensity. Third, several of our included studies were identified from our hand-search of bibliographies but were not retrieved through our initial search of electronic databases. Although our electronic search yielded 5,265 citations that were potentially content-relevant, many of these studies were excluded due to a lack of comparative reporting of outcomes. We encountered difficulties devising electronic search terms to explicitly distinguish studies that are both content-relevant and inherently comparative in nature (i.e., reported relevant outcomes by RRT modality). Further, we speculate that some missed articles may have also been indexed prior to the inclusion of key search terms (e.g., MeSH headings and subheadings in PubMed) for our outcomes of interest[72]. Finally, we did not seek unpublished data from investigators who may have studied life participation among patients on RRT. It is possible studies reporting better outcomes among patients with transplants were more likely to be published. Notwithstanding these limitations, we believe our review provides a comprehensive summary of the most recent evidence regarding rates of life participation among patients receiving various RRTs and could serve as a valuable resource to patients and clinicians seeking to understand the current state of evidence informing this area.

In summary, a majority of studies reported better rates of life participation among patients with kidney transplants compared to patients receiving dialysis. Studies reported no significant differences in activities among patients receiving hemodialysis and patients receiving peritoneal dialysis. Many studies featured significant weaknesses in their design, limiting inferences. Rigorously performed studies incorporating randomized or longitudinal designs allowing for causal inferences and appropriately accounting for factors which could confound observed differences in outcomes among patients on different RRTs could better guide patients' and nephrologists' selection decisions.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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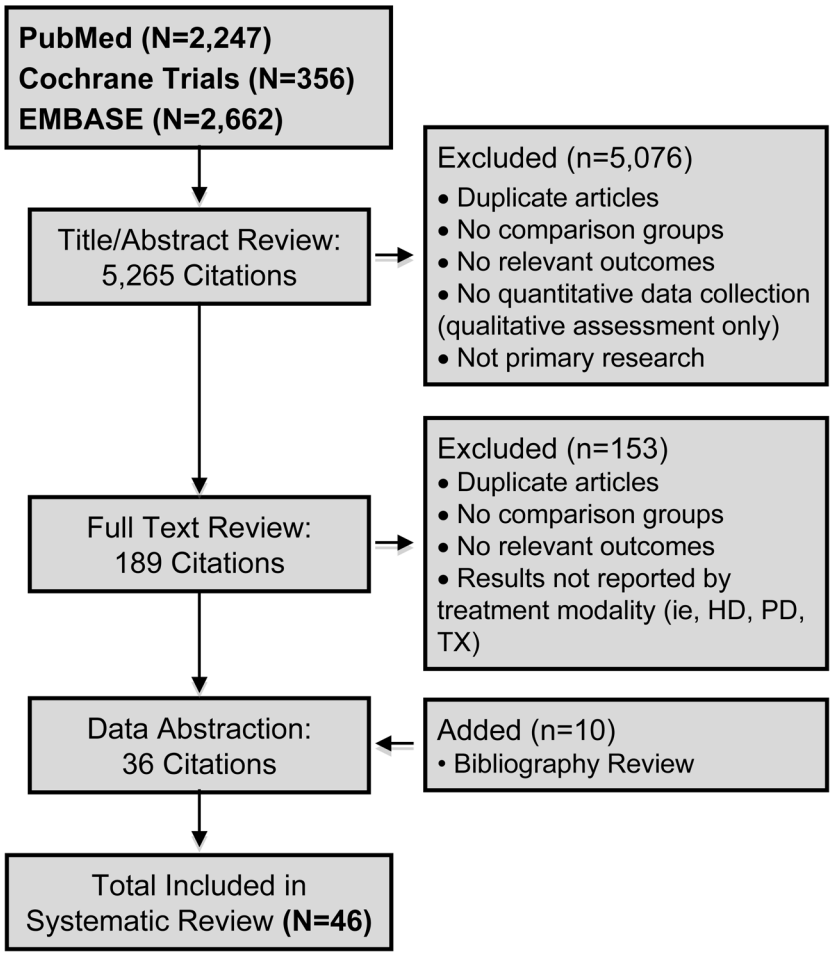

Figure 1.
Summary of Literature Search and Article Review Process

Table 1

Study Characteristics and Outcome Domains Addressed

Study	Earliest Year of Study Data	Location	Study Design (Follow Up)	Treatment Modality	Sample Size	Patient Demographics				Outcome Domains				
						Age (y)	Female Sex	US Racial/Ethnic Minority	Married*	Physical	Travel	Rec	Freedom	Work
2011 Ibrahim	2011	Malaysia; Multi-Site	Cross-Sectional	HD	183	37.6% aged 51–60 y	48.5%	N/A	75.9%	X		X		
				PD	91									
2010 Johansen	2005	US; Multi-Site	Cross-Sectional	HD	161	M:60.7 ±14.6; F: 59.8 ±13.8	45%	M: 28%; F: 36%	N/R	X				
				PD	1,386									
2009 Aiyasanon	2005	Thailand; Single-Site	Cross-Sectional	HD	87	54.05	49.4%	N/A	66.7%	X	X	X	X	X
				PD	23	61.39	47.8%	N/A	69.6%					
2009 Alavi	2007	Iran; Single-Site	Cross-Sectional	HD	63	55.3 ± 14.5	55.6%	N/A	81%	X				
				TX	100	40.6 ± 14	41%	N/A	77%					
2009 Borowiak	2009	Poland; Multi-site	Cross-Sectional	HD	50	59.6 ± 13.4	56%	N/A	N/R	X			X	
				PD	50	58.9 ± 13.2	48%							
2009 Kontodimoloulos	N/R	Greece; Multi-Site	Cross-Sectional	HD	642	58.1 ± 14.9	38.7%	N/A	65.7%	X		X		
				PD	65	58.7 ± 12.9	49.2%	N/A	75.4%					
				TX	167	43.7 ± 12.5	39.5%	N/A	63.6%					
2009 Masuda	2009	Japan; Single-Site	Cross-Sectional	HD	35	58.3 ± 14.7	31.4%	N/A	N/R	X				
				PD	26	47.5 ± 14.2	46.2%							
2009 Panagopoulou	2009	Greece; Single-Site	Pre-Post Tx	HD	40	57 ± 25	50%	N/A	67.5%					X
				PD	36	59 ± 25	41.6%	N/A	72.2%					
				TX	48	39 ± 20	33%	N/A	47.9%					
2009 Thong	1997	Netherlands; Multi-Site	Cross-Sectional	HD	1010	63.2 ± 13.8	43.3%	N/A	65%	X				
				PD	543	53.3 ± 14.6	36.1%	N/A	73.5%					
2009 Basok	N/R	Turkey; Single-Site	Cross-Sectional	HD	24	43.08 ± 12.44	100%	N/A	N/R	X		X		
				PD	21	45.19 ± 8.92								
				TX	20	36.45 ± 8.55								
2007 Apostolou	2007	Greece; Single-Site	Cross-Sectional	PD	26	53.6 ± 12.7	42.3%	N/A	65%	X		X		
				TX	20	49.2 ± 11.4	50%	N/A	89%					
2007 Molsted	N/R	Denmark; Single-Site	Cross-Sectional	HD	71	59 ± 16	24%	N/A	N/R					X

Study	Earliest Year of Study Data	Location	Study Design (Follow Up)	Treatment Modality	Sample Size	Patient Demographics				Outcome Domains				
						Age (y)	Female Sex	US Racial/Ethnic Minority	Married*	Physical	Travel	Rec	Freedom	Work
				PD	59	59 ± 13	44%							
2007 Sayin	2007	Turkey; Single-Site	Cross-Sectional	HD	75	46.91 ± 15.77	28%	N/A	74.7%	X		X		
				PD	41	46.15 ± 15.29	61%	N/A	70.7%					
				TX	20	33.15 ± 10.61	65%	N/A	45.0%					
2006 Juergensen	N/R	US; Multi-Site	Cross-Sectional	HD	84	69.6 ± 13.3	N/R	20%	60%			X		
				PD	62	55 ± 14	N/R	17%	57%					
2006 Ogutmen	2003	Turkey; Multi-Site	Cross-Sectional	HD	64	48.14 ± 15.5	42.2%	N/A	70%	X		X		
				PD	207	46.00 ± 13.88								
				TX	302	38.22 ± 11.52								
2005 Barendse	N/R	UK; Single-Site	Cross-Sectional	HD	35	52.8 ± 14.3	39%	N/A	76%				X	
				PD	57									
				TX	46									
2005 Kutner	1996	US; Multi-Site	Prospective Cohort (1 y)	HD	455	61.2 ± 15.6	43.3%	29.9%	53.4%	X				
				PD	413	56.1 ± 14.7	47.2 %	19.9%	65.6%					
2005 Lee	2002	UK; Single-Site	Cross-Sectional	HD	99	M: 62.4 ± 14.5; F: 64.0 ± 13.8	39%	N/A	N/R	X		X	X	X
				PD	74	M: 63.5 ± 13.6; F: 53.7 ± 15.5	49%							
				TX	209	M: 53.6 ± 13.8; F: 51.6 ± 14.1	40%							
2005 Niu	2002	Taiwan; Multi-Site	Cross-Sectional	HD	80	54.7 ± 13.5	57.9%	N/A	72.5%	X				
				PD	80	50.8 ± 12.2								
				TX	80	43.3 ± 8.8								
2005 Van de Ham	N/R	Netherlands; Multi-Site	Cross-Sectional	HD	16	49.0 ± 11.9	48.57%	N/A	N/R	X				
				TX	35	52.3 ± 10.4	37.5%							
2004 Wu	1995	US; Multi-Site	Prospective Cohort (1 y)	HD	698	54	48%	37%	51%	X	X	X	X	X
				PD	230	59	46%	20%	67%					
2003 Manns	1999	UK; Single-Site	Prospective Cohort (1 y)	HD	151	62.2	13%	N/A	64%	X		X		
				PD	41	56.1	80%	N/A	70%					

Study	Earliest Year of Study Data	Location	Study Design (Follow Up)	Treatment Modality	Sample Size	Patient Demographics				Outcome Domains				
						Age (y)	Female Sex	US Racial/Ethnic Minority	Married*	Physical	Travel	Rec	Freedom	Work
2003 Tomasz	N/R	Poland; Single-Site	Cross-Sectional	HD	61	57.84 ± 11.85	39.34%	N/A	14.75%	X		X		X
				TX	83	43.3 ± 11.73	48.19%	N/A	71.08%					
2002 Baiardi	1997	Italy; Single-Site	Prospective Cohort (16+ mo)	HD	171	61.9 ± 13.4	37.4%	N/A	N/R	X				
				PD	30	64.0 ± 15.7	36.7%							
				TX	34	44.0 ± 12.0	35.3%							
2002 Harris	2002	UK; Multi-Site	Prospective Cohort (1 y)	HD	96	77.0 ± 4.4	38%	N/A	N/R	X				
				PD	78	76.8 ± 4.0	30%							
2000 Carmichael	N/R	UK; Single-Site	Cross-Sectional	HD	49	57.8 ± 13	34.7%	N/A	71.4%	X		X		
				PD	97	57 ± 15	40.2%	N/A	70.1%					
2000 Diaz-Buxo	1996	US; Multi-Site	Cross-Sectional	HD	16,755	59.44 ± 15.28	48.22%	47.07%	N/R	X		X		
				PD	1,260	53.45 ± 15.31	49.52%	31.03%						
2000 Fujisawa	N/R	Japan; Multi-Site	Cross-Sectional	HD (awaiting TX)	114	45.8 ± 11.9	24%	N/A	N/R	X				
				HD (not awaiting TX)		45.7 ± 6.8	31%							
				TX	117	43.9 ± 9.1	57%							
1999 Merkus	1993	Netherlands; Multi-Site	Cross-Sectional	HD	120	59 ± 16	43%	N/A	N/R	X		X		
				PD	106	52 ± 14	35%							
1998 Jofre	1993	Spain; Multi-Site	Pre-Post Tx	Pre-TX (HD)	93	45 ± 13.2	45%	N/A	N/R	X				
				Post-TX										
1997 Merkus	1997	Netherlands; Multi-Site	Cross-Sectional	HD	120	59.3 ± 15.5	43%	N/A	68%	X		X		
				PD	106	52.3 ± 14.0	35%	N/A	79%					
1996 Curtin	1996	US; Multi-Site	Cross-Sectional	HD	238	43 ± 10.6	50.1%	49.6%	N/R					X
				PD	30									
1996 Lok	N/R	Australia; Single-Site	Cross-Sectional	HD	56	42.5	37.5%	N/A	N/R	X				
				PD	8									
1995 Khan	N/R	UK; Single-Site	Cross-Sectional	HD	43	48.8	41.6%	N/A	N/R	X				
				PD	27									
				TX	102									
1995 Tell	N/R	US; Single-Site	Cross-Sectional	HD (in-center)	186	54.9 ± 15.3	52%	51%	M: 70%; F: 49%	X				

Study	Earliest Year of Study Data	Location	Study Design (Follow Up)	Treatment Modality	Sample Size	Patient Demographics				Outcome Domains				
						Age (y)	Female Sex	US Racial/Ethnic Minority	Married*	Physical	Travel	Rec	Freedom	Work
				HD (home)	12									
				PD	58									
1994 Holley	1993	US; Single-Site	Cross-Sectional	HD	46	N/R	53%	48%	N/R					X
				PD	31									
1992 Pietrabissa	1982	Italy; Single-Site	Cross-Sectional	HD	172	N/R	N/R	N/A	N/R	X				
				TX	71									
1991 Tucker	N/R	US; Single-Site	Cross-Sectional	HD	22	50.4 ± 13.8	62%	72%	62%			X		
				PD	29	47.1 ± 13.9	45%	27%	73%					
1990 Devins	N/R	Canada; Single-Site	Prospective Cohort** (6 wk)	HD (in-center)	39	41	42%	N/A	63%			X		X
				HD (home)	15									
				PD	11									
				TX	34									
1990 Koch	N/R	Germany; Multi-Site	Cross-Sectional	HD	290	50.1	43%	N/A	68%	X				
				PD	68	51.8	32%	N/A	79%					
				TX	761	43.5	41%	N/A	70%					
1990 Simmons	1970	US; Multi-Site	Cross-Sectional	HD	83	Range, 19–56	N/R	N/R	N/R	X		X	X	X
				PD	510									
				TX (current)	91									
				TX (historical)	82									
1989 Bremer	N/R	US; Multi-Site	Cross-Sectional	HD (in-center)	105	57.1 ± 13.4	49%	38%	N/R			X		
				HD (self-care)	41	54.5 ± 11.4	46%	37%						
				HD (home)	47	53.2 ± 12.9	49%	19%						
				PD	79	54.9 ± 13.7	35%	13%						
				TX (first)	166	37.6 ± 11.4	42%	15%						
				TX (failed)	30	36.3 ± 10.3	60%	20%						
				TX (>1)	21	31.2 ± 8.3	38%	10%						
1989 Julius	1984	US; Multi-Site	Cross-Sectional	HD	95	60% >44 y	41.1%	49.5%	61.1%				X	
				PD	119	60.5% >44 y	48.7%	23.3%	63.0%					

Study	Earliest Year of Study Data	Location	Study Design (Follow Up)	Treatment Modality	Sample Size	Patient Demographics				Outcome Domains				
						Age (y)	Female Sex	US Racial/Ethnic Minority	Married*	Physical	Travel	Rec	Freedom	Work
1988 Wolcott	N/R	US; Multi-Site	Cross-Sectional	HD	33	47.4 ± 15.1	30%	39%	49%	X				
				PD	33	46.2 ± 14.4	30%	33%	64%					
1987 Hart	N/R	US; Multi-Site	Cross-Sectional	HD (in-center)	347	51.9	50%	46.5%	N/R		X		X	
				HD (home)	287	47.0	35.9%	13.6%						
				PD	81	49.8	54.3%	16.1%						
				TX	144	37.2	43.8%	16.6%						
1985 Evans	N/R	US; Multi-Site	Cross-Sectional	HD (in-center)	347	47.6	44.5%	27.2%	NR				X	
				HD (home)	287				75%					
				PD	81				75%					
				TX	44				66.7%					

Note: Unless otherwise indicated, age is given as mean or mean ± standard deviation; other patient demographics given as percentage.

HD = hemodialysis; PD = peritoneal dialysis; Tx = transplant; M=Male; F=Female; NR = not reported; NA = not applicable; US, United States; UK, United Kingdom; Physical, physical functioning; Rec, recreation;

*Or Living with a Partner.

Table 2

Summary of Study Quality Assessment for Relevant Outcomes

Outcome Domain	Total Articles	Well-Described Criteria*	Response Rate >60%	Minimal Risk of Bias**	Valid Outcome Assessment	Appropriate Adjustment^
Physical Function	35	25 (71%)	18 (51%)	6 (17%)	34 (97%)	13 (37%)
Travel	2	2 (100%)	1 (50%)	2 (100%)	2 (100%)	1 (50%)
Recreation	20	15 (75%)	13 (65%)	5 (25%)	19 (95%)	5 (25%)
Freedom	7	6 (86%)	3 (43%)	3 (43%)	7 (100%)	1 (14%)
Work	13	8 (61%)	8 (61%)	2 (15%)	13 (100%)	4 (31%)

Note: Quality Assessment: number of articles that met criteria (% of total articles)

* Inclusion and exclusion criteria

** Selection bias.

^ For potential confounders. Total articles.

Table 3

Physical Function and Life Participation Outcome Measures and Study Results: HD versus PD

Study; Design	Outcome Measure	HD		PD			Statistical Results		Treatment Favored
		N	Estimate@	N	Estimate@	Reported P**	Effect Size^	Calculated CI****	
	Physical Function								
Aiyasanon; 2009; CS	Thai SF-36 Physical Functioning	87	52	23	29	0.001	0.79	----	**HD**
Aiyasanon; 2009 (CS)	Thai SF-36 Role Physical	87	37	23	17	<0.05	0.46	----	**HD**
Aiyasanon; 2009 (CS)	CHEQ (Thai) Role Physical	87	77	23	59	0.001	0.79	----	**HD**
Tell; 1995 (CS)	Karnofsky self-report	186	72.9	58	78	0.02	−0.34	----	**PD**
Masuda; 2009 (CS)	Average no. steps/d	35	3,391	26	6,336	<0.05	−0.83	(−4784.1, −1105.9)	**PD**
Merkus; 1997 (CS)	SF-36 Physical Functioning	120	50.7	120	60.9	<0.05	−0.37	(−17.3, −3.1)	**PD**
Merkus; 1999 (CS)	SF-36 Physical Functioning	120	50.7	106	60.9	<0.05	−0.36	----	**PD**
Ogutmen; 2006 (CS)	SF-36 Role Physical	64	35.71	207	55.10	<0.05	−0.43	(−32.1, −6.7)	**PD**
Thong; 2009 (CS)	SF-36 Physical Functioning	1,010	48.3	543	61.2	<0.05	−0.47	(−15.8, −10.0)	**PD**
Thong; 2009 (CS)	SF-36 Role Physical	1,010	25.9	543	35.7	<0.05	−0.26	(−13.7, −5.9)	**PD**
Harris; 2002 (Cohort)	UK-version SF-36 PCS	96	31.6	78	32.0	0.2	−0.03	----	----
Kutner; 2005 (Cohort)	SF-36 Physical Functioning	32	N/R	141	N/R	0.3	−3.48	---	---
Kutner; 2005 (Cohort)	SF-36 Role Physical	32	N/R	141	N/R	0.3	−2.90	---	---
Wu; 2004 (Cohort)	SF-36 Physical Functioning	452	1.0#	133	0.72#	0.1	---	----	---
Wu; 2004 (Cohort)	SF-36 Role Physical	452	1.0#	133	0.84#	0.7	---	----	---
Baiardi; 2002 (CS) ***	SF-36 Physical Functioning	171	59.3	30	59.7	N/R	−0.01	(−11.2, 10.4)	----
Basok; 2009 (CS)	SF-36 Physical Functioning	24	62.27	21	56.61	N/R	0.25	(−7.9, 19.2)	----
Basok; 2009 (CS)	SF-36 Role Physical	24	58.83	21	39.29	N/R	0.46	(−6.1, 45.2)	----
Borowiak; 2009 (CS)	EQ 5D (mobility)	50	38##	50	44##	NS	−0.14	(−0.6, 0.3)	----
Carmichael;2000 (CS)	SF-36 Physical Functioning	49	44.4	97	40.3	NS	0.13	(−6.4, 14.6)	---
Carmichael;2000 (CS)	SF-36 Role Physical	49	21.4	97	19.7	NS	0.05	(−9.8, 13.2)	---
Devins; 1990 (CS) ***	Author-developed difficulties in ADL scale	39	2	11	2.6	NS	−0.40	(−1.6, 0.4)	---
Diaz-Buxo; 2000 (CS)	SF-36 Physical Functioning	16,755	41.4	1,260	42.1	N/R	−0.11	(−2.4, 1.0)	---

Study; Design	Outcome Measure	HD		PD			Statistical Results		Treatment Favored
		N	Estimate@	N	Estimate@	Reported P**	Effect Size^	Calculated CI****	
Diaz-Buxo; 2000 (CS)	SF-36 Role Physical	16,755	33.1	1,260	33	N/R	−0.01	(−2.4, 2.1)	---
Ibrahim; 2011 (CS)	SF-36 Physical Functioning	183	72.568	91	75.275	N/R	−0.15	(−7.2, 1.8)	----
Ibrahim; 2011 (CS)	SF-36 Role Physical	183	68.443	91	76.786	N/R	−0.41	(13.5, −3.2)	----
Koch; 1990 (CS)	Satisfaction with physical function	290	0.51	68	0.47	N/R	0.09	(−0.2, 0.4)	---
Kontodimopoulos; 2008 (CS)	Greek SF-36 Physical Functioning	642	49.2	65	49.2	0.9	0.00	(−7.8, 7.8)	---
Kontodimopoulos; 2008 (CS)	Greek SF-36 Role Physical	642	40.3	65	30.9	0.08	0.21	(−1.8, 20.6)	---
Lee; 2005 (CS)	SF-36 Physical Functioning	99	26.5	74	30.9	NS	−0.16	(−12.9, 4.1)	---
Lee; 2005 (CS)	SF-36 Role Physical	99	60.4	74	60.6	NS	0.00	(−13.4, 12.9)	---
Lok; 1996 (CS)	HD Stressor Scale	56	3.76	8	3.43	NS	0.32	(−0.4, 1.1)	---
Manns; 2003 (CS)	SF-36 Physical Functioning	151	46.2	41	40	0.2	0.22	----	---
Manns; 2003 (CS)	SF-36 Role Physical	151	27	41	29.3	0.7	−0.06	----	---
Merkus; 1997 (CS)	SF-36 Role Physical	106	28.6	106	31.7	NS	−0.08	(−13.3, 7.1)	----
Ogutmen; 2006 (CS)	SF-36 Physical Functioning	64	56.99	207	57.06	N/R	−0.83	(−46.9, −23.8)	---
Niu; 2005 (CS)	WHOQOL-BREF (Taiwan)	80	11.96	80	11.61	N/R	−0.99	(−0.4, 1.1)	---
Sayin; 2007 (CS)	SF-36 Physical Functioning	75	55.90	41	55.76	0.1	0.00	(−10.8, 11.1)	----
Sayin; 2007 (CS)	SF-36 Role Physical	75	40.69	41	39.10	0.9	0.04	(−13.7, 16.9)	----
Simmons; 1990 (CS)	Author developed physical well-being scale (summary score)	83	14.04	510	14.64	N/R	−1.00	(−1.5, 0.3)	---
Wolcott; 1988 (CS)	Karnofsky (clinical performance)	33	72.5	33	72.9	NS	---	---	---
Travel									
Aiyasanon; 2009 (CS)	CHEQ (Thai) (travel restrictions)	87	68	23	51	<0.05	0.46	----	**HD**
Wu; 2004 (Cohort)	CHEQ-Travel	452	1.0	133	1.07	0.8	−0.03	----	---
Recreation									
Carmichael;2000(CS)	SF-36 Social Functioning	49	44.9	97	53.2	<0.05	−0.29	(−18.2, 1.6)	**PD**
Ibrahim; 2011 (CS)	SF-36 Social Functioning	183	77.322	91	83.516	N/R	−0.31	(−11.3, −1.1)	**PD**
Lee; 2005 (CS)	SF-36 Social Functioning	99	36.7	74	46.5	<0.05	−0.33	(−18.8, 1.6)	**PD**
Tucker; 1991 (CS)	Quality of Life Assessment Battery (mean recreation/wk)	29	5.1	22	7.3	<0.05	−0.34	(−5.9, 1.5)	**PD**
Wu; 2004 (Cohort)	CHEQ (limitations to recreation)	452	1.0	133	0.85	0.5	0.06	----	---

Study; Design	Outcome Measure	HD		PD			Statistical Results		Treatment Favored
		N	Estimate@	N	Estimate@	Reported P**	Effect Size^	Calculated CI****	
Aiyasanon; 2009(CS)	CHEQ (Thai) (recreation)	87	65	23	62	NS	0.46	----	---
Basok; 2009 (CS)	SF-36 Social Functioning	24	68.75	21	63.69	0.1	0.19	(−10.8, 20.9)	---
Devins; 1990 (CS) ***	Intrusiveness Ratings Scale	39	2.5	11	3.2	NS	−0.51	(−1.6, 0.2)	---
Diaz-Buxo; 2000 (CS)	SF-36 Social Functioning	16,755	64	1,260	66.1	NS	−0.04	(−2.8, 0.6)	---
Hart; 1987 (CS)	Sickness Impact Profile	343	23.7	77	24	NS	−0.25	----	---
Juergensen; 2006 (CS)	Author developed questions (recreation)	84	4.95	52	5.12	NS	−0.09	(−0.8, 0.5)	---
Kontodimopoulos 2008 (CS)	Greek SF-36 Social Functioning	642	58.1	65	54.9	0.4	0.11	(−4.5, 10.9)	---
Manns; 2003 (CS)	SF-36 Social Functioning	151	60.7	41	62.2	0.8	−0.06	----	---
Merkus; 1997 (CS)	SF-36 Social Functioning	120	63.1	120	68.9	NS	−0.21	(−12.9, 1.3)	----
Merkus; 1999 (CS)	SF-36 Social Functioning	120	63.1	106	68.9	NS	−0.26	----	---
Ogutmen; 2006 (CS)	SF-36 Social Functioning	64	66	207	71.9	NS	−0.27	(−11.9, 0.3)	---
Sayin; 2007 (CS)	SF-36 Social Functioning	75	62.62	41	56.32	0.5	0.22	(−4.6, 17.2)	----
Simmons; 1990 (CS)	Author-developed scale	83	2.24	510	2.21	NS	0.03	(−0.2, 0.3)	---
Freedom									
Aiyasanon;2009 (CS)	CHEQ (Thai) (freedom)	87	57	23	42	<0.05	0.46	----	**HD**
Juergensen; 2006 (CS)	Author-developed scale (independence)	84	5.14	52	6.18	0.02	−0.41	----	**PD**
Wu; 2004 (Cohort)	CHEQ (freedom)	452	1.0	133	1.03	0.9	−0.01	----	---
Borowiak; 2009 (CS)	EQ-5D (usual activity)	50	40	50	46	NS	−0.13	(−0.6, 0.3)	----
Barendse; 2005 (CS)	Renal Treatment Satisfaction Questions	35	4.3	57	4.3	NS	0.00	(−0.7, 0.7)	---
Bremer; 1989 (CS)	Index of Well-Being (tied-down, free)	105	4.9	79	4.5	NS	−0.55	(−0.2, 1.0)	---
Lee; 2005 (CS)	EQ-5D (usual activities)	99	18.09	74	20.55	NS	−0.20	(−0.5, 0.1)	---
Simmons; 1990 (CS)	Author-developed social well-being scale	83	5.17	510	5.29	NS	−0.14	(−0.3, 0.1)	---
Work									
Evans; 1985 (CS)	Reported ability to work	347	44.8##	81	27.8##	N/R	0.41	(0.1, 0.7)	**HD**
Hart; 1987 (CS)	Sickness Impact Profile (work)	338	45	81	51	<0.01	−0.32	----	**HD**
Julius; 1989 (CS)	Reported working or looking	95	0.096##	119	0.227##	<0.05	−0.56	(−1.0, −0.1)	**PD**
Molsted; 2007 (CS)	KDQOL (work status)	71	17.9	59	33.6	<0.05	−0.42	(−28.8, −2.6)	**PD**

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Study; Design	Outcome Measure	HD		PD			Statistical Results		Treatment Favored
		N	Estimate@	N	Estimate@	Reported P**	Effect Size^	Calculated CI****	
Wu; 2004 (Cohort)	CHEQ (work)	452	1.0	133	1.17	0.5	−0.07	----	---
Aiyasanon; 2009 (CS)	CHEQ (Thai) (limitations to work)	87	67	23	57	NS	0.46	----	---
Curtin; 1996 (CS)	Percent of employed pts	311	23.4	42	28.6	0.2	−0.14	(−0.5, 0.2)	---
Devins; 1990 (CS)***	Intrusiveness Ratings Scale	39	4	11	3.6	NS	0.19	(−1.0, 1.8)	---
Hart; 1987 (CS)	Pt-reported work	46	0.37##	31	0.52##	NS	−0.34	(−0.8, 0.2)	---
Lee; 2005 (CS)	KDQOL (work status)	99	20	74	28.2	NS	−0.23	(−18.8, 2.4)	---
Panagopoulou2009 (CS)***	Pt-reported full time employment	40	0.05##	36	0.138##	N/R	−0.61	(−1.6, 0.3)	---
Panagopoulou2009 (CS)***	Pt-reported part-time employment	40	0.15##	36	0.17##	N/R	−0.08	(−0.8, 0.6)	---
Simmons; 1990 (CS)	Author developed scale (job)	83	2.18	510	2.38	NS	−0.17	(−0.5, 0.1)	---

@Estimates are means unless otherwise noted.

**Author-reported p-values.

^Calculated Cohen's d.

#Odds ratio.

##Percentage.

***denotes studies were originally designed as longitudinal cohort but authors only reported cross-sectional assessments of relevant outcomes

****We calculated the CI for the Cohen's d effect size difference for studies that reported all of the needed estimates (e.g., means plus standard deviations) We reported '---' for studies that we could not calculate the CIs for due to missing estimates.

Abbreviations and definitions: ADL, activities of daily living; CS, cross sectional study design; NS, not statistically significantly different at P>0.05 level; NR, not reported within the article; Pt, patient; Pts, patients; CI, confidence interval; HD, hemodialysis; PD, peritoneal dialysis; CHEQ, CHOICE (Choices for Healthy Outcomes in Caring for ESRD) Health Experience Questionnaire; SF-36, 36-Item Short-Form Health Survey; PCS, physical component summary; UK, United Kingdom; KDQOL, Kidney Disease Quality of Life scale; WHOQOL-BREF, World Health Organization Quality of Life instrument, short version,

Table 4

Summary of Published Evidence Comparing Life Participation Outcomes by RRT Modality and Study Characteristics

	HD vs. PD			HD vs. Tx			PD vs. Tx		
	No. of outcomes that			No. of outcomes that			No. of outcomes that		
	Favors HD	Favors Neither	Favors PD	Favors HD	Favors Neither	Favors Tx	Favors PD	Favors Neither	Favors Tx
Physical Function Domain									
Study Design									
Randomized Trial									
Prospective Cohort		5							
Cross-Sectional	3	26	6		8	17		7	14
Pre-Post Transplant						1			
Location									
US		8				1			1
Non-US	3	23	7		8	17		7	13
Study Quality									
Appropriate Adjustment *		12	2		2	3		3	2
No/Minimal Adjustment *	3	19	5		6	15		4	12
Publication Year									
1980–1990		4			1	2		1	2
1991–2000		6	3		1	4			2
2001–2012	3	21	4		6	12		6	10
Outcome Measures									
SF-36 (Thai/UK/Greek)	2	24	5		5	10		5	10
CHEQ (Thai)	1								
Karnofsky		1	1						
EQ-5D		1							
WHOQOL		1				2			1
Sickness Impact Profile						1			

	HD vs. PD			HD vs. Tx			PD vs. Tx		
	No. of outcomes that			No. of outcomes that			No. of outcomes that		
	Favors HD	Favors Neither	Favors PD	Favors HD	Favors Neither	Favors Tx	Favors PD	Favors Neither	Favors Tx
Nottingham						1			
HD Stressor Scale		1							
Author-developed scales		2			2	1		1	1
Other patient reports		1			1	2		1	2
Physical assessments			1			1			
Travel Domain									
Study Design									
Randomized Trial									
Prospective Cohort		1							
Cross-Sectional	1								
Pre-Post Transplant									
Location									
US		1							
Non-US	1								
Study Quality									
Appropriate Adjustment *		1							
No/Minimal Adjustment *	1								
Publication Year									
1980–1990									
1991–2000									
2001–2012	1	1							
Outcome Measures									
CHEQ (Thai)	1	1							
Recreation Domain									

	HD vs. PD			HD vs. Tx			PD vs. Tx		
	No. of outcomes that			No. of outcomes that			No. of outcomes that		
	Favors HD	Favors Neither	Favors PD	Favors HD	Favors Neither	Favors Tx	Favors PD	Favors Neither	Favors Tx
Study Design									
Randomized Trial									
Prospective Cohort		1							
Cross-Sectional		13	4		4	3		2	5
Pre-Post Transplant									
Location									
US		5	1			2			2
Non-US		9	3		4	1		2	3
Study Quality									
Appropriate Adjustment *		4			1			1	1
No/Minimal Adjustment *		10	4		3	3		1	4
Publication Year									
1980–1990					1	2			3
1991–2000			2						
2001–2012			2		3	1		2	2
Outcome Measures									
SF-36 (Greek)			3		2	1		2	2
Sickness Impact Profile						1			1
Intrusiveness Ratings Scale					1				1
WHOQOL-100					1				
Quality of Life Assessment Battery			1						
Author-developed scales						1			1
Freedom Domain									
Study Design									
Randomized Trial									

	HD vs. PD			HD vs. Tx			PD vs. Tx		
	No. of outcomes that			No. of outcomes that			No. of outcomes that		
	Favors HD	Favors Neither	Favors PD	Favors HD	Favors Neither	Favors Tx	Favors PD	Favors Neither	Favors Tx
Prospective Cohort		1							
Cross-Sectional	1	5	1			4			4
Pre-Post Transplant									
Location									
US		3	1			2			2
Non-US	1	3				2			2
Study Quality									
Appropriate Adjustment *		1							
No/Minimal Adjustment *	1	5	1			4			4
Publication Year									
1980–1990		2				2			2
1991–2000									
2001–2012	1	4	1			2			2
Outcome Measures									
CHEQ (Thai)	1	1							
EQ 5D		2				1			1
Renal Treatment Satisfaction		1				1			1
Index of Well-Being		1				1			1
Author-developed scales		1	1			1			1
Work Domain									
Study Design									
Randomized Trial									
Prospective Cohort		1							
Cross-Sectional	2	8	2			6			5
Pre-Post Transplant									

	HD vs. PD			HD vs. Tx			PD vs. Tx		
	No. of outcomes that			No. of outcomes that			No. of outcomes that		
	Favors HD	Favors Neither	Favors PD	Favors HD	Favors Neither	Favors Tx	Favors PD	Favors Neither	Favors Tx
Location									
US	2	4	1			3			3
Non-US		5	1			3			2
Study Quality:									
Appropriate Adjustment *	1	2	1			1			1
No/Minimal Adjustment *	1	7	1			5			4
Publication Year									
1980–1990	2	3	1			4			4
1991–2000		1							
2001–2012		5	1			2			1
Outcome Measures									
CHEQ (Thai)		2							
Sickness Impact Profile	1					1			1
KDQOL		1	1			1			1
Intrusiveness Ratings Scale		1				1			1
WHOQOL-100						1			
Author-developed scales		1				1			1
Other patient reports	1	4	1			1			1

RRT, renal replacement therapy; HD, hemodialysis; PD, peritoneal dialysis; Tx, transplantation; US, United States; SF-36, 36-Item Short-Form Health Survey; CHEQ, CHOICE (Choices for Healthy Outcomes in Caring for ESRD) Health Experience Questionnaire; WHOQOL, World Health Organization Quality of Life instrument; UK, United Kingdom; KDQOL, Kidney Disease Quality of Life scale;

* For confounders.

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Table 5

Physical Function and Life Participation Outcome Measures and Study Results: HD versus Tx

Study; Design	Outcome Measure	HD		Tx		Statistical Results			Treatment Favored
		N	Estimate*	N	Estimate*	Reported P**	Effect Size^	Calculated CI****	
Physical Function									
Alavi; 2009; CS	Nottingham Extended ADL	63	31.7	100	51.4	0.00	−1.62	(−23.6, −15.8)	**TX**
Basok; 2009 (CS)	SF-36 Physical Functioning	24	62.27	20	77.78	N/R	−0.73	(−28.4, −2.6)	**TX**
Fujisawa; 2000 (CS)	SF-36 Physical Functioning	114	81.6	117	86.2	<0.05	−0.29	(−8.7, −0.5)	**TX**
Khan; 1995 (CS)	SF-36 Physical Functioning	43	46.35	102	67.51	<0.05	−0.36	----	**TX**
Khan; 1995 (CS)	SF-36 Role Physical	43	51.09	102	63.22	<0.05	−0.36	----	**TX**
Koch; 1990 (CS)	Satisfaction with life questions	290	0.51##	761	0.18##	N/R	0.86	(0.7, 1.0)	**TX**
Kontodimopoulos; 2008 (CS)	SF-36 (Greek) Physical Functioning	642	49.2	167	72.9	<0.001	−0.83	(−28.6, −18.8)	**TX**
Kontodimopoulos 2008 (CS)	SF-36 (Greek) Role Physical	642	40.3	167	62.6	<0.001	−0.51	(−29.8, −14.8)	**TX**
Lee; 2005 (CS)	SF-36 Physical Functioning	99	26.5	209	56.4	<0.05	−0.99	(−37.1, −22.7)	**TX**
Lee; 2005 (CS)	SF-36 Role Physical	99	60.4	209	86.7	<0.05	−0.76	(−34.6, −18.0)	**TX**
Niu; 2005 (CS)	WHOQOL-BREF (Taiwan; physical health)	80	11.96	80	14.34	<0.05	−0.99	(−3.1, −1.6)	**TX**
Ogutmen; 2006 (CS)	SF-36 Role Physical	64	35.71	302	71.09	<0.05	−0.83	(−47.0, −23.8)	**TX**
Panagopoulou 2009 (CS)***	Pt-reported full time employment	40	0.05#	48	0.375#	N/R	−1.34	(−2.2, −0.5)	**TX**
Sayin; 2007 (CS)	SF-36 Physical Functioning	75	55.90	20	68.75	N/R	−0.51	(−25.5, −0.2)	**TX**
Simmons; 1990 (CS)	Author-scale physical well-being score	83	14.04	91	17.55	<0.01	−0.99	(−4.6, −2.4)	**TX**
Tomasz; 2003 (CS)	WHOQOL-100	61	12.28	83	13.3	<0.05	−0.37	(−1.9, −0.1)	**TX**
Van den Ham; 2005 (CS)	Symptom-limited graded cycle-ergometry test (ie, exercise test)	16	6.2	35	7.2	<0.05	−0.67	(−1.9, −0.1)	**TX**
Jofre; 1998; (Pre-Post)	Sickness Impact Profile	93	5.5	93	3.6	<0.01	0.29	(0.0, 3.8)	**TX**
Baiardi; 2002(CS)***	SF-36 Physical Functioning	171	59.3	34	64.6	N/R	−0.19	(−15.7, 5.1)	----
Basok; 2009 (CS)	SF-36 Role Physical	24	58.83	20	60	N/R	−0.04	(−26.6, 23.3)	---
Devins; 1990 (CS)**	Author-scale (difficulties daily living)	39	2	34	1.7	NS	0.17	(−0.5, 1.1)	---
Fujisawa; 2000 (CS)	SF-36 Role Physical	114	68	117	77.6	NS	−0.26	(−19.2, 0.0)	---
Ogutmen; 2006 (CS)	SF-36 Physical Functioning	64	56.99	302	59.92	NS	−0.11	(−10.2, 4.4)	---

Study; Design	Outcome Measure	HD		Tx		Statistical Results			Treatment Favored
		N	Estimate*	N	Estimate*	Reported P**	Effect Size^	Calculated CI****	
Panagopoulou; 2009 (CS)***	Pt-reported part time employment	40	0.15#	48	0.19#	N/R	−0.16	(−0.8, 0.5)	---
Pietrabissa; 1992 (CS)	Physical well-being scale developed by Simmons et al. (summary score)	172	12.38	71	11.81	NS	0.28	----	---
Sayin; 2007 (CS)	SF-36 Role Physical	75	40.69	20	42.50	N/R	−0.05	(−20.7, 17.1)	----
Recreation									
Hart; 1987 (CS)	Sickness Impact Profile (recreation/ pastimes)	343	23.7	146	9	N/R	----	----	**TX**
Kontodimopoulos 2008 (CS)	SF-36 (Greek) Social Functioning	642	58.1	167	72.4	<0.001	−0.49	(−19.3, −9.3)	**TX**
Simmons; 1990 (CS)	Author-developed scale (recreation)	83	2.24	91	2.86	<0.05	−0.67	(−0.9, −0.3)	**TX**
Basok; 2009 (CS)	SF-36 Social Functioning	24	68.75	20	64.38	0.1	0.14	(−14.6, 23.3)	---
Devins; 1990 (CS)***	Intrusiveness Ratings Scale (recreation/ social)	39	2.5	34	2	NS	0.32	(−0.2, 1.0)	---
Sayin; 2007 (CS)	SF-36 Social Functioning	75	62.62	20	57.93	0.5	0.18	(−8.5, 17.9)	----
Tomasz; 2003 (CS)	WHOQOL-100 (environment)	61	11.93	83	12.43	NS	−0.26	(−1.1, 0.1)	---
Freedom									
Barendse; 2005(CS)	Renal Treatment Satisfaction Questionnaire	35	4.3	46	5.7	<0.05	−1.12	(−2.0, −0.8)	**TX**
Bremer; 1989 (CS)	Index of Well-Being (tied-down, free)	105	4.2	166	5.3	<0.05	−0.55	(−1.6, −0.6)	**TX**
Lee; 2005 (CS)	EQ-5D (usual activities)	99	18.09	209	54.95	<0.05	−0.94	(−1.3, −0.6)	**TX**
Simmons; 1990 (CS)	Author-developed scale (doing most things)	83	5.17	91	5.78	<0.05	−0.83	(−0.8, −0.4)	**TX**
Work									
Devins; 1990 (CS)***	Intrusiveness Ratings Scale (work/ finances)	39	4	34	2.1	<0.05	1.03	(1.0, 2.8)	**TX**
Evans; 1985 (CS)	Patient reported ability to work	347	44.8#	144	62.3#	N/R	−0.39	(−0.6, −0.2)	**TX**
Hart; 1987 (CS)	Sickness Impact Profile (work)	338	45	144	28.4	N/R	----	----	**TX**
Tomasz; 2003 (CS)	WHOQOL-100 (working capacity)	61	10.4	83	12.18	<0.05	−0.46	(−3.1, −0.5)	**TX**
Lee; 2005 (CS)	KDQOL (work status)	99	20	209	46.8	<0.05	−0.65	(−36.7, −16.9)	**TX**
Simmons; 1990 (CS)	Author-developed scale (job satisfaction)	83	2.18	91	2.66	<0.01	−0.44	(−0.8, −0.1)	**TX**

^Calculated Cohen's d.

*Estimates are means unless otherwise noted.

**Author-reported p-values.

#Percentage.

##Percentage with low satisfaction with physical performance.

***denotes studies were originally designed as longitudinal cohort but authors only reported cross-sectional assessments of relevant outcomes

****We calculated the confidence interval for the Cohen's d effect size difference for studies that reported all of the needed estimates (e.g., means plus standard deviations) We reported '---' for studies that we could not calculate the confidence intervals for due to missing estimates.

Abbreviations and definitions: ADL, activities of daily living; CS, cross sectional study design; Pre-Post, pre-post transplantation; NS, not statistically significantly different at P>0.05 level; NR, not reported within article; Pt, patient; Pts, patients; CI, confidence interval; HD, hemodialysis; KDQOL, Kidney Disease Quality of Life scale; SF-36, 36-Item Short-Form Health Survey; WHOQOL, World Health Organization Quality of Life instrument; BREF, short version, Tx, transplantation

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Table 6

Physical Function and Life Participation Outcome Measures and Study Results: PD versus Tx

Study; Design	Outcome Measure	PD		Tx		Statistical Results			Treatment Favored
		N	Estimate*	N	Estimate*	Reported P**	Effect Size^	Calculated CI****	
Physical Function									
Apostolou; 2007; CS	SF-36 Physical Functioning	26	36	20	51.5	0.01	−2.77	(−18.9, −12.1)	**TX**
Apostolou; 2007 (CS)	SF-36 Role Physical	26	12	20	47.5	0.001	−4.95	(−39.8, −31.2)	**TX**
Basok; 2009 (CS)	SF-36 Physical Functioning	21	56.61	20	77.78	N/R	−1.09	(−33.4, −8.9)	**TX**
Khan; 1995 (CS)	SF-36 Physical Functioning	27	38.99	102	67.51	<0.05	−0.43	----	**TX**
Khan; 1995 (CS)	SF-36 Role Physical	27	29.7	102	63.22	<0.05	−0.43	----	**TX**
Koch; 1990 (CS)	Pt-reported low satisfaction with physical performance	68	0.47#	761	0.18#	N/R	0.80	(0.49, 1.0)	**TX**
Kontodimopoulos; 2008 (CS)	SF-36 (Greek) Physical Functioning	65	49.2	167	72.9	<0.001	−1.04	(−30.3, −17.1)	**TX**
Kontodimopoulos; 2008 (CS)	SF-36 (Greek) Role Physical	65	30.9	167	62.6	<0.001	−0.76	(−43.7, −19.7)	**TX**
Lee; 2005 (CS)	SF-36 Physical Functioning	74	30.9	209	56.4	<0.05	−0.83	(−33.6, −17.1)	**TX**
Lee; 2005 (CS)	SF-36 Role Physical	74	60.6	209	86.7	<0.05	−0.79	(−34.8, −17.3)	**TX**
Niu; 2005 (CS)	WHOQOL-BREF (Taiwan; Scale physical health)	80	11.61	80	14.34	<0.05	−1.17	(−3.5, −2.0)	**TX**
Ogutmen; 2006 (CS)	SF-36 Role Physical	207	55.1	302	71.09	<0.05	−0.36	(−23.8, −8.1)	**TX**
Panagopoulou; 2009 (CS)***	Pt-reported full time employment	36	0.14	48	0.375	N/R	−0.71	(−1.3, −0.1)	**TX**
Simmons; 1990 (CS)	Author-scale physical well-being score	510	14.64	91	17.55	<0.01	−0.72	(−3.8, −2.0)	**TX**
Baiardi; 2002 (CS)***	SF-36 Physical Functioning	30	59.7	34	64.6	N/R	−0.17	(−19.4, 9.6)	----
Basok; 2009 (CS)	SF-36 Role Physical	21	45.81	20	60	N/R	−0.47	(−48.6, 7.2)	---
Devins; 1990 (CS)***	Author-developed difficulties in ADL scale	11	2.6	34	1.7	NS	0.49	(−0.4, 2.2)	---
Ogutmen; 2006 (CS)	SF-36 Physical Functioning	207	57.06	302	59.92	N/R	−0.12	(−7.1, 1.4)	---
Panagopoulou; 2009 (CS)***	Pt-reported employment	36	0.17#	48	0.19#	N/R	−0.07	(−0.7, 0.5)	---
Sayin; 2007 (CS)	SF-36 Physical Functioning	41	55.76	20	68.75	0.1	−0.47	(−27.9, 2.0)	----
Sayin; 2007 (CS)	SF-36 Role Physical	41	39.10	20	42.50	0.9	−0.08	(−25.3, 18.5)	----
Recreation									

Study; Design	Outcome Measure	PD		Tx		Statistical Results			Treatment Favored
		N	Estimate*	N	Estimate*	Reported P**	Effect Size^	Calculated CI****	
Apostolou; 2007 (CS)	SF-36 Social Functioning	26	49.3	20	76.7	0.001	−5.67	(−30.3, −24.5)	**TX**
Devins; 1990 (CS) ***	Intrusiveness Ratings Scale (recreation/ social activities)	11	3.2	34	2	<0.05	0.82	(0.2, 2.0)	**TX**
Hart; 1987 (CS)	Sickness Impact Profile (recreation)	77	24	146	9	<0.05	----	----	**TX**
Kontodimopoulos; 2008 (CS)	SF-36 (Greek) Social Functioning	65	54.9	167	72.4	<0.001	−0.67	(−25.0, −10.0)	**TX**
Simmons; 1990 (CS)	Author-scale (recreation satisfaction)	510	2.21	91	2.86	<0.05	−0.66	(−0.9, −0.4)	**TX**
Basok; 2009 (CS)	SF-36 Social Functioning	21	63.39	20	64.38	NS	−0.03	(−16.3, 14.9)	---
Sayin; 2007 (CS)	SF-36 Social Functioning	41	56.32	20	57.93	0.5	−0.05	(−18.5, 15.3)	----
Freedom									
Barendse; 2005 (CS)	Renal Treatment Satisfaction	57	4.3	46	5.7	<0.05	−1.05	(−1.9, −0.9)	TX
Bremer; 1989 (CS)	Index of Well-Being (tied-down, free)	79	4.5	166	5.3	<0.05	−0.44	(−1.3, −0.3)	TX
Lee; 2005 (CS)	EQ-5D (usual activities)	74	20.55	209	54.95	<0.05	−0.85	(−1.2, −0.5)	TX
Simmons; 1990 (CS)	Author-scale (doing most things)	510	5.29	91	5.78	<0.05	−0.59	(−0.7, −0.3)	TX
Work									
Devins; 1990 (CS) ***	Intrusiveness Ratings Scale (work)	11	3.6	34	2.1	<0.05	1.01	(0.5, 2.5)	TX
Evans; 1985 (CS)	Pt-reported ability to work	81	27.8#	144	62.3#	N/R	−0.80	(−1.1, −0.5)	TX
Hart; 1987 (CS)	Sickness Impact Profile (work)	81	51	144	28.4	<0.01	----	----	TX
Lee; 2005 (CS)	KDQOL (work status)	74	28.2	209	46.8	<0.05	−0.43	(−30.2, −7.0)	TX
Simmons; 1990 (CS)	Author-scale (job satisfaction)	510	2.38	91	2.66	N/R	−0.23	(−0.5, −0.01)	TX

^ Calculated Cohen's d.

* Estimates are means unless otherwise noted.

Percentage.

** Author-reported p-values.

*** denotes studies were originally designed as longitudinal cohort but authors only reported cross-sectional assessments of relevant outcomes

**** We calculated the CI for the Cohen's d effect size difference for studies that reported all of the needed estimates (e.g., means plus standard deviations) We reported '---' for studies that we could not calculate the CIs for due to missing estimates.

Abbreviations and definitions: ADL, activities of daily living; CS, cross sectional study design; Pre-Post, pre-post transplantation; NS, not statistically significantly different at P>0.05 level; NR, not reported within article; Pt, patient; Pts, patients; CI, confidence interval; PD, peritoneal dialysis; KDQOL, Kidney Disease Quality of Life scale; SF-36, 36-Item Short-Form Health Survey; WHOQOL, World Health Organization Quality of Life instrument; BREF, short version, Tx, transplantation