

# Beyond Treatment Compliance: The Relationship Between Hemodialysis Adherence and Quality of Life Among Patients with End-Stage Renal Disease in the Philippines

Vanessa Crispina De Villa-Galeria, MD

Student, AGO Medical and Educational Center Graduate School of Health

**Abstract**— End-stage renal disease (ESRD) requiring maintenance hemodialysis presents challenges that extend beyond treatment compliance, affecting patients' physical functioning, psychological well-being, social participation, and overall quality of life. While adherence to dialysis schedules, medication regimens, fluid restrictions, and dietary recommendations is essential for preventing complications and improving clinical outcomes, its relationship with quality of life remains an important area of investigation, particularly in the Philippine setting. This study aimed to examine the relationship between adherence to hemodialysis treatment and quality of life among patients with ESRD in the Philippines and provide evidence to inform patient-centered interventions that improve treatment outcomes and overall well-being. A quantitative cross-sectional descriptive-correlational design was employed among 68 patients undergoing maintenance hemodialysis in selected dialysis facilities in Iriga City, Philippines. Data were collected using a structured questionnaire based on the Greek Simplified Medication Adherence Questionnaire for Hemodialysis and the WHO Quality of Life-BREF. Descriptive statistics and Spearman's rho correlation analysis were utilized. Findings revealed high treatment adherence ( $M = 4.15$ ), with dietary adherence obtaining the highest score. Quality of life was moderate overall ( $M = 3.98$ ), with physical functioning and symptoms identified as the most affected domain. A strong positive and statistically significant relationship was observed between treatment adherence and quality of life ( $\rho = 0.798$ ,  $p < 0.001$ ). The findings emphasize that while adherence contributes significantly to improved patient outcomes, comprehensive interventions addressing clinical, nutritional, psychosocial, and environmental needs are necessary to enhance the overall well-being of individuals undergoing hemodialysis.

**Keywords**— Hemodialysis; End-stage renal disease; Treatment adherence; Quality of life; Patient-centered care.

## I. INTRODUCTION

Chronic kidney disease (CKD) has become one of the most significant global public health challenges due to its increasing prevalence, progressive nature, and substantial impact on morbidity, mortality, and healthcare systems. CKD is characterized by the gradual deterioration of kidney function, resulting in impaired regulation of fluid balance, electrolyte levels, and removal of metabolic waste products. As kidney function continues to decline, many patients eventually progress to end-stage renal disease (ESRD), a condition requiring renal replacement therapy through dialysis or kidney transplantation to sustain life. Recent evidence identifies CKD as a rapidly expanding global health concern, driven largely by population aging, increasing prevalence of

diabetes mellitus, hypertension, and other noncommunicable diseases (Kovesdy, 2022; Makmun et al., 2024). The increasing burden of CKD highlights the need not only for effective disease management strategies but also for approaches that address the long-term well-being of affected individuals.

In the Philippines, CKD remains a growing health concern and contributes significantly to mortality and healthcare utilization. National reports identify CKD as one of the leading causes of death in the country, with thousands of Filipinos requiring renal replacement therapy annually (Philippine Statistics Authority, 2024). The increasing demand for dialysis services has placed additional pressure on healthcare institutions and families, particularly because ESRD requires lifelong management. In response to this

growing concern, the Department of Health implemented the Chronic Kidney Disease Prevention and Control Program through Administrative Order No. 2021-0010 to strengthen prevention, early detection, and management strategies for kidney disease in the country (Department of Health, 2021). In the Bicol Region, ESRD continues to represent a significant health challenge, with increasing numbers of patients requiring hemodialysis services (Bicol Medical Center Renal Care and Transplant Center, 2024).

Hemodialysis remains the most commonly utilized renal replacement therapy among patients with ESRD because of its availability and established clinical effectiveness. However, while hemodialysis prolongs survival, it does not restore kidney function or eliminate the lifelong burden associated with chronic illness. Successful outcomes depend heavily on patients' ability to adhere to complex treatment regimens, including attending scheduled dialysis sessions, taking prescribed medications, maintaining fluid restrictions, and following recommended dietary modifications. Treatment adherence is therefore a critical factor in preventing complications, improving clinical stability, and maintaining functional capacity among individuals undergoing dialysis (Abdul-Jabbar & Kadhim, 2022). Conversely, poor adherence has been associated with increased hospitalization, treatment complications, healthcare costs, and mortality risk (Nielsen et al., 2023; Varghese et al., 2021).

Despite its importance, adherence among hemodialysis patients remains influenced by multiple personal, psychological, social, and environmental factors. The demanding nature of dialysis treatment, medication burden, financial challenges, physical limitations, and emotional distress may affect patients' ability to sustain recommended health behaviors. Studies have demonstrated that patient knowledge, disease acceptance, self-efficacy, and social support contribute significantly to treatment adherence. Alikari et al. (2023) emphasized that greater understanding of disease management promotes informed decision-making and improves self-care practices, while Derasin et al. (2024) reported that

acceptance of the disease condition is associated with stronger adherence behaviors among Filipino dialysis patients. Furthermore, social and family support systems play an essential role in helping patients maintain treatment routines and cope with the challenges of long-term dialysis (Mandias et al., 2024; Alatawi et al., 2024).

Beyond adherence, quality of life has emerged as an essential outcome measure in evaluating the effectiveness of chronic disease management. For patients undergoing hemodialysis, survival alone does not represent successful treatment because the disease affects multiple aspects of daily living, including physical functioning, emotional health, social relationships, and economic stability. Previous studies have shown that hemodialysis patients frequently experience fatigue, pain, sleep problems, psychological distress, reduced independence, and limitations in social participation, all of which negatively influence quality of life (Kustimah et al., 2020; Alshammari et al., 2023). Physical symptoms associated with dialysis, combined with financial pressures and dependence on healthcare services, may significantly affect patients' overall perception of well-being.

Psychological and social dimensions are also important contributors to quality of life among individuals receiving long-term dialysis. Anxiety, depression, uncertainty regarding the future, and emotional adjustment difficulties are common among patients with ESRD and may influence treatment experiences and coping abilities (Alshelleh et al., 2023; Yonata et al., 2022). However, protective factors such as family support, positive coping strategies, and meaningful social connections may help patients adapt to their condition. In Filipino communities, family involvement remains a significant source of emotional and practical assistance, supporting patients in managing the demands of chronic illness (Remonte et al., 2024). These findings emphasize that dialysis care should extend beyond medical management and incorporate psychosocial and supportive interventions.

Although previous studies have examined treatment adherence and quality of life among hemodialysis patients, limited evidence exists regarding their relationship in the Philippine context, particularly in smaller healthcare settings such as Iriga City and the Bicol Region. Many existing studies have focused on international populations, creating a need for locally generated evidence that considers the unique socioeconomic, cultural, and healthcare circumstances of Filipino patients. Understanding how adherence behaviors relate to quality of life may provide valuable information for developing interventions that address both clinical outcomes and patient experiences.

The present study addresses this gap by examining the relationship between adherence to hemodialysis treatment and quality of life among patients with end-stage renal disease in the Philippines. Specifically, it aimed to assess the level of treatment adherence in terms of dialysis session attendance, medication adherence, fluid restriction compliance, and dietary adherence; determine the level of quality of life across physical functioning and symptoms, mental and emotional health, social and personal well-being, environmental conditions, and overall satisfaction domains; analyze the relationship between treatment adherence and quality of life; and identify implications for developing a comprehensive patient-centered intervention framework to enhance adherence and improve the overall well-being of hemodialysis patients.

## II. METHODOLOGY

This study employed a quantitative cross-sectional descriptive-correlational research design to examine the relationship between adherence to hemodialysis treatment and quality of life among patients with end-stage renal disease in the Philippines. The descriptive component determined the level of treatment adherence and quality of life among respondents, while the correlational component examined the association between these variables without manipulating any conditions. The study was conducted from January to March 2026 among patients receiving maintenance hemodialysis in selected dialysis facilities in Iriga City, Camarines Sur, Philippines. A total of 68 adult patients diagnosed with

end-stage renal disease and undergoing regular hemodialysis were included through total enumeration. Participants were required to be at least 18 years old, undergoing hemodialysis for a minimum of three months, receiving regular dialysis sessions lasting at least four hours twice to thrice weekly, and capable of providing informed consent. Patients undergoing peritoneal dialysis, temporary dialysis due to acute kidney injury, or those with communication, cognitive, or psychiatric conditions affecting participation were excluded.

Data were collected using a structured self-administered questionnaire developed based on established instruments, including the Greek Simplified Medication Adherence Questionnaire for Hemodialysis (GR-SMAQ-HD) and the World Health Organization Quality of Life-BREF (WHOQOL-BREF). The instrument consisted of three sections: demographic characteristics, treatment adherence, and quality of life assessment. Treatment adherence was measured according to four dimensions: attendance at hemodialysis sessions, drug therapy adherence, fluid intake restriction, and dietary adherence. Quality of life was assessed across five domains: physical functioning and symptoms, mental and emotional health, social and personal well-being, environmental conditions, and overall satisfaction. The questionnaire underwent expert validation by professionals in nephrology, nursing, and research methodology, followed by pilot testing among non-participating hemodialysis patients. The reliability assessment yielded a Cronbach's alpha coefficient of 0.92, indicating high internal consistency of the instrument.

Data were analyzed using descriptive and inferential statistical methods. Frequency and percentage distributions were used to describe respondents' demographic characteristics, while weighted mean scores were utilized to determine the levels of treatment adherence and quality of life. The relationship between treatment adherence and quality of life was analyzed using Spearman's rho correlation coefficient, which was appropriate for examining associations among variables measured through Likert-scale responses. Statistical significance was determined at a 0.05 level, with p-values below 0.05

interpreted as statistically significant. Ethical approval was secured prior to data collection, and informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the research process through appropriate data coding, secure storage, and protection of participant information.

### III. RESULTS

#### *Level of hemodialysis treatment adherence among patients with end-stage renal disease*

The findings revealed that patients undergoing maintenance hemodialysis demonstrated high overall treatment adherence, with an overall mean score of

4.15. Among the specific adherence dimensions, dietary adherence obtained the highest score ( $M = 4.29$ ), followed by hemodialysis session attendance ( $M = 4.24$ ) and fluid intake restriction ( $M = 4.24$ ), all interpreted as very high adherence. Medication adherence obtained the lowest mean score ( $M = 3.84$ ), although it remained within the high adherence category.

These results suggest that patients generally recognize the importance of maintaining recommended dialysis behaviors, particularly those directly associated with preventing immediate complications and maintaining treatment effectiveness.

**Table 1.** Level of Hemodialysis Treatment Adherence Among Patients with End-Stage Renal Disease ( $n = 68$ )

| Treatment Adherence Dimension  | Mean Score | Interpretation      |
|--------------------------------|------------|---------------------|
| Food Diet Adherence            | 4.29       | Very High Adherence |
| Hemodialysis Session Adherence | 4.24       | Very High Adherence |
| Fluid Intake Restriction       | 4.24       | Very High Adherence |
| Drug Therapy Adherence         | 3.84       | High Adherence      |
| Overall Treatment Adherence    | 4.15       | High Adherence      |

The high adherence observed in this study may be attributed to the structured nature of hemodialysis care, continuous patient monitoring, and repeated education provided by healthcare professionals. Attendance at scheduled dialysis sessions is often reinforced by direct interaction with dialysis teams and the understanding that missed sessions may lead to serious complications. Previous studies have emphasized that regular dialysis attendance is essential in reducing hospitalization risks and improving clinical outcomes among patients with end-stage renal disease (Cohen et al., 2019; Varghese et al., 2021). Similarly, adherence to dietary and fluid restrictions may be strengthened by patients' direct experiences with symptoms such as edema, breathing difficulty, and discomfort associated with excessive fluid accumulation (Kaplan & Karadağ, 2022).

Dietary adherence obtaining the highest score may reflect the effectiveness of continuous nutritional counseling and patient awareness regarding the role of diet modification in controlling metabolic complications. Patients undergoing hemodialysis are required to manage restrictions involving sodium,

potassium, phosphorus, and fluid intake, making dietary behavior a critical component of self-care. Studies have shown that adequate patient education and support systems improve adherence to dietary recommendations among individuals with chronic kidney disease (Lambert et al., 2022; Nielsen et al., 2023).

Although medication adherence remained high, it was the lowest among the measured domains. This finding indicates that medication-taking behaviors may present greater challenges compared with other treatment requirements.

Possible barriers include medication burden, cost of medicines, side effects, and difficulties maintaining complex treatment schedules. Nielsen et al. (2023) noted that medication adherence among dialysis patients is influenced by socioeconomic conditions, treatment complexity, and patient beliefs regarding medications. In the Philippine context, financial limitations and accessibility issues may further affect consistent medication use (Pajimna et al., 2023; Gutierrez & Sakulbumrungsil, 2021).



Overall, the findings demonstrate that patients in this study have developed strong adherence behaviors; however, maintaining these behaviors requires continued support.

According to Orem's Self-Care Deficit Theory, adherence reflects patients' ability to perform necessary self-care activities to maintain health and well-being. Similarly, Bandura's Social Cognitive Theory emphasizes that self-efficacy and supportive healthcare environments influence sustained health behaviors. Therefore, interventions should continue strengthening patient education, medication support, and psychosocial assistance to maintain long-term adherence.

## ***Level of quality of life among patients undergoing maintenance hemodialysis***

The results showed that respondents experienced a moderate level of quality of life, with an overall mean score of 3.98. Among the measured domains, overall satisfaction obtained the highest rating ( $M = 4.09$ ), followed by mental and emotional health ( $M = 4.07$ ), social and personal well-being ( $M = 3.96$ ), environmental conditions ( $M = 3.95$ ), and physical functioning and symptoms ( $M = 3.81$ ). Although patients demonstrated strong adherence to treatment, their overall quality of life remained moderate, indicating that adherence alone does not eliminate the physical, psychological, and social burden associated with long-term dialysis.

**Table 2.** *Quality of Life Among Patients Undergoing Maintenance Hemodialysis (n = 68)*

| Quality of Life Domain                   | Mean Score | Interpretation           |
|------------------------------------------|------------|--------------------------|
| <b>Overall Satisfaction</b>              | 4.09       | Moderate Quality of Life |
| <b>Mental and Emotional Health</b>       | 4.07       | Moderate Quality of Life |
| <b>Social and Personal Well-being</b>    | 3.96       | Moderate Quality of Life |
| <b>Environmental Conditions</b>          | 3.95       | Moderate Quality of Life |
| <b>Physical Functioning and Symptoms</b> | 3.81       | Moderate Quality of Life |
| <b>Overall Quality of Life</b>           | 3.98       | Moderate Quality of Life |

The lowest score in physical functioning and symptoms highlights the continuing impact of ESRD and dialysis-related limitations on daily activities. Hemodialysis patients commonly experience fatigue, weakness, pain, sleep disturbances, and reduced physical capacity, which can affect independence and participation in daily life. Similar findings were reported by Kustimah et al. (2020), who identified physical limitations and psychological distress as major contributors to reduced quality of life among individuals undergoing hemodialysis. Alshammari et al. (2023) also emphasized that symptom burden, particularly sleep problems and fatigue, significantly influences patient well-being.

The relatively higher scores in mental and emotional health and overall satisfaction may indicate patient adaptation and acceptance of their condition. Many patients undergoing long-term dialysis develop coping mechanisms over time, supported by family relationships and healthcare interactions. In the Philippine context, strong family involvement often

serves as an important source of emotional and practical support for individuals with chronic illnesses (Mandias et al., 2024; Remonte et al., 2024). However, despite adaptation, emotional challenges such as anxiety, depression, uncertainty, and dependence remain common among dialysis patients (Alshelleh et al., 2023; Yonata et al., 2022).

The moderate rating in environmental conditions also reflects broader challenges affecting patients' experiences of care. Factors such as transportation expenses, financial burden, healthcare accessibility, and dependence on support systems may influence quality of life. Although healthcare coverage programs have improved access to dialysis services, socioeconomic barriers continue to affect the overall experience of patients receiving long-term treatment (Pajimna et al., 2023).

These findings emphasize that improving quality of life among hemodialysis patients requires interventions beyond maintaining treatment

compliance. A holistic approach integrating symptom management, psychological support, nutritional guidance, social assistance, and family participation is necessary to address the multidimensional effects of ESRD.

### **Relationship between treatment adherence and quality of life among patients with end-stage renal disease undergoing hemodialysis**

The study identified a strong positive and statistically significant relationship between treatment adherence

and quality of life among hemodialysis patients ( $p = 0.798$ ,  $p < 0.001$ ).

This indicates that patients who demonstrated higher adherence to dialysis-related treatment behaviors also reported better quality-of-life outcomes.

The finding confirms that adherence behaviors are not only important for clinical stability but also contribute to improved physical, psychological, social, and environmental well-being.

**Table 3.** Relationship Between Overall Treatment Adherence and Quality of Life Among Hemodialysis Patients ( $n = 68$ )

| Variables                                                     | Spearman's rho ( $\rho$ ) | p-value | Interpretation              | Decision    |
|---------------------------------------------------------------|---------------------------|---------|-----------------------------|-------------|
| <b>Overall Treatment Adherence vs Overall Quality of Life</b> | 0.798                     | <0.001  | Strong Positive Correlation | Significant |

The association between adherence and quality of life supports previous evidence showing that consistent compliance with dialysis schedules, medication regimens, fluid restrictions, and dietary recommendations reduces complications and promotes better health outcomes.

Abdul-Jabbar and Kadhim (2022) emphasized that adherence to maintenance hemodialysis treatment is associated with improved disease management and reduced adverse outcomes.

Likewise, Derasin et al. (2024) highlighted that acceptance of the disease condition and commitment to treatment contribute significantly to sustained adherence among Filipino dialysis patients.

The findings also support the theoretical foundation of the study.

Under Orem's Self-Care Deficit Theory, patients who effectively perform self-care activities are more likely to maintain health and prevent complications.

Meanwhile, Bandura's Social Cognitive Theory explains that adherence behaviors are influenced by self-efficacy, expected outcomes, and environmental support.

Thus, improving adherence requires not only patient motivation but also supportive healthcare systems and social networks.

However, the results also demonstrate that adherence should not be viewed as the sole indicator of successful dialysis care.

Despite high adherence levels, respondents only achieved moderate quality of life.

This suggests that other factors, including socioeconomic conditions, emotional health, symptom burden, and access to support services, continue to influence patient outcomes.

The analysis demonstrated that all dimensions of treatment adherence were significantly associated with all quality-of-life domains.

Dietary adherence showed the strongest and most consistent relationship across domains, particularly with overall satisfaction ( $p = 0.707$ ), environmental conditions ( $p = 0.698$ ), and social and personal well-being ( $p = 0.686$ ).

Hemodialysis session adherence also showed strong relationships with environmental conditions and overall satisfaction.

**Table 4.** Relationship Between Treatment Adherence Dimensions and Quality-of-Life Domains

| Treatment Adherence Dimension  | Physical Functioning & Symptoms | Mental & Emotional Health | Social & Personal Well-being | Environmental Conditions | Overall Satisfaction |
|--------------------------------|---------------------------------|---------------------------|------------------------------|--------------------------|----------------------|
| Hemodialysis Session Adherence | 0.585**                         | 0.593**                   | 0.481**                      | 0.673**                  | 0.701**              |
| Drug Therapy Adherence         | 0.567**                         | 0.595**                   | 0.506**                      | 0.571**                  | 0.474**              |
| Fluid Intake Restriction       | 0.481**                         | 0.613**                   | 0.595**                      | 0.584**                  | 0.642**              |
| Food Diet Adherence            | 0.651**                         | 0.668**                   | 0.686**                      | 0.698**                  | 0.707**              |

The strong relationship between dietary adherence and quality of life may be explained by the central role of nutrition management in controlling symptoms and preventing complications among dialysis patients. Proper dietary practices contribute to improved metabolic balance, reduced symptom severity, and greater confidence in disease management. Previous studies have emphasized that nutritional counseling and dietary support are essential components of comprehensive CKD management (Lambert et al., 2022; Nielsen et al., 2023).

The significant association between dialysis session adherence and quality of life reinforces the importance of completing prescribed dialysis treatments. Regular dialysis prevents toxin accumulation, controls fluid balance, and maintains physiological stability. Cohen et al. (2019) demonstrated that missed or delayed dialysis sessions are associated with increased clinical risks.

The findings further indicate that treatment adherence behaviors are interconnected with psychosocial

outcomes. Patients who successfully manage their treatment routines may experience improved confidence, reduced anxiety, and better social functioning. This supports the importance of multidisciplinary care involving physicians, nurses, dietitians, social workers, and mental health professionals.

Implications for developing a comprehensive patient-centered intervention framework to enhance treatment adherence and improve quality of life among hemodialysis patients in the Philippine setting

The findings indicate that while patients demonstrated high adherence, their quality of life remained moderate, highlighting the need for interventions that extend beyond treatment compliance.

The proposed patient-centered framework emphasizes an integrated approach addressing physical symptoms, medication management, nutritional support, psychological well-being, family involvement, and healthcare accessibility.

**Table 5.** Proposed Components of the Patient-Centered Hemodialysis Adherence and Quality of Life Enhancement Framework

| Identified Need Based on Findings                      | Proposed Intervention Component                                               | Expected Outcome                    |
|--------------------------------------------------------|-------------------------------------------------------------------------------|-------------------------------------|
| Moderate quality of life despite high adherence        | Holistic dialysis care approach integrating clinical and psychosocial support | Improved overall patient well-being |
| Lower medication adherence compared with other domains | Medication counseling, reminders, and adherence monitoring                    | Improved medication compliance      |
| Poor physical functioning and persistent symptoms      | Symptom management and individualized physical activity support               | Improved physical functioning       |

|                                               |                                                               |                                 |
|-----------------------------------------------|---------------------------------------------------------------|---------------------------------|
| <b>Psychological and emotional challenges</b> | Mental health counseling, coping strategies, and peer support | Improved emotional well-being   |
| <b>Financial and environmental barriers</b>   | Social assistance linkage and healthcare access support       | Reduced treatment burden        |
| <b>Need for sustained adherence behaviors</b> | Continuous patient education and family involvement           | Long-term adherence maintenance |

This approach aligns with current recommendations emphasizing comprehensive chronic disease management rather than focusing solely on biomedical outcomes. Hemodialysis patients require continuous education, emotional support, and assistance in managing the practical challenges associated with lifelong treatment. Gurung and Devkota (2025) emphasized that quality of life among dialysis patients is influenced by physical symptoms, emotional distress, and social limitations.

Therefore, improving outcomes among Filipino hemodialysis patients requires healthcare programs that recognize patients as individuals with complex medical, psychological, and social needs. The proposed intervention framework provides a foundation for strengthening dialysis services through multidisciplinary collaboration and patient-centered care.

#### IV. CONCLUSION & RECOMMENDATION

This study demonstrated that adherence to hemodialysis treatment is significantly associated with the quality of life among patients with end-stage renal disease in the Philippines. Respondents generally exhibited high adherence to their prescribed treatment regimen, particularly in dietary practices, attendance at hemodialysis sessions, and fluid restriction compliance, while medication adherence, although still high, represented an area requiring further attention. Despite these positive adherence behaviors, patients reported only a moderate level of quality of life, with physical functioning and symptoms identified as the most affected domain, reflecting the continuing burden of long-term dialysis treatment. The findings further revealed a strong positive relationship between treatment adherence and quality of life, indicating that patients who consistently followed their treatment recommendations were more likely to

experience better physical, psychological, social, and environmental outcomes. However, adherence alone is insufficient to achieve optimal patient well-being. The results emphasize the need for a comprehensive, patient-centered approach that integrates clinical management with nutritional support, psychosocial care, family involvement, and improved access to healthcare resources. Moving beyond treatment compliance toward holistic care is essential in improving the overall health outcomes and lived experiences of individuals undergoing maintenance hemodialysis.

Based on the findings, healthcare providers and dialysis centers should strengthen comprehensive patient-centered programs that address both treatment adherence and quality of life among individuals undergoing hemodialysis. Continuous patient education, individualized counseling, medication management support, nutritional guidance, and monitoring of fluid and dietary practices should be integrated into routine dialysis care, with particular emphasis on improving medication adherence. Healthcare institutions should also establish psychosocial support services, including counseling, peer support groups, and family-centered interventions, to address emotional distress, social limitations, and adjustment challenges associated with chronic dialysis. Collaboration among nephrologists, nurses, dietitians, social workers, rehabilitation specialists, and community health stakeholders is recommended to provide holistic support for patients. Government agencies and healthcare policymakers may consider strengthening programs that reduce financial and accessibility barriers to dialysis care. The implementation and evaluation of the proposed Integrated Hemodialysis Adherence and Quality of Life Enhancement Program (I-HAQEP) is recommended as an evidence-based intervention



framework for improving patient outcomes. Future researchers may further explore additional determinants of quality of life, such as mental health, health literacy, spirituality, social support, and long-term outcomes using larger samples and longitudinal research designs.

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