

Fluid Overload and Self-Efficacy in Hemodialysis: Implications for Patient Care

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ARTICLE INFO

Article history

Received 03 April 2025

Revised 17 June 2025

Accepted 22 June 2025

Keywords

Chronic Kidney Disease

Fluid Overload

Fluid Restriction

Hemodialysis

Self-Efficacy

ABSTRACT

This study aimed to investigate the relationship between self-efficacy and fluid overload in patients undergoing hemodialysis. The study included 96 adult patients receiving regular hemodialysis at a private hospital in Bandung, Indonesia. Self-efficacy in fluid restriction was assessed using a validated 20-item questionnaire based on Bandura's model. Overhydration was measured using the Interdialytic Weight Gain (IDWG) index. Descriptive and inferential analyses were performed, including Kendall's Tau-b correlation test. The study revealed that 60.4% of participants had low self-efficacy, while 66.7% were classified as overhydrated. A statistically significant inverse relationship was found between self-efficacy and fluid overload ($p = 0.002$), suggesting that patients with lower self-efficacy were more likely to experience overhydration. Self-efficacy plays a critical role in fluid management among patients receiving hemodialysis. Strengthening self-efficacy through nurse-led behavioral interventions, standardized patient education, and digital health monitoring may enhance fluid adherence.

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Introduction

Chronic kidney disease (CKD) is a growing global health concern, affecting an estimated 16.2% of the population as of 2022 [1]. As a progressive and complex condition, CKD imposes significant physiological, psychological, and economic burdens on patients and healthcare systems [2,3]. Hemodialysis remains one of the primary modalities of renal replacement therapy, alongside peritoneal dialysis, transplantation, and conservative care [4,5]. However, despite its life-sustaining nature, hemodialysis is associated with a variety of challenges, particularly related to long-term adherence and patient self-management.

One of the most prevalent complications among patients receiving hemodialysis is fluid overload, a condition that contributes to cardiovascular morbidity, respiratory compromise, and reduced quality of life [6,7]. Fluid overload occurs when patients exceed prescribed fluid limits between dialysis sessions, leading to interdialytic weight gain (IDWG) beyond safe thresholds [8,9]. Adherence to fluid restrictions is essential to prevent such complications, yet remains difficult to achieve consistently [10,11]. Research indicates that non-adherence to fluid restrictions in patients receiving hemodialysis ranges from 10% to 60% [12].

In Indonesia, CKD prevalence has reached 3.8% nationally [14], underscoring the growing burden of the disease and the urgency for effective management strategies. Self-efficacy, defined as an individual's belief in their ability to perform behaviors to achieve desired outcomes [15,16], is a key psychological factor in promoting adherence to treatment regimens. In hemodialysis patients, it influences the ability to regulate fluid intake and maintain health-conscious decisions [17–19]. This underscores the important role of healthcare professionals in strengthening self-efficacy through education, motivation, and tailored interventions [20,21].

Although fluid management is widely recognized as a critical clinical issue in chronic kidney disease, the underlying psychological aspects, particularly self-efficacy, have received limited attention in both research and practice. Previous studies have often emphasized medical adherence without deeply investigating the motivational and behavioral mechanisms that influence patient compliance. The concept of self-efficacy, grounded in Bandura's theory, is particularly significant in the context of hemodialysis, where patients are required to adhere to complex and often uncomfortable fluid restrictions. Despite its established role in other chronic disease domains, its application in understanding and predicting fluid overload behavior in hemodialysis patients remains underexplored.

This study addresses this gap by examining the novel intersection between self-efficacy and IDWG, a clinical marker of fluid overload. By investigating this relationship, the study aims to contribute to the development of more holistic, patient-centered strategies for fluid

management, strategies that incorporate psychological readiness and behavioral empowerment as essential components of care.

Material and Methods

This study employed a cross-sectional design to examine the relationship between self-efficacy and fluid overload in patients with CKD undergoing hemodialysis. The design was selected to capture a snapshot of this association at a single point in time and is consistent with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [22]. The research was conducted at a private hospital in Bandung, Indonesia, over a three-month period from May to July 2024. The site was selected based on its accessibility to a large and diverse population of patients receiving regular hemodialysis, which provided a representative setting for the study objectives.

The study population consisted of adult CKD patients receiving outpatient hemodialysis. Participants were recruited using purposive sampling, targeting individuals who met the following inclusion criteria: 1) aged 19 years or older; 2) able to read and write; 3) mentally alert and capable of providing informed consent; 4) receiving hemodialysis at least twice weekly; 5) undergoing hemodialysis for a minimum of six months; and 6) not currently hospitalized. Patients who were non-cooperative, unconscious, or receiving furosemide therapy during data collection were excluded.

The sample size was calculated using the Lemeshow formula for cross-sectional studies, which is appropriate when estimating proportions with a specified precision. The calculation assumed a 66% estimated prevalence of overhydration among patients receiving hemodialysis (based on previous local studies), a confidence level of 95%, and a margin of error of 10%. The resulting minimum sample size was 87 participants. To account for potential dropouts or incomplete data, a total of 96 patients were recruited, which exceeds the minimum requirement and ensures adequate statistical power for correlation analysis.

Data were collected through a combination of clinical measurement and structured self-report instruments. Prior to hemodialysis, participants' pre-dialysis weights were recorded to assess fluid overload. Following this, each participant completed a questionnaire designed to evaluate their self-efficacy in managing fluid intake. To assess self-efficacy, a 20-item questionnaire was administered, which was developed in accordance with Bandura's self-efficacy theory [23]. This instrument captures three essential dimensions of self-efficacy: magnitude (the perceived difficulty of tasks), strength (the individual's confidence in performing tasks), and generality (the applicability of efficacy across different situations). Each item was rated on a Likert-type scale, allowing respondents to indicate their level of agreement

or confidence. The overall score represents the individual's self-perceived ability to adhere to prescribed fluid restrictions during hemodialysis.

Validity testing produced item validity indices ranging from 0.481 to 0.813. Items with indices below 0.500 were carefully reviewed for conceptual alignment with Bandura's self-efficacy framework and clarity in wording. Based on expert feedback, these items were retained due to their theoretical relevance and acceptable contribution to the overall construct coverage. Additionally, the instrument's reliability was tested using Cronbach's alpha, which yielded a coefficient of 0.924, demonstrating strong internal consistency and supporting the tool's psychometric robustness. Among the 20 items, only two items had validity indices close to the lower bound (0.481 and 0.492), while the majority scored above 0.600, ensuring that most items contributed adequately to construct validity.

In parallel, fluid overload was assessed using the IDWG index. IDWG was calculated by subtracting the patient's post-dialysis weight from the pre-dialysis weight recorded just before the next dialysis session. This value reflects the volume of fluid accumulated between two dialysis sessions and is widely accepted as a clinical marker of fluid adherence. For consistency, weight measurements were conducted using the same calibrated digital scale, and all readings were recorded by trained dialysis nurses. In this study, IDWG values were further categorized into two groups: normal (<2.5 kg) and overhydrated (≥ 2.5 kg), based on commonly used clinical cut-off points indicating increased cardiovascular risk and poor fluid control in hemodialysis patients.

Descriptive statistics were used to summarize participant demographics and the distribution of self-efficacy and IDWG values. Frequencies and measures of central tendency (mean, median) were reported. Kendall's Tau-b correlation was used to examine the relationship between self-efficacy and fluid overload, given the ordinal and non-parametric nature of the data. A p-value < 0.05 was considered statistically significant. All analyses were performed using SPSS version 26.0.

The study received ethical approval from the Research Ethics Committee of Universitas 'Aisyiyah Bandung (Approval No. 769/KEP.01/UNISA-BANDUNG/V/2024) and Al Islam Hospital Bandung (Approval No. 033/KEPK-RSAI/6/2024). Written informed consent was obtained from all participants. Confidentiality and anonymity were strictly maintained throughout the research process, and participants were informed of their right to withdraw at any stage without affecting their treatment.

Results

A total of 96 patients receiving hemodialysis participated in this study. The demographic and clinical characteristics are presented in Table 1. Most participants were female (55.2%) and aged 55–65 years (40.6%). Over half were unemployed (54.2%) and had completed senior high school (51.0%). The most prevalent comorbidity was hypertension (66.7%).

Table 1. Sociodemographic and clinical characteristics of participants (n = 96).

Characteristic	Category	n (%)
Age (years)	25–44 years	31 (32.3)
	45–54 years	26 (27.1)
	55–65 years	39 (40.6)
Gender	Men	43 (44.8)
	Women	53 (55.2)
Education	Primary or Junior	21 (21.9)
	Senior High School	49 (51.0)
	Higher Education	26 (27.1)
Marital Status	Married	89 (92.7)
	Single	7 (7.3)
Employment Status	Employed	44 (45.8)
	Unemployed	52 (54.2)
Duration of Dialysis	<1 year	5 (5.2)
	1–3 years	23 (24.0)
	3–5 years	46 (47.9)
	>5 years	22 (22.9)
Comorbidities	Hypertension	64 (66.7)
	Diabetes Mellitus	12 (12.5)
	Hypertension & Diabetes	7 (7.3)
	Others	13 (13.5)

The combined distribution of self-efficacy levels and fluid status is shown in Table 2. Among patients with low self-efficacy, 81.0% were overhydrated, while among those with high self-efficacy, only 44.7% experienced overhydration. Statistical analysis using Kendall's Tau-b revealed a significant negative correlation between self-efficacy and overhydration ($p = 0.002$), indicating that lower self-efficacy was associated with a higher risk of fluid overload.

Table 2. Distribution of self-efficacy levels and fluid status (n = 96).

Self-Efficacy Level	Overhydrated n (%)	Normal n (%)	Total n (%)
Low (n = 58)	47 (81.0)	11 (19.0)	58 (60.4)
High (n = 38)	17 (44.7)	21 (55.3)	38 (39.6)
Total	64 (66.7)	32 (33.3)	96 (100.0)

*Statistical test: Kendall's Tau-b correlation

**p-value: 0.002

In addition to categorical comparison, descriptive statistics of IDWG by self-efficacy level are presented in Table 3. Patients with low self-efficacy had a higher mean IDWG ($2.41 \pm$

0.45 kg) compared to those with high self-efficacy (1.70 ± 0.38 kg). The median IDWG was also greater in the low self-efficacy group (2.38 kg) than the high self-efficacy group (1.71 kg). This difference reflects a meaningful behavioral disparity in fluid adherence.

Table 3. Descriptive statistics of IDWG by self-efficacy level.

Self-Efficacy Level	Mean (SD)	Median (IQR)	Min	Max
Low	2.41 (0.45)	2.38 (2.15–2.68)	1.52	3.43
High	1.70 (0.38)	1.71 (1.49–2.00)	0.65	2.33

These trends are further illustrated in Figure 1, which presents a boxplot of IDWG distribution across self-efficacy groups. The distribution of IDWG differed notably between self-efficacy groups. Patients with low self-efficacy exhibited higher median IDWG values (approximately 2.38 kg) and greater variability, indicating more fluctuation and higher fluid retention. In contrast, those with high self-efficacy had a lower median IDWG (approximately 1.71 kg) with a narrower interquartile range, reflecting more consistent adherence to fluid restrictions. The presence of outliers in the low self-efficacy group further underscores the irregularity in fluid management behavior.

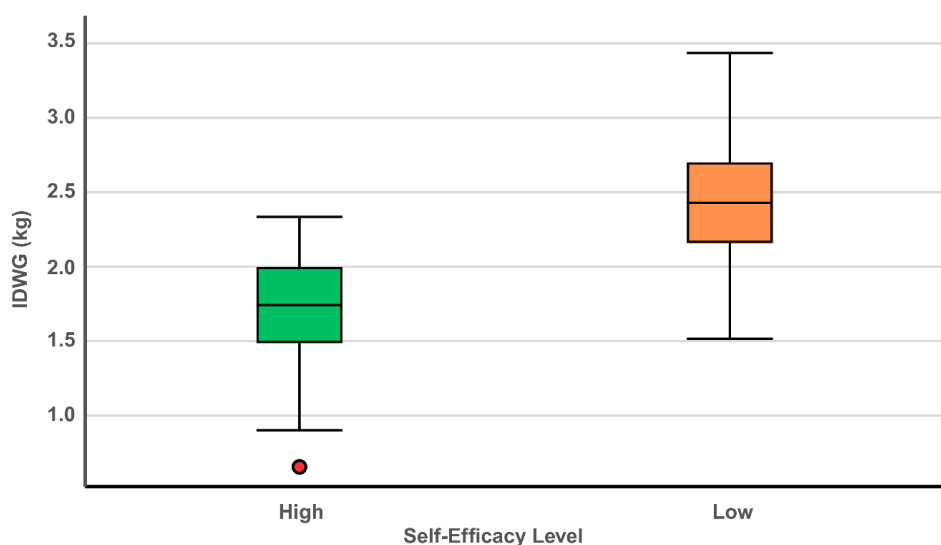


Fig 1. Distribution of IDWG by self-efficacy level.

Discussion

This study explored the relationship between self-efficacy and fluid overload among patients undergoing hemodialysis and found a statistically significant inverse association between the two variables. Patients with lower self-efficacy were more likely to experience fluid overload, as reflected by their IDWG values. Specifically, 81.0% of patients in the low self-efficacy group were overhydrated compared to only 44.7% in the high self-efficacy group.

These findings are consistent with previous research indicating that self-efficacy plays a pivotal role in treatment adherence, particularly in chronic disease management [12,17,18].

The importance of fluid management in CKD patients receiving hemodialysis cannot be overstated, as non-adherence to fluid restrictions is a well-documented contributor to cardiovascular complications, hospitalizations, and mortality [8,9]. The IDWG data in this study provide further insight into this relationship. Patients with low self-efficacy had significantly higher average IDWG (2.41 ± 0.45 kg) compared to those with high self-efficacy (1.70 ± 0.38 kg), reinforcing the behavioral link between self-belief and health outcomes. Clinically, an IDWG exceeding 2.0–2.5 kg between sessions is considered suboptimal and has been linked to increased risks of hypertension, left ventricular hypertrophy, and hospitalization. The mean value of 2.41 kg in the low self-efficacy group approaches or surpasses this threshold, suggesting a meaningful deviation from recommended limits. This highlights the real-world significance of even moderate differences in self-efficacy, as they may translate into higher fluid burden and potential cardiovascular complications. The boxplot visual further demonstrated this pattern, showing greater variability and higher medians in the low self-efficacy group.

These findings align with Bandura's theory, which posits that individuals with higher self-efficacy are more likely to exert effort, persist in the face of difficulties, and self-regulate their behaviors toward achieving health-related goals [15]. However, it is important to interpret the findings cautiously due to the cross-sectional nature of the study. While the data suggest that low self-efficacy is associated with higher fluid overload, the direction of this relationship cannot be confirmed. It is plausible that frequent episodes of overhydration and the resulting clinical complications could undermine patients' confidence in managing fluid intake, thereby lowering self-efficacy. This possibility of reverse causation warrants consideration and should be explored in longitudinal or intervention-based research.

In the context of hemodialysis, self-efficacy enables patients to adhere to strict fluid limitations, despite the discomfort or habitual tendencies toward excessive intake [24]. The role of nurses is critical in this domain, particularly through personalized education, behavioral coaching, and continuous support. This study also supports earlier works, who found that targeted interventions to enhance self-efficacy, such as motivational interviewing and structured health education, that can improve fluid adherence and reduce IDWG [20,21]. These interventions should be embedded within routine renal care, delivered not only by nurses but also through collaborative efforts with dietitians, psychologists, and nephrologists. The data also suggest that clinicians should routinely assess patient self-efficacy as part of holistic care planning, especially for those at risk of overhydration.

Sociodemographic factors observed in this study also merit consideration. The majority of participants were in the older age group, unemployed, and living with hypertension. These characteristics are known to influence both self-efficacy and treatment adherence [25,26]. Older patients may have more health complications and cognitive fatigue, while those without employment may lack daily structure or motivation to follow care plans [27,28]. Although not the focus of this study, these contextual elements highlight the need for socio-behavioral strategies in renal nursing practice. While not formally tested as moderating variables, these factors may confound or interact with self-efficacy in influencing fluid management behavior. For example, older patients may experience cognitive decline, physical fatigue, or limited health literacy, which could hinder both self-regulation and adherence despite having moderate self-efficacy. Similarly, unemployed individuals may face psychological stress or reduced social support, which can impact their motivation and confidence in managing fluid intake. Educational background may also play a role; patients with lower education levels may struggle to fully comprehend dietary and fluid restrictions, potentially weakening the link between self-efficacy beliefs and actual behavior. These sociodemographic characteristics, therefore, may either attenuate or amplify the observed relationship between self-efficacy and IDWG. Future studies with multivariate or moderation analysis designs are recommended to examine these interactions more rigorously.

Conclusion

This study demonstrated a statistically significant inverse relationship between self-efficacy and fluid overload among patients undergoing hemodialysis, as measured by Interdialytic Weight Gain (IDWG). The analysis using Kendall's Tau-b correlation revealed a negative association ($p = 0.002$), indicating that lower self-efficacy was significantly associated with higher IDWG values. Categorically, 81.0% of patients with low self-efficacy experienced overhydration (defined as $IDWG \geq 2.5$ kg), compared to only 44.7% among those with high self-efficacy. These findings support the critical role of psychological readiness, particularly self-efficacy, in influencing fluid adherence.

Beyond the clinical setting, this research underscores the need for renal care policies that recognize and invest in psychosocial components of chronic illness management. Self-efficacy indicators could be operationalized through structured nursing assessments integrated into electronic medical records, using validated instruments administered at regular intervals. Evaluation could be embedded in quality assurance frameworks that track patient outcomes like fluid adherence or hospitalization rates. Existing models such as Indonesia's "Program Indonesia Sehat" or WHO's person-centered care framework provide

precedent for integrating psychosocial metrics into national standards. Strategies that empower patients and support multidisciplinary collaboration will be essential in delivering high-quality, person-centered care. Future studies should explore longitudinal impacts of self-efficacy on morbidity and mortality, evaluate scalable digital interventions, and include broader social and cultural factors that influence self-management in diverse patient populations.

Limitation and Suggestions

Several limitations should be acknowledged. First, the use of a cross-sectional design limits the ability to infer causality between self-efficacy and fluid overload. Second, the study was conducted in a single hospital setting with purposive sampling, which may limit the generalizability of the findings to broader hemodialysis populations. Third, self-efficacy was measured using self-report, which may be subject to social desirability or recall bias. Fourth, while Kendall's Tau-b correlation was appropriate for ordinal data, the study did not employ multivariate analysis such as logistic regression to control for potential confounders (e.g., age, comorbidities, duration of dialysis). This limits the ability to isolate the effect of self-efficacy from other influencing variables. Finally, other psychosocial and environmental variables, such as family support, depression, or access to health education, that were not assessed but may influence fluid management behavior.

For clinical practice, this study underscores the importance of incorporating self-efficacy assessments into routine care for patients receiving hemodialysis. Nurses and interdisciplinary teams should develop and implement tailored behavioral interventions, such as motivational counseling, educational videos, or mobile health reminders, that aim to strengthen self-management skills. The findings support the integration of psychosocial indicators, such as self-efficacy, into national renal care quality standards. Policies should promote training for healthcare professionals on behavioral coaching techniques and allocate resources for long-term adherence support, especially in low-resource settings.

Acknowledgment

We want to express our gratitude to all who participated in this research. We would also like to thank Universitas 'Aisyiyah Bandung for supporting this study.

Conflict of Interest

The authors have no relevant financial or non-financial interests to disclose.

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