

Changes in the Quality of Life of Patients Undergoing Hemodialysis: A Longitudinal Study

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ABSTRACT

Objective: To investigate changes in the quality of life of patients undergoing hemodialysis. **Material and Methods:** A longitudinal cohort study was conducted with 226 patients undergoing hemodialysis at two hospitals in Campina Grande, Paraíba, Brazil. Patients were clinically examined for dental caries experience (number of decayed, missing, and filled teeth - DMFT) and asked to complete a socioeconomic and demographic questionnaire. The Short Form Health Survey (SF-36) and Oral Health Impact Profile-14 (OHIP-14) questionnaires were used to assess general health-related quality of life (HRQoL) and oral health-related quality of life (OHRQoL), respectively. After 3 years, patients were contacted again to participate in the research. The Wilcoxon test was used to compare OHIP-14 and SF-36 scores between the initial and final assessments. **Results:** The comparison of the SF-36 and OHIP-14 scores obtained at the beginning and end of the study revealed statistically significant differences in all dimensions of both questionnaires. **Conclusion:** The OHRQoL of patients undergoing hemodialysis worsened after 3 years of follow-up; HRQoL improved regarding pain, vitality, limitations by social aspects, limitations by emotional aspects, and worsened regarding functional capacity and limitations by physical aspects.

Keywords: Renal Dialysis; Quality of Life; Oral Health.

■ Introduction

Chronic kidney disease (CKD) is characterized by the progressive and irreversible loss of kidney function [1]. Its global prevalence is around 11-13%, with incidence rates increasing in many countries [2]. Among the main risk factors for the disease are hypertension, diabetes mellitus, and glomerulonephritis, with hemodialysis being the most commonly used renal clearance method for the treatment of patients with end-stage renal disease (ESRD) [3].

Due to therapeutic and diagnostic advances, the survival of hemodialysis patients has continuously improved. Thus, the concern with the well-being and quality of life of these patients has increased in recent years [4]. According to Zucoloto et al. [5], oral health status can directly affect an individual's quality of life by influencing speech, chewing, taste, and self-confidence. Hemodialysis patients frequently exhibit changes in salivary flow and composition [6], which make them more vulnerable to oral manifestations, such as dry mouth [7], premature tooth loss, increased prevalence of periodontal disease [8], halitosis, and dental calculus accumulation [9].

Some studies have investigated oral health-related quality of life (OHRQoL) in patients undergoing hemodialysis [10-12]. However, no attempt has been made to verify changes in OHRQoL over time in this specific group. This is a clinically important knowledge gap, given that continuous, repeated assessment of quality-of-life measures serves as a parameter for monitoring the quality of care provided to hemodialysis patients [13].

Given the above, this study aimed to investigate changes in the perception of health-related quality of life (HRQoL) and oral health-related quality of life OHRQoL of hemodialysis patients followed for three years (2016-2019). We hypothesize that the quality of life of these people worsens over time.

■ Material and Methods

Study Design and Sample Characterization

A longitudinal cohort study was conducted with hemodialysis patients at two hospitals in Campina Grande, Paraíba, Brazil, in 2016. The municipality under study has a population of approximately 407,472 inhabitants [14], and hospitals serve about 69 municipalities, covering a population of approximately 1,025,343 people. A non-probabilistic sample was adopted. A previous study by the authors presented the inclusion and exclusion criteria in more detail at the beginning of the research [11]. In summary, all chronic renal patients undergoing hemodialysis for 6 months or more, registered in the hemodialysis service of the study centers, and older than 18 years were included, and those unable to respond to the interview due to cognitive deficit were excluded. Clinical, socioeconomic, demographic, and subjective variables were collected. Another assessment of patients who agreed to participate was conducted after 3 years (2019). The STROBE checklist was used to assist in conducting the research.

Pilot Study and Calibration

Before data collection, a pilot study, training, and calibration exercises were carried out. Examiners' training and calibration exercises were composed of two stages (theoretical and clinical). The theoretical stage involved discussing criteria for diagnosing dental caries and was coordinated by a specialist in epidemiological surveys (the gold standard), who guided the examiner (the dental surgeon) in performing the examinations. The clinical stage was conducted at a dental school, where 20 individuals were randomly selected for examination to determine inter-examiner agreement. After a 7-day interval, examinations were repeated to assess intra-

examiner agreement. Kappa test values ranged from 0.81 to 0.95, indicating excellent agreement. Participants in the pilot study were not included in the main sample.

Non-Clinical Data Collection

Socioeconomic and demographic characteristics were collected via a questionnaire completed by patients in the hospital before the hemodialysis session, including sex, age, marital status, education, skin color, family income, and place of residence. Age was obtained in years and categorized by the median as " ≤ 57 years" and " > 57 years". Schooling was assessed by years of study and categorized as "illiterate", "up to eight years of study", "eight to eleven years of study", and "more than eleven years of study". Skin color was classified according to the criteria of the Brazilian Institute of Geography and Statistics [15] and dichotomized into "white" and "non-white". Family income was collected according to the value of the Brazilian minimum wage (BMW), which corresponded to R\$ 880,00 in 2016 (R\$ 4,05 = US \$ 1.00, approximately). This variable was dichotomized into "monthly income ≥ 3 minimum wages" and "monthly income > 3 minimum wages".

The instruments used to assess OHRQoL and HRQoL were OHIP-14 and SF-36 questionnaires, respectively. OHIP-14 measures the individual perception of the biopsychosocial impact of oral disorders on quality of life, and it consists of 14 questions divided into 7 dimensions (functional limitation, physical pain, physical disability, psychological discomfort, psychological disability, social disability, and disablement) [16]. Responses are assessed using a Likert scale: Never = 0; rarely = 1; sometimes = 2; repeatedly = 3; always = 4. The higher the score obtained, the greater the impact of the oral condition on quality of life. The questionnaire has internal reliability and has been translated and validated into the Brazilian version [17]. Patients' questionnaires were coded in both evaluations to enable the comparison of responses obtained at both moments.

SF-36 is a generic health assessment instrument originally developed in English that has been translated and culturally adapted for the Brazilian population. This questionnaire consists of thirty-six questions covering eight components: functional capacity, physical aspects, pain, general health status, vitality, social aspects, emotional aspects, and mental health. Each dimension is linearly transformed into a scale from 0 to 100, with the highest score representing the best quality of life [18].

Clinical Data Collection

Clinical data were collected through anamnesis and intraoral physical examination performed in the hospital's restroom before the hemodialysis session.

The intraoral physical examination was based on the criteria of the World Health Organization (WHO) [19] and performed with the aid of artificial light from headlamps (Echolife, São Paulo, SP, Brazil), mouth mirror No. 5 (Golgran, São Caetano do Sul, SP, Brazil), "ball point" type probe (0.5 mm sphere) (Golgran, São Caetano do Sul, SP, Brazil), and gauze. The decayed, missing, and filled teeth index (DMFT) was evaluated and categorized into " ≤ 24 " and " > 24 " based on the median.

Variables smoking, alcohol consumption, diabetes, and hypertension were divided into "yes" or "no". Hemodialysis time was collected in months and categorized as " < 1 year", "1 to 5 years", and " > 5 years". The time since the last dentist visit was collected in months and categorized as " < 1 year", "1 to 2 years", and " ≥ 3 years".

Data Analysis

Initially, descriptive statistical analysis was conducted to characterize the sample. Absolute and percentage frequencies were calculated for categorical variables, and measures of central tendency and variability were calculated for quantitative variables. The assumption of normality for quantitative data was verified using the Kolmogorov-Smirnov test; however, it was not confirmed. Thus, the Wilcoxon nonparametric test for repeated measures was selected to compare OHIP-14 and SF-36 scores between baseline and follow-up assessments. The significance level was set at $p < 0.05$. All analyses were conducted using IBM SPSS Statistics at the 5% significance level.

Ethical Aspects

This study was evaluated and approved by an independent Research Ethics Committee under Opinion no. 2.614.715, in accordance with National Health Council Standard 466/12 and the Declaration of Helsinki. All participants gave informed consent before their inclusion in the study.

Results

Overall, 251 patients undergoing hemodialysis were enrolled in the two hospitals under study at the time of the initial assessment in 2016. Of these, 226 were included in the study sample; 11 refused to participate, 3 were discharged, 6 died, and 5 presented cognitive deficits and were excluded. After three years (2019), 117 patients were being followed up, of these, 79 patients died (34.9%), 11 were discharged after kidney transplantation (4.9%), 5 were transferred to other hospitals (2.2%) and 14 dropped out the study (6.2%), with total loss of follow-up of 109 patients (48.2%). The statistical sample power ($1 - \beta$) was greater than 80%, indicating that the number of cases evaluated was sufficient to generate statistically reliable results for the quality of life outcome.

Table 1 shows the socioeconomic and demographic characteristics found at the beginning of the study. The average age of participants was 55.52 years ($SD = 14.70$).

Table 1. Distribution of patients with chronic renal failure according to socioeconomic and demographic characteristics.

Variables	N	%
Sex		
Female	92	40.7
Male	134	59.3
Age [†]		
≤57 years	114	50.4
>57 years	112	49.6
Marital Status		
Not married	42	18.6
Widower	19	8.4
Divorced	28	12.4
Married	125	55.3
Stable union	12	5.3
Schooling		
Not literate	35	15.5
Up to eight years of study	126	55.8
Eight to eleven years of study	53	23.5
More than eleven years of study	12	5.3
Race		
White	57	25.2
Not white	169	74.8
Family Income		

≤3 minimum wages	201	88.9
> 3 minimum wages	25	11.1
Place of Residence		
Urban area	199	88.1
Countryside	27	11.9

+Variables categorized by the median.

Table 2 shows the clinical characteristics assessed at the beginning of the study. The average DMFT was 22.68 (SD = 8.37). Most participants had not visited the dentist for 3 or more years (44.7%), and 56.3% had been on hemodialysis for 1 to 5 years.

Table 2. Distribution of patients according to clinical characteristics.

Variables	N	%
DMFT ⁺		
≤24	116	51.3
>24	110	48.7
Smoker		
Yes	12	5.3
No	214	94.7
Alcoholic		
Yes	6	2.7
No	220	97.3
Diabetes		
Yes	61	27.0
No	165	73.0
Hypertension		
Yes	158	69.9
No	68	30.1
Time of Hemodialysis		
<1 year	39	17.3
1 to 5 years	128	56.3
>5 years	59	26.1
Last visit to the Dentist		
<1 year	80	35.4
1 to 2 years	45	19.9
≥3 years	101	44.7

+Variables categorized by the median.

Table 3 presents the results of the comparative analysis of the impact of oral condition on oral health-related quality of life during the observation period. Significant increase was observed in the overall OHIP-14 scores ($p < 0.001$), as well as in all domains: functional limitation ($p < 0.001$), physical pain ($p < 0.001$), psychological discomfort ($p < 0.001$), physical disability ($p = 0.004$), psychological disability ($p < 0.001$), social disability ($p < 0.001$) and disablement ($p < 0.001$).

Table 3. Comparative analysis of the level of impact of the oral condition on quality of life during the observation period.

Observation period:					
OHIP-14	Average	SD	Median	IR	
				Q1	Q3
1. Functional Limitation					
T1	1.12	1.01	0.98	0.25	1.53
T2	1.65	0.90	1.00	1.00	2.01
p-value	< 0.001*				
2. Physical Pain					
T1	1.66	1.17	1.34	0.66	2.64
T2	2.09	1.09	1.68	1.00	3.00

p-value	< 0.001*				
3. Psychological Discomfort					
T1	1.15	1.16	0.90	0.00	2.00
T2	1.68	0.86	1.45	1.00	2.10
p-value	< 0.001*				
4. Physical Disability					
T1	1.43	1.12	1.48	0.52	2.08
T2	1.73	0.88	1.48	1.00	2.04
p-value	0.004*				
5. Psychological Disability					
T1	0.89	1.16	0.40	0.00	1.90
T2	1.58	0.83	1.00	1.00	2.10
p-value	< 0.001*				
6. Social Disability					
T1	0.22	0.51	0.00	0.00	0.00
T2	1.47	0.77	1.00	1.00	2.00
p-value	< 0.001*				
7. Invalidity					
T1	0.63	0.79	0.00	0.00	1.18
T2	1.36	0.66	1.00	1.00	1.59
p-value	< 0.001*				
OHIP Global					
T1	7.09	5.07	7.36	2.50	10.29
T2	11.57	4.53	10.36	8.01	14.01
p-value	< 0.001*				

T1 = Initial Assessment; T2 = Final Evaluation; SD = Standard Deviation; IR = Interquartile Range (Percentile 25 – Percentile 75);

*Wilcoxon test for repeated measurements ($p < 0.05$).

Table 4 presents a comparative analysis of the general quality of life during the observation period. There was a statistically significant reduction in functional capacity ($p < 0.001$), increased limitation due to physical aspects ($p = 0.003$), decreased level of pain ($p = 0.024$), increased vitality ($p = 0.006$), decreased social aspects ($p = 0.001$), and reduced limitations due to emotional aspects ($p < 0.001$).

Table 4. Comparative analysis of the level of general quality of life during the observation period.

SF-36	Average	SD	Median	IR	
				P25	P75
1. Functional Capacity					
T1	54.49	31.21	55.00	25.00	82.50
T2	43.50	33.46	45.00	10.00	75.00
p-value	< 0.001*				
2. Limitation of Physical Aspects					
T1	31.62	43.10	0.00	0.00	75.00
T2	47.44	48.51	25.00	0.00	100.00
p-value	0.003*				
3. Pain					
T1	64.83	32.90	62.00	31.00	100.00
T2	57.25	31.74	52.00	32.00	84.00
p-value	0.024*				
4. General Health Status					
T1	49.01	21.28	47.00	35.00	62.00
T2	45.91	19.74	45.00	30.00	61.00
p-value	0.147				
5. Vitality					
T1	57.99	21.51	60.00	45.00	75.00
T2	64.23	20.16	65.00	50.00	80.00
p-value	0.006*				
6. Social Aspects					
T1	78.63	26.11	87.50	62.50	100.00

T2	65.71	35.44	75.00	37.50	100.00
p-value	0.001*				
7. Limitations of Emotional Aspects					
T1	85.75	33.99	100.00	100.00	100.00
T2	49.29	49.25	33.33	0.00	100.00
p-value	< 0.001*				
8. Mental Health					
T1	71.86	19.05	72.00	60.00	88.00
T2	70.12	18.04	72.00	56.00	84.00
p-value	0.123				

T1 = Initial Assessment; T2 = Final Evaluation; SD = Standard Deviation; IR = Interquartile Range (Percentile 25 – Percentile 75);

*Wilcoxon test for repeated measurements ($p < 0.05$).

Discussion

The results of the present study indicate worsening in OHRQoL perception among patients undergoing hemodialysis between the two evaluations (2016–2019). All OHIP-14 dimensions showed significant variation at the end of the study. Changes in OHRQoL over time in these patients are still a little explored topic. However, cross-sectional studies that have also assessed OHRQoL in this specific group have shown that oral changes generally do not have a major impact on quality of life [11,20,21]. The severity of these patients' general health means that oral problems are not among their priorities [17,21].

The worsening in the "functional limitation" domain of OHIP-14 is characterized by increased difficulty with pronunciation or impaired taste over time. These problems in hemodialysis patients have also been described previously [17], in which, despite presenting these limitations and reporting poor oral health, OHRQoL was reported as good or moderate. Taste change has been mainly associated with an increase in urea concentration in saliva, which causes a characteristic odor and metallic taste [22]. In contrast, difficulty with pronunciation may be associated with xerostomia, which is common in CKD patients [7], and worsening in this dimension may reflect worsening of these symptoms in this group.

The "physical pain" domain refers to items 3 ("have you ever felt severe pain in your mouth?") and 4 ("do you have difficulty eating some foods?") of the questionnaire. Orofacial pain, dental caries, and tooth loss are reported in the literature as clinical conditions perceived by patients and that affect not only oral health but also general health, emotional state, and the performance of daily activities [23,24]. Previous studies have shown that hemodialysis patients have a high DMFT index [12] and a need for dental treatment [25], both of which can influence chewing and the occurrence of dental pain episodes.

Worsening in relation to physical pain may also be associated with increased age of patients after the follow-up period, and according to Ahluwalia et al. [26], aging is an important predictor of caries experiences and not only increases the risk of high DMFT index, but also contributes to the decline in OHRQoL [5].

In addition, the increased duration of hemodialysis treatment may aggravate this change in perception of OHRQoL. The longer the individual remains on hemodialysis, the greater the negative effect on their oral health and, consequently, on OHRQoL. Over time, the oral health of hemodialysis patients deteriorates, which may have a greater impact on their quality of life. This is also reflected in the "psychological discomfort" domain, where the questions address concerns and stress related to the oral condition. The worst result in this dimension after the follow-up period may also have been influenced by the increased dialysis time [27].

Feeding impairment and the need to stop eating are requirements of the "physical disability" domain, which also worsened after the 3-year follow-up. Problems with feeding and chewing in hemodialysis patients are often due to xerostomia [17]. Saliva secretion in these patients is lower than in the general population [7]. In addition, these patients are required to limit water intake to avoid hypervolemia [17]. The worsening in this

dimension should be a cause for concern, as eating discomfort is associated with a risk of malnutrition, as it can affect food selection, leading patients to avoid essential nutrients [28], thereby impacting their survival.

In the "psychological incapacity" domain, questions refer to difficulty relaxing and feelings of shame due to the oral condition. These conditions were reported in a previous study, but they did not have a high impact on the OHRQoL of hemodialysis patients [21]. According to Spanemberg et al. [29], although most oral problems do not represent a risk of death, they are responsible for poor quality of life, as they cause functional, aesthetic, and psychological problems. The worsening of the psychological disability dimension reflects the difficulty of acceptance that involves a person with dental problems in a scenario where the aesthetic function of teeth is often considered more important than the masticatory function [23].

The "social incapacity" domain includes questions about irritation with other people and difficulty performing daily routine activities due to the oral condition. At the same time, the "disablement" dimension seeks to determine whether there is a perception that life has worsened and whether patients feel totally unable to perform their routine activities. Oral changes can cause effects ranging from difficulty relaxing to the loss of desire to leave the house and socialize [30]. A previous study found that poor oral health is associated with poorer health-related quality of life and a decreased ability to work with CKD patients [31]. The worsening of these dimensions affects oral health and various aspects of these patients' quality of life.

Regarding the general quality of life of hemodialysis patients, over time, functional capacity decreased, and limitations due to physical factors increased. The "functional capacity" domain of the SF-36 questionnaire is equivalent to question number 3, which asks whether the patient reports difficulty due to physical health to do anything from vigorous activities (playing hard sports or lifting heavy objects) and moderate activities (sweep the house, move a table) up to daily activities such as walking up the stairs, walking, kneeling, bathing and dressing. The worsening in this domain reflects the limitations imposed by the disease. Chronic kidney disease patients have reduced respiratory muscle strength, nutritional problems, and associated comorbidities [32], which directly interfere with their functional capacity and independence. With advancing age and disease progression, there is a tendency toward increased deterioration in HRQoL [33].

Limitations due to physical aspects, in turn, concern the difficulty in performing work or regular activities due to poor physical health. Hemodialysis treatment alters patients' daily lives. It requires their constant presence in hospitals, limiting the performance of daily activities, so that CKD patients find it difficult to remain and/or return to work, which contributes to loss of autonomy and onset of depression, anxiety, and stress symptoms [34].

The present study also found that hemodialysis patients showed improvement in some SF-36 domains: decreased pain, increased vitality, and reduced limitations due to social and emotional factors. In contrast, a previous study suggested that, in addition to physical limitations, hemodialysis patients are more susceptible to mental suffering, reduced vitality, and difficulty in socializing [35]. A possible reason for this difference is that our patients were older than those in that study, and younger patients' perceptions of the disease's impact on their quality of life can be aggravated by restrictions on routine habits and decreased autonomy, which is more common among older patients. The improvement in these dimensions indicates patients' psychological adaptation to their new reality.

In Brazil, where the present study was conducted, there has been a significant improvement in oral health epidemiological indicators since the implementation of the "*Brasil Sorridente*" national oral health policy in 2004 [36]. However, the absence of dentists in multidisciplinary teams to provide adequate care to these patients is still common in hospitals [37]. The worsening in OHIP scores - 14 between initial assessment (2016)

and follow-up assessment (2019) suggests a change in the perception of these patients regarding their OHRQoL, which indicates the need for the creation of public health policies addressing dental care for this population.

This study has some limitations. Loss of patient follow-up should be carefully assessed, given the difficulty of regrouping participants after three years, especially in a sample with a high number of deaths; however, despite losses, other studies involving patients undergoing hemodialysis reported samples of similar size [7,20,27]. No information on saliva production or composition, on biochemical changes in blood, or on the presence of other pathologies that could also affect patients' quality of life was collected, representing a potential area for future investigation.

Conclusion

The OHRQoL of patients undergoing hemodialysis worsened after three years of follow-up. HRQoL showed improvement in pain, vitality, limitations due to social aspects, limitations due to emotional aspects, and worsening in functional capacity and limitations due to physical aspects. An epidemiological surveillance system for ESRD patients should be established in Brazil, along with measures to facilitate and encourage their access to dental services.

Authors' Contributions

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All authors declare that they contributed to the critical review of intellectual content and approval of the final version to be published.			

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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