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Research Article

Comparisons of Health-Related Quality of Life Between Patients Undergoing Peritoneal Dialysis Versus Hemodialysis: A Systematic Review and Meta-Analysis

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Abstract

Introduction: The juxtaposition of Health-Related Quality of Life (HRQoL) between patients undergoing hemodialysis and peritoneal dialysis has generated conflicting and inconclusive findings in the existing research. We aim to compare HRQoL outcomes between patients going through peritoneal dialysis and patients going through hemodialysis patients.

Methods: PubMed, SCOPUS, and Cochrane Central literature reviews were conducted from their inception until June 2023. We assessed HRQoL via two scales: SF-36 and EQ-35. Mean, along with their standard deviations, were pooled using a random effects model. Review Manager was used to conduct the analysis. Quality assessment was done using the JBI critical appraisal checklist.

Results: A total sum of 27 articles were included in our study. The total population comprised was 29,036 patients. Six studies reported EQ-D5, while 22 articles assessed HRQoL via SF-36. We observed that patients going through peritoneal dialysis patients reported better outcomes on PCS (MD=2.99; p=0.04), MCS (MD=2.75; p=0.04), P (MD=5.59; p=0.01), GH (MD=3.35; p=0.01), EW (MD=3.06; p=0.01) and RE (MD=6.61; p=0.003) subdomains of SF-36 while HRQoL reported on EQ-D5 was comparable across the two groups. A high heterogeneity level and a moderate publication bias level were observed.

Conclusion: Even though we observed that patients going through peritoneal dialysis reported better outcomes on particular domains, the overall HRQoL was similar across the two groups. As HRQoL outcomes are subjective, a complex interplay exists between disease prognosis and patient factors such as income, education, and willpower. Further studies are warranted to understand the counteraccusations of these factors fully.

Keywords: Hemodialysis; Peritoneal dialysis; Health-related quality of life; HRQoL

Introduction

End-Stage Renal Disease (ESRD) is characterized by kidney function impairment and permanent damage to the kidney's ability to filter waste products and remove excessive fluid from the body [1]. It can be treated by kidney replacement therapy, including patients undergoing hemodialysis and peritoneal dialysis. Dialysis can affect the HRQoL of the patients [2,3]. In the modern era, researchers and clinicians are interested in the treatment's efficacy and patients' quality of life post-treatment. It is generally understood that dialysis patients experience a reduction of their QoL; however, which dialysis subtype leads to a more rapidly deteriorating QoL remains elusive [4,5]. Determination of HRQoL is subjective, involving multi-factorial measurements including physical function, emotional function, social function, and treatment effectiveness from patients [6-8], generic and disease-specific instruments have been used to measure HRQoL. Two commonly used scales to quantify HRQoL

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are the 36-item Short Form Health Survey (SF-36) and European Quality of Life -5 Dimensions (EQ-D5) [9-10].

EQ-D5 and SF-36 are the most familiar tools for recognizing generic HRQol [11-13]. In 1990, as a part of EuroQol, EQ-D5 was initiated [14]. Its purpose was to evaluate the higher preference for higher overall survival in the department of Health Status [6]. This self-reporting measure contains a survey, which is supposed to be the Short Form (SF). According to the disease, the form consists of many fundamental scales that are the backbone for assessing the patient's condition. In 1933, the generic tool SF-36 was appreciated as it was inaugurated as a part of the Medical Outcomes Study or MOS [15].

Research that has compared HRQoL between patients going through hemodialysis and patients going through peritoneal dialysis patients has yielded results that are still controversial and inconclusive [16]. This might be due to different healthcare systems and modalities of RRT, income, education, inadequate sample size, multicultural environments, psychological problems, the severity of the condition, the instrument's responsiveness, the timing of follow-up, and various instruments [9,17]. We hypothesize that patients going through peritoneal dialysis and patients going through hemodialysis had different effects on the HRQoL of ESRD patients.

Materials and Methods

The systemic review adhered to the Preferred Reporting Items for Systemic Reviews and Meta-Analysis (PRISMA) guidelines [18].

Data Sources and Search Strategy

An electronic search of the MEDLINE, Cochrane CENTRAL, and SCOPUS databases was conducted from their inception until June 2023. The following keywords and their MeSH terms were employed for the search (quality of life OR health-related quality of life OR QoL OR HRQoL) AND (hemodialysis or peritoneal dialysis OR Kidney transplant OR CKD OR chronic kidney disease). We also screened references of the included studies to identify any other potential studies.

Study Selection

The studies were selected based on the following inclusion criteria: 1) patient population ≥18 years of age, 2) ESRD patients treated with either hemodialysis or peritoneal dialysis, and 3) HRQol was assessed via SF-36 and EQ-D5 scales.

We excluded case reports, letters to the editors, reviews, and systematic reviews.

Outcomes

The outcome was HRQoL assessed via SF-36 and EQ-D5.

SF-36

SF-36 evaluates eight dimensions of QoL, i.e., Physical Functioning (PF), role limitations due to physical health (RP), Pain (P), General Health (GH), Energy (E), social Functioning (SF), role limitations due to emotional Problems (RE), and Emotional Well-being (EW) [19]. SF-36 items are subsequently divided into these subdomains as the PF scale consists of 10 items, and the RP scale has four things. The BP scale includes two things. The GH scale's five items measure the patient's overall perception of their health. The Vitality (VT) scale with four items examines patients' energy levels, fatigue, and enthusiasm towards their daily activities. The three items in the RE scale assess the emotional factors and their impact on daily work and activities. The EW scale determines the patient's overall mental health status, including depression, anxiety, dynamic control, and positive effects. (**z**) These eight sub-scales contribute to two distinct primary component summary scores - Physical Component Summary (PCS) score (PF+RP+BP +P +GH) and Mental Component Summary (MCS) score (E+SF+RE+EW). GH and VT are members of both dimensions [19,20].

EQ-5D

The EuroQol Group established a standardized instrument called EQ-5D, which determines health outcomes based on five domains: mobility, self-care, usual activities, pain and discomfort, anxiety, and depression. Every domain has three response categories (no problems, moderate problems, and extreme situations). The scores on these domains can be shown individually as a health profile or merged to create a single summary index number known as utility, ranging from 0 to 1. A value of 0 represents death, while a score of 1 displays perfect health. Furthermore, individuals are asked to rate their overall health on a Visual Analog Scale (VAS) EQ-VAS ranging from 0 (worst imaginable health state) to 100 (best potential health state), which results in a measured QoL score [21].

Data Extraction and Assessment of Study Quality

The articles retrieved from the systemic search were exported to the EndNote reference Library software, where duplicates were screened for and removed. Three independent reviewers carefully assessed the remaining pieces (MAB, NS, IJ), and only articles that met the pre-defined criteria were selected. All papers were initially shortlisted based on title and abstract, after which the full papers were reviewed to confirm relevance. A third investigator (MTZ) was consulted to resolve any discrepancies. From the finalized articles, we extracted data about SF-36 and its components (PF, RP, BP, SF, RE, MH, GH, VT). The second instrument used for extraction was EQ-D5 and its features (mobility, self-care, usual activities, pain and discomfort, depression, and anxiety). Quality assessment was done via the Joanna Briggs Institute (JBI) critical appraisal checklist [22].

Statistical Analysis

All statistical analysis was performed on Review Manager (Version 5.4.1, Copenhagen: The Nordic Cochrane Centre, The Cochrane Collaboration, 2014). The outcomes were pooled using a random effects model comparing the means with their standard deviation. Higgins I2 was used to assess the statistical heterogeneity between trials; an I^2 statistic of more than 50% was considered significant, and a value less than 50% for I^2 was considered acceptable. A P-value of 0.05 or less was deemed necessary in all cases. Publication bias was assessed by visual inspection of Begg's funnel plot.

Results

Literature Search and Baseline Characteristics

The PRISMA flow chart summarizes the search and study selection process (Figure 1). Our initial search yielded 4,080 articles. After screening, 1,204 articles were assessed for eligibility. Twenty-seven papers were included in the meta-analysis [9,10,21,23-46]. A total of 29,036 patients were included in our study (5,235 patients going through peritoneal dialysis and 23,801 patients going through hemodialysis). Six studies used EQ-D5, while the rest assessed HRQoL on the SF-36 generic

tool. The mean age of the population ranged from 37 to 71 years. We observed a male-dominant population in our study (n=16,190, 53.6%).

EQ-D5

Details of the domains for the generic tool, EQ-D5 are as follows:

VAS

Three studies assessed the VAS score domain. We found a non-significant difference between patients going through peritoneal dialysis and patients going through hemodialysis patients (MD=6.45, 95% CI [-3.82, 16.72]; P=0.22, I^2 = 86%) (Figure 2).

Utility

Four studies assessed the Utility Score domain. We found a non-significant difference between patients going through peritoneal dialysis and patients going through hemodialysis patients. (MD=-0.01, 95% CI [-0.08, 0.07]; P=0.86, I^2=74%) as shown in Figure 3.

EQ-D5 Categorical Response

Patients Reporting no Problem

Four studies reported the number of participants reporting no problem on EQ-D5 subdomains. We observed no significant difference in response between the two groups, as shown in Figure 4.

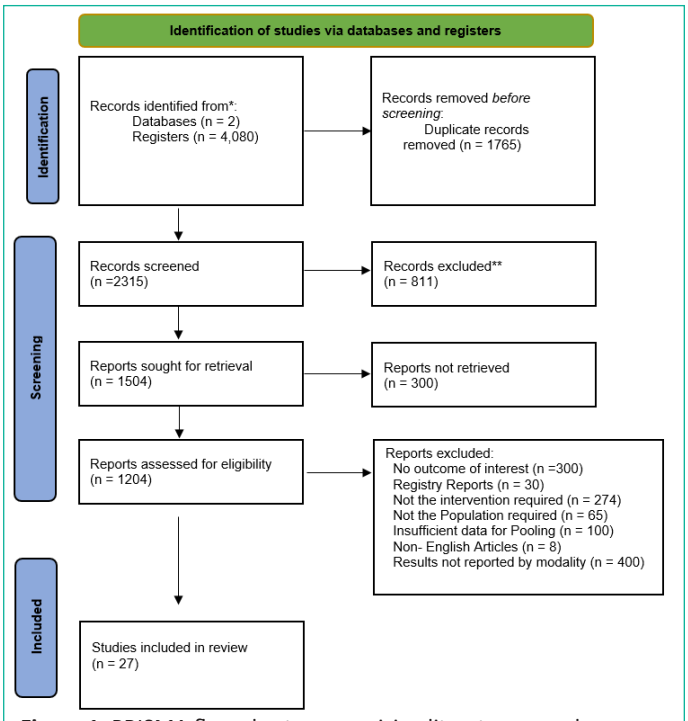

Figure 1: PRISMA flow chart summarizing literature search.

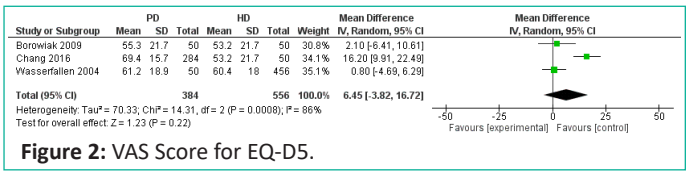

Figure 2: VAS Score for EQ-D5.

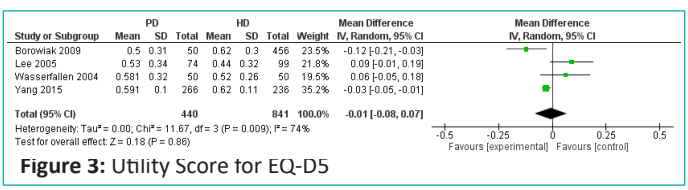

Figure 3: Utility Score for EQ-D5

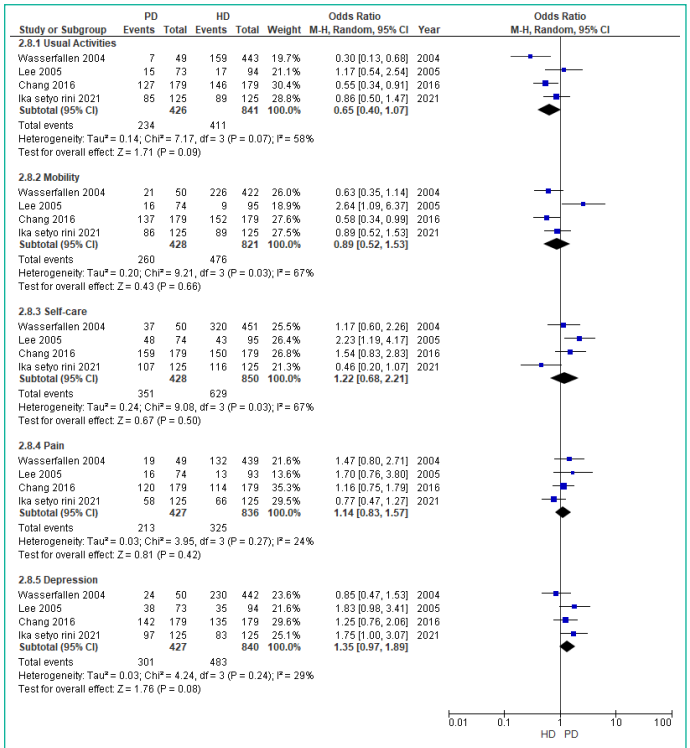

Figure 4: People reporting "No problem" on EQ-D5.

Patients Reporting Some Problems

Four studies reported some problem responses across the domains. More patients receiving hemodialysis reported problems on the P subdomain than patients going through peritoneal dialysis. The rest of the domains showed a non-significant difference in response between the two groups (Figure 5).

Patients Reporting Severe Problems

Four studies reported patients experiencing severe problems assessed via EQ-D5. We observed no significant difference between the two groups across all EQ-D5 domains (Figure 6).

SF-36

The results of subdomains of SF-36 are summarized in Table

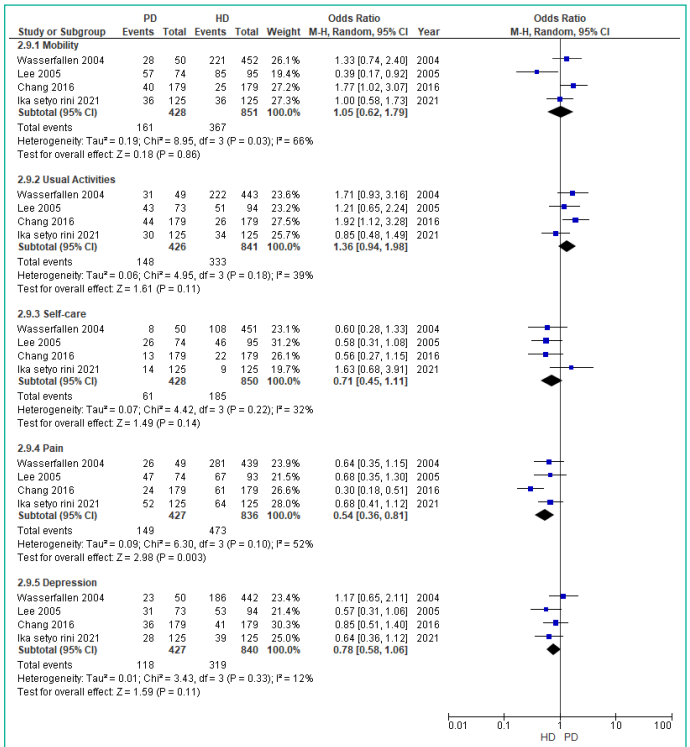

Figure 5: Patients reporting "Some problem" on EQ-D5

Table 1: Baseline Characteristics of Included Studies.

Author (Year)	Country	GDP classification	Study design	n		Mean age(SD)		Male N(%)		Female N(%)		HRQoL tool	
												SF-36	EQ 5D
				HD	PD	HD	PD	HD	PD	HD	PD		
[21]	Netherlands	high income	CS	120	60	59.3(15.5)	52.3(14.0)	68(57%)	69(65%)	52(43%)	37(35%)	Y	
[23]	Netherlands	high income	Pro	84	55	60(15)	52(14)	46(55%)	38(69%)	38(45%)	17(31%)	Y	
[24]	UK	high income	CS	183	109	-	-	109(59.56%)	62(56.88%)	74(40.43%)	47(43.11%)	Y	
[25]	Ireland	high income	CS	112		44(12)		70.54%		29.46%		Y	
[26]	USA	high income	CS	16755	1260	59.44(15.28)	53.45(15.31)	8676(51.78%)	636(50.48%)	8079(48.22%)	624(49.52%)	Y	
[27]	UK	high income	Pro	96	78	77.0(4.4)	76.8(4.0)	60(62.5%)	55(70.5%)	36(37.5%)	23(29.5%)	Y	
[28]	USA	high income	CS	558	64	64(15)	60(17)	376(67.4%)	32(50%)	182(32.6%)	32(50%)		Y
[29]	USA	high income	CS	1679	1623	63.4(15.5)	59.0(15.0)	891(53.06%)	860(53%)	788(47%)	763(47.01%)	Y	
[30]	UK	high income	CS	99	74	63(14.1)	58.7(15.2)	60(60.6%)	38(51.35%)	39(39.39%)	36(48.64%)	Y	Y
[31]	Turkey	upper-middle	CS	68	47	51.0(15.2)	48.7(16.5)	36(53%)	29(61.8%)	32(47%)	18(38.2%)	Y	
[32]	China	upper-middle	CS	654	408	57.22(12.4)	61.59(12.6)	360(55%)	165(40.4%)	294(45%)	243(59.6%)	Y	
[33]	Turkey	upper-middle	CS	75	41	46.91(15.7)	46.15(15.3)	54(72%)	25(61%)	21(28%)	16(39%)	Y	
[34]	Poland	high income	CS	100		59.25		48		52			Y
[9]	Greece	high income	CS	642	65	58.1(14.9)	58.7(12.9)	394(61.3%)	33(50.8%)	248(38.7%)	32(49.2%)	Y	
[35]	Malaysia	upper-middle	CS	183	91	-	-	141(51.5%)		133(48.5%)		Y	
[36]	Turkey	upper-middle	CS	90	64	55.0(15.7)	52.4(15.3)	49(54.4%)	37(57.8%)	41(45.6%)	27(42.2%)	Y	
[37]	South Africa	upper-middle	CS	56	26	38.6(1.4)	36.0(2.2)	26(46.4%)	17(65.4%)	30(53.6%)	9(34.6%)	Y	
[38]	Poland	high income	CS	40	30	-	-	23(57.5%)	15(50%)	17(42.5%)	15(50%)	Y	
[45]	Singapore	high income	CS	236	266	54.5(10.6)	59.3(12.5)	142(60.2%)	121(45.5%)	94(39.8%)	145(54.5%)		Y
[46]	Brazil	Middle income	CS	257	60	57.9 (15.9)	56.5(15.3)	161(62.7%)	21(35%)	96(37.3%)	39(65%)	Y	
[10]	Poland	high income	CS	44	25	49	42	30(68.18%)	14(56%)	14(31.82%)	11(44%)	Y	
[39]	Taiwan	high income	CS	1403	284	57.1(13.6)	46.7(13.2)	700(49.9%)	145(51.1%)	703(50.1%)	139(48.9%)		Y
[41]	Germany	High income	Pro	64	19	43.8 (9.1)	43.2 (± 9.7)	40(62.5%)	6(31.6%)	24(37.5%)	13(68.4%)	Y	
[21]	China	High income	CS	52	60	58.92(10.32)	59.63(10.78)	32(61.54%)	36(60%)	20(38.46%)	24(40%)		Y
[42]	china	High income	Pro	151	102	56.47(16.99)	59.73 (17.33)	81(53.64%)	50(49.02%)	70(46.36%)	52(50.98%)	Y	
[44]	brazil	Upper middle income	Pro	884	278	50.7(14.37)	57.6(14.98)	525(59.4%)	125(45%)	359(40.6%)	153(55%)	Y	
[43]	Indonesia	Low - Middle	CS	125	125	46-65		66(52.8%)	59(47.2%)	71(56.8%)	54(43.2%)		Y

Pro: Prospective Study; CS: Cross Sectional Study; Y: Yes; PD: Peritoneal Dialysis; HD: Hemodialysis

2 and Figure 7. A total of nineteen studies reported results on different subdomains of SF-36. Patients undergoing peritoneal dialysis reported significantly higher scores on PCS, MCS, P, GH, EW, and RE subdomains. (Supplementary Figure 1-10) Significant heterogeneity was observed across all the domains, as shown in Table 2.

Publication Bias and Quality Assessment

Visual inspection of Begg's funnel plot for SF-36 revealed mild asymmetry, suggesting moderate publication bias (S11). Examination of the EQ-D5 plot showed significant asymmetry, suggesting minor study effects (S12). The Quality Assessment form is shown in Supplementary Table 1 for the included studies.

Table 2: Results of SF-36 domains.

	SF-36 subdomains	MD	Confidence intervals	p-value	I^2 value
1	Physical Component Summary	2.99	0.16-5.81	0.04	94%
2	Mental Component Summary	2.75	0.19-5.32	0.04	89%
3	Physical Functioning:	3.65	0.31-7.61	0.07	97%
4	Role Limitations due to Physical Health:	0.85	-3.07-4.77	0.67	94%
5	Pain	5.59	1.34–9.83	0.01	97%
6	General Health:	3.53	0.7–6.36	0.01	96%
7	Energy	1.82	-1.22–4.87	0.24	94%
8	Social Functioning	2.04	-1.68–5.75	0.28	94%
9	Role Limitations due to Emotional Problems:	6.61	2.28–10.93	0.003	92%
10	Emotional Well-Being:	3.06	0.67–5.45	0.01	93%

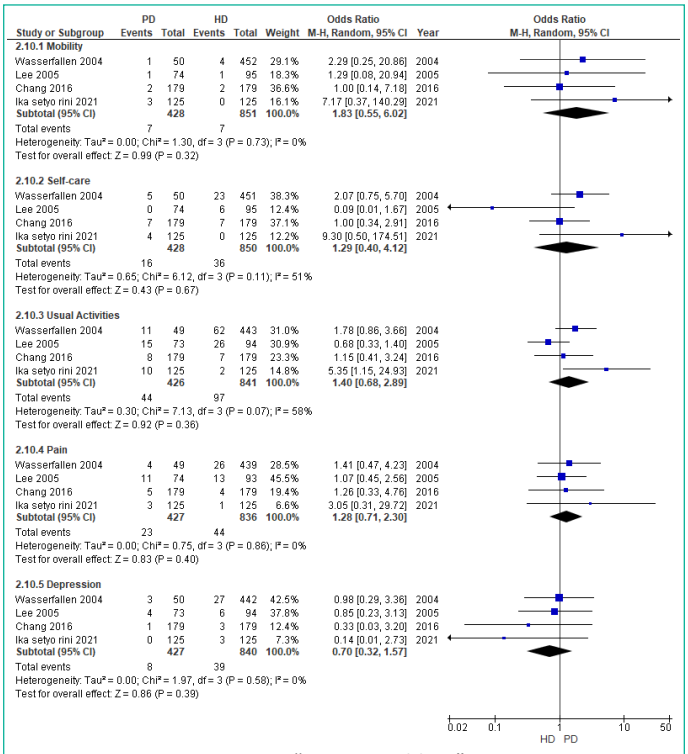

Figure 6: Patients reporting "Severe problem" on EQ-D5.

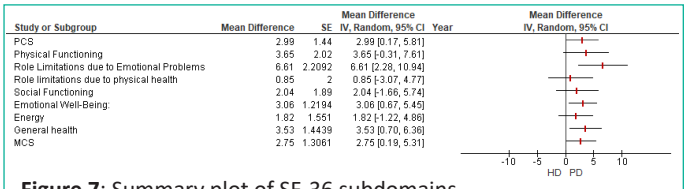

Figure 7: Summary plot of SF-36 subdomains.

Discussion

The present meta-analysis aimed to determine whether dialysis subtypes caused far worsening HRQoL in ESRD patients. We observed that neither dialysis method is superior to the other in terms of better HRQoL. However, we observed that patients going through peritoneal dialysis had significantly higher scores on several subdomains on SF-36 than patients going through hemodialysis.

Patients undergoing peritoneal dialysis reported better HRQoL outcomes on PCS, MCS, P, GH, RW, and EW subdomains of SF-36. This is consistent with the study by Chasuwan et al. and Zazzeroni et al. [47,48]. However, the most challenging part is translating these apparent significant changes in scores into actual clinically observed differences. The scores may show a considerable increase or decrease in scores; however, they may result in negligible clinical differences. One of the ways to circumvent this issue is by using the Minimal Clinically Significant Difference (MCID). MCID is the slightest change that patients perceive as beneficial or harmful [49]. Samsa et al. calculated the MCID for SF-36 to range from 3-5 [50]. Viewing from this perspective, the mean difference between PCS and MCS scores was not enough to arrive at meaningful conclusions. This means that while patients undergoing peritoneal dialysis might experience better QoL on individual domains, the overall HRQoL remains relatively similar to patients undergoing hemodialysis.

A significant heterogeneity was observed across the subdomains of SF-36, ranging from 89% to 97%. One of the potential causes can be due to the already deteriorating mental health of patients going through hemodialysis. Sapilak et al. reported that SF-36 scale scores are strongly negatively correlated with depression and anxiety.

Their analysis of 1,215 patients found a greater prevalence of depression in patients going through hemodialysis. Hence, this may have caused the participants to score lower than expected on the mental components of the scale. We also identified that income may be a contributing factor. The study by Lemos et al. showed that patients who earned more than the minimum wage had better mental, physical, and emotional health. They also observed advancing age as a possible predictor of worse HRQoL in hemodialysis patients, especially in functional capacity and social functioning subdomains.

This can be monitored via the results of Harris et al., who only included a patient population above 70+ years. The mean PCS and MCS scores were appreciably lower compared to studies such as Yang et al. and Kutner et al. that included a population of mean age around 40-50 [26,29,45].

We also analyzed HQoL via EQ-D5. We observed a non-significant difference in patients going through peritoneal dialysis and patients going through hemodialysis in patients on utility and VAS scores. We analyzed EQ-D5 subdomain responses categorized according to the level of problem faced by the patients. We observed that an equal number of participants in both groups reported no pain. The same was honored with the severe problem category of response. However, a significantly higher number of patients going through hemodialysis said some problems in the pain domain. The major limitation of using EQ-D5 is the set of 3 levels of response, which restrict patients' subjectiveness. Hence, the VAS domain provides a more apt representation of HRQoL as it allows patients to score freely. A moderate level of heterogeneity was observed. This could be attributed to the variation of EQ-5D value sets region-wise. The value sets strongly depend on the region population health state preferences, which depend upon the existent healthcare system and its accessibility, the people's financial standing, culture, and even geographical factors such as topography and climate.

It is essential to consider certain limitations when interpreting the current study's findings. Firstly, all the studies included in the analysis were observational, which may have introduced variations in methodologies and decreased the overall reliability of the results. Additionally, the included studies only provided HRQoL outcomes at a specific time, limiting our understanding of any changes over time. We strongly recommend conducting longitudinal studies to track HRQoL deterioration from a baseline measurement. Moreover, it is worth noting that the dura-

tion of dialysis varied across the included studies. Patients who have been on dialysis for longer may experience worse HRQoL than those who have recently initiated dialysis.

Conclusion

In summary, despite the new evidence provided by the research suggesting improved HRQoL dialysis in patients undergoing peritoneal dialysis, uncertainties remain. To enhance our understanding, we strongly advocate for longitudinal studies that assess HRQoL from a baseline measurement, which would provide further clarity on the long-term impact. Additionally, there is a need for future investigations to further explore the influence of demographic factors and co-morbidities on HRQoL and examine the potential of HRQoL as a prognostic indicator for mortality or the progression of health deterioration. Such studies would contribute to a more comprehensive understanding of the complex interplay between HRQoL, patient characteristics, and health outcomes.

Author Statements

Ethics Approval

The data utilized by the current study is publicly available and hence does not necessitate approval from the ethics committee.

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