Self-care Adherence in Hemodialysis Patients: A Structural Equation Modeling

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Abstract

BACKGROUND: Management of health problems in patients undergoing hemodialysis is quite complicated, fluid restriction, diet, following treatment recommendations, and managing physical activity are problems that are often difficult to manage. Self-regulation of HD patients is needed to maintain adherence regarding fluid restriction, diet, medication, and physical activity management.

AIM: We aimed to investigate self-care adherence in hemodialysis patients with a structural equation modeling.

METHODS: One hundred and thirty patients with the hemodialysis-dependent end-stage renal disease took part in a quantitative cross-sectional study.

RESULTS: The researchers investigated personality traits, information factors, emotional factors, disease representation, motivation, appraisal, coping, and self-care adherence.

CONCLUSION: Except for motivation, which has no direct effect on coping (T-statistic = 1.666), almost every construct in this model significantly affects coping.

Introduction

Management of health problems in patients undergoing hemodialysis is quite complicated, fluid restriction, diet [1], following treatment recommendations [2], and management of physical activity [3] are some of the problems that are often difficult to manage. Self-regulation of HD patients is needed to maintain adherence regarding fluid restriction, diet, medication, and management of physical activity [4]. Low self-care adherence which includes fluid management, diet, medication, and physical activity can be a major factor in hemodialysis failure. Evaluation of self-care adherence can be seen from interdialytic weight gain (IDWG), blood pressure, sodium levels, and functional independence. Until now, the effect of self-regulation-based adherence on self-care management of hemodialysis patients assessed from IDWG, blood pressure, sodium levels, and functional independence is not known [5].

About 30–60% of chronic kidney disease (CKD) patients undergoing hemodialysis fail to adhere to recommendations for fluid and salt intake, the estimated non-adherence in the HD patient population is still below 74% [6]. Non-adherence rates in patients receiving dialysis, medication, food, and fluid restriction and physical activity adherence ranged from 26–53%, 39–85%, 41.4–67%, and 64–70%; therefore, non-adherence patients are considered as one of the important problems for health-care providers, because low patient adherence will hinder the success of hemodialysis [7].

CKD is increasing globally and affects about 10% of the adult population, but nine out of ten people are unaware of the condition [8]. According to the Basic Health Research (Riskesdas) in 2018, the prevalence of CKD increased to 0.38% in Indonesia. This number has doubled compared to 2013, which was only 0.2% [9]. Data from the Indonesian Renal Registry (IRR, 2018) estimate that the incidence of CKD requiring dialysis is around 499 per million population. Meanwhile, the prevalence of non-adherence to HD patients with diet and fluid restriction ranges from 10% to 85%, depending on the various measurement tools used. Several studies have shown that 10% to 20% of HD patients routinely exhibit a high IDWG.

Non-adherence of hemodialysis patients to the regimen will cause several complications. The success of hemodialysis therapy depends on the patient's lifelong adherence to four aspects of the regimen, namely, dietary adherence, fluid restriction, and dialysis treatment [10] and physical activity is things that need to be adhered to by hemodialysis patients, non-adherence in physical activities contributes to loss of muscle strength and mass, which limit the quality of life and rehabilitation of hemodialysis patients. [11]. Inadequate balance of diet and physical activity will cause abnormal body composition and impaired physical capacity. These complications lead to an increased risk of hospitalization, morbidity, and mortality [12]. Non-adherence of hemodialysis patients is based on several things, one of which is a fluid restriction which is often difficult for patients to do, especially if the patient is taking drugs that make the mucous membranes dry such as diuretics, causing thirst, and the patient tries to drink [13].

Efforts to increase adherence with HD patients are to increase self-regulation because adherence behavior is a mechanism that needs patient control [6], [14], [15], [16]. Self-regulation of HD patients is a special skill that is carried out to manage their disease. Hemodialysis patients must manage excessive thirst, maintain the recommended diet, take prescribed drugs, and carry out physical activities as recommended, but the self-regulation of HD patients to date still tends to be below. Self-regulation is a behavior that requires special abilities from individuals, it is necessary to have appropriate motivation and information informing adherence [17].

The information motivation and behavioral skills model state that the promoting of behavior depends on the extent to which the patient has mastered sufficient knowledge and is motivated to change his behavior. Lazarus's appraisal and coping strategy are the correct theory to determine the patient's perception and dealing with the disease. This theoretical concept helps to understand the psychosocial effect (primary appraisal, secondary appraisal, and coping strategy) on HD patients' decision-making to improve self-regulation. This self-regulation-based adherence model can be used as an alternative solution to replace the belief-based adherence model that has been used and is considered less effective [18].

Information factors, personal characteristics, emotional, disease representation, and motivation affect the appraisal. The appraisal itself has several aspects of the primary appraisal, including the patient's perception of the severity of the disease, and secondary appraisal, which includes the patient's perception of the success of treatment. A good appraisal can improve coping in hemodialysis patients, and then, good coping can improve self-care management. Hemodialysis patients must be able to manage the recommended regimen, including fluid intake management, food, medication, and physical activity. Therefore, self-care adherence behavior emerges, which is assessed from outcomes consisting of IDWG, blood pressure, sodium levels, and functional independence. Based on the explanation above, research on "Development of a Self-Regulatory Based adherence Model for IDWG, Sodium Levels, Blood Pressure, and Functional Independence in Hemodialysis Patients" needs to be done. This model is built based on self-regulation and information motivation and behavioral skills [19] and stress, appraisal, and coping [20]. Effective self-regulatory strategies are needed to improve adherence to recommended hemodialysis patient adherence behaviors need to be implemented to improve fluid and dietary management (control sodium levels and increase IDWG) and reduce morbidity and mortality in this vulnerable population [21].

We aimed to investigate self-care adherence in hemodialysis patients with a structural equation modeling.

Methods

This research is quantitative research using a cross-sectional approach. This study involved 130 hemodialysis dependent patients. The criteria of inclusion are age 26–45 years, stable hemodynamic conditions, and hemodialysis 2 times a week for more than 3 months. The independent variables in this study are characteristic factors, information factors, emotional factors, disease representation, motivation, appraisal, and coping which consist of 24 sub-variables, while the dependent variable consists of two variables: Self-care adherence, fluid management, diet, medication, and physical activity. The information questionnaire consists of knowledge on an adaptation of dialysis quiz [22], awareness of disease conditions adaptation CKD patient awareness questionnaire [23], and a media questionnaire showing the involvement of media types that provide information related to hemodialysis. The characteristic factor questionnaire consisted of age, gender, education level, marital status, occupation, income, and hemoglobin level. The emotional factor questionnaire consists of 12 statements. Questionnaire representation of adaptation disease was measured using a illness perception questionnaire [24]. The motivation questionnaire was measured by the treatment motivation questionnaire (TMQ) [25]. The appraisal was measured by the Primary Appraisal and Secondary Appraisal Questionnaire [26]. Coping was measured using ways of coping [27]. Self-care adherence was measured by self-care of CKD index [28]. This research has used inferential structural equation modeling (SEM) analysis. The protocol has been declared ethically feasible by the Health Research Ethics Committee of Sultan Agung Islamic Hospital No: 12/EC/KEPK/2020.

Results

Characteristics of respondents

Table 1 explains that 42.3% of HD patients at Sultan Agung Islamic Hospital are 46–55 years old, 60% are female, 71.5% have secondary education, 85.4% are married, and 60.8% of patients are still working, 52.3% still have income below the minimum wage, and 36.9% are still anemic.

Table 1: Description of the demographic characteristics factors in the HD room of Sultan Agung Islamic Hospital in 2020 (n = 130)

Characteristic Factor	Category	f	%
Age	18–25 years	3	2.3
	26–35 years	6	4.6
	36–45 years	27	20.8
	46–55 years	55	42.3
	56–65 years	33	25.4
	> 65 years	6	4.6
Total		130	100
Gender	Male	52	40
	Female	78	60
Total		130	100
Education level	Basic education	15	11.5
	Middle education	93	71.5
	Higher education	22	16.9
Total		130	100
Marital status	Not married yet	8	6.2
	Marry	111	85.4
	Widow/widower	11	8.5
Total		130	100
Profession	Not work	51	39.3
	Work	79	60.8
Total		130	100
Income	≤People's minimum wage	68	52.3
	> People's minimum wage	62	47.7
Total		130	100
Hb. Level	Anemia	48	36.9
	Not anemia	82	63.1
Total		130	100

Characteristics of research variables

Table 2 shows that of the three sub-variables of information factors that show low results, the respondents' knowledge about hemodialysis is 32.3%, low awareness of disease conditions still reaches 23.2%, and the media to obtain information about hemodialysis is mostly from the media electronics, which is 43.8%.

The variable fear was still found as much as 37.7% in the severe category. This shows that the psychological and physical pressure felt by HD patients at Sultan Agung Islamic Hospital which is still high. The anxiety variable was found to be 33.1% in the severe category, demonstrating the feelings of uncertainty and worry felt by HD patients. Depression variable was found at 33.8% in the severe category, HD patients still feel very deep sadness and helplessness.

About 46.9% of respondents showed severe symptoms in the sub-variable of disease identity. As many as, 60.8% of respondents were unable to recognize the cause of the disease. As many as 51.5% of respondents had a negative timeline, meaning that patients have not been able to interpret the time in developing of their disease during hemodialysis.

Table 2: Characteristics of research variables

Variable	Category	f	%
Information factor			
Knowledge	Low	42	32.3
	Moderate	67	51.5
	High	21	16.2
Total		130	100
Disease condition awareness	Low	30	23.1
	Moderate	69	53.1
	High	31	23.8
Total		130	100
Information media	Health workers	5	3.8
	Print media	6	4.6
	Celibate Friends	23	17.7
	Electronic Media	57	43.8
	Family	32	24.6
	Personal experience	7	5.4
Total		130	100
Emotional factor			
Fear	Normal	3	2.3
	Light	24	18.5
	Moderate	54	41.5
	Heavy	49	37.7
Total		130	100
Anxiety	Normal	7	5.4
	Light	18	13.8
	Moderate	62	47.7
	Heavy	43	33.1
Total		130	100
Depression	Normal	4	3.1
	Light	21	16.2
	Moderate	61	46.9
	Heavy	44	33.8
Total		130	100
Disease representation			
Disease Identity	Severe Symptoms	61	46.9
	Mild Symptoms	69	53.1
Total		130	100
Causes of disease	Unable to recognize	79	60.8
	Able to recognize	51	39.2
Total		130	100
Timeline	Negative	67	51.5
	Positive	63	48.5
Total		130	100
Consequence	Negative	69	53.1
	Positive	61	46.9
Total		130	100
Control	Negative	70	53.8
	Positive	60	46.2
Total		60	100
Motivation			
Personal motivation	Low	70	53.8
	High	60	46,2
Total		130	100
Social motivation	Low	67	51.5
	High	63	48.5
Total		130	100
Appraisal			
Primary appraisal	Negative	67	51.5
	Positive	63	48.5
Total		130	100
Secondary appraisal	Negative	70	53.8
	Positive	60	46.2
Total		130	100
Coping			
Focus on problem	Negative	64	49.2
	Positive	66	50.8
Total		130	100
Focus on Emotions	Negative	77	59.2
	Positive	53	40.8
Total		130	100
Self-care adherence			
Fluid Management	Good	21	16.2
	Enough	87	66.9
	Not enough	22	16.9
Total		130	100
Diet	Good	24	18.5
	Enough	82	63.1
	Not enough	24	18.5
Total		130	100
Treatment	Good	13	10
	Enough	88	67.7
	Not enough	29	22.3
Total		130	100
Physical activity	Good	15	11.5
	Enough	92	70.8
	Not enough	23	17.7
Total		130	100

As many as 53.1% of respondents had negative consequences, meaning that the patient had not been able to interpret the implications of the conditions

experienced during hemodialysis. As many as 53.8% of respondents had negative control over the disease symptoms, meaning that the patient had not been able to control the conditions they experienced while undergoing hemodialysis.

About 53.8% of HD patients at Islamic Hospital Sultan Agung have low personal motivation, and 51.5% of HD patients have low social motivation. Patients have a low motivation to act about the impact of adherence and non-adherence behavior, evaluation of the results of these behaviors, and perceptions of support from others are still low.

About 51.5% of HD patients at Islamic Hospital Sultan Agung have a negative primary appraisal, meaning that it shows low cognitive processes in self-assessment of the severity of the disease. As many as, 53.8% of HD patients at Islamic Hospital Sultan Agung have a negative secondary appraisal, this shows that the cognitive process in self-assessment of the success of hemodialysis management is still low.

The negative category was found as much as 49.2% in the problem-focused coping variable, this indicates that the patient has not been able to adapt to the problem by solving the problem rationally. As many as, 59.2% of HD patients at Islamic Hospital Sultan Agung have coping focused on negative emotions, meaning that patients have not been able to adjust emotionally to the problems experienced during hemodialysis. About 16.9% of respondents are less able to manage fluids, 18.5% are less able to manage diet, 22.3% are less able to manage medication, and 17.7% are less able to manage their physical activities.

SEM analysis

Table 3 explains that almost all constructs of this model have a significant effect except motivation on coping, motivation does not have a direct effect on coping (T-statistic = 1.666). The appraisal variable is the strongest in influencing coping. Meanwhile, coping itself is the most powerful factor in influencing self-care adherence.

Discussion

The results showed that the self-care adherence of hemodialysis patients was shaped by

indicators of fluid management, diet, medication, and physical activity. The results of this study are in line with the concept of self-regulation proposed by Leventhal *et al.* [29] that self-care adherence can be directly affected by the coping process.

Hemodialysis patients have complex lives that require intensive and extensive life changes. Non-adherence to dialysis treatment recommendations and other medical requirements are a very common behavior. Approximately 50% of people with ESRD who undergo HD do not adhere to the prescribed treatment regimen. Estimates for non-adherence to HD care recommendations range from 22% to 86%, depending on the definition and measurement of adherence [30].

Adherence is "the extent to which a person's behavior in taking medication, following a diet, and/or implementing lifestyle changes is following agreed recommendations from a health-care provider." Adherence marks the extent to which the patient's behavior is appropriate in regards to the doctor's recommendation. Non-adherence can be unintentional (i.e., when the patient does not comply due to lack of understanding, negligence, or miscommunication with the health care professional) or advertent (i.e., when the patient actively chooses not to follow a medication regimen) [31]. Adherence to dietary and fluid restrictions, drug prescriptions, and dialysis regimens are important determinants of the outcome of hemodialysis therapy. Hemodialysis therapy must be carried out regularly to maintain stable kidney function so that the condition does not get worse. In addition, fluid regulation, medication, physical activity, and lifestyle changes such as diet are management that must be adhered to by ESRD patients [32].

Fluid and dietary non-adherence can be indicated by biochemical indices, including sodium gain, and IDWG. There are no standard limits for potassium and phosphate levels that define non-adherence. Studies have used a range of 5.5 to 8 mEq/L as a marker of potassium non-adherence and a range from 5.5 mg/dL to 7.5 mg/dL as a marker of phosphate non-adherence. IDWG is measured by absolute and relative values and is increased by high sodium and fluid intake. The prevalence of non-adherence to HD patients with diet and fluid restriction ranges from 10% to 85%, depending on the various measurement tools used. Several studies have shown that 10% to 20% of HD patients routinely exhibit a high IDWG. Increased IDWG has been associated with decreased dialysis

Table 3: Analysis of structural equation modeling

Variable	Original sample (O)	Sample mean (M)	Standard deviation	T-statistics	p	Sig.
Information Factor (X1) - > Appraisal (X6)	0.102	0.221	0.161	5.002	0.021	Significant
Information Factor (X1) - > Coping (X7)	0.117	0.118	0.228	5.578	0.019	Significant
Information Factor (X1 - > Self-care adherence (Y1)	0.116	0.126	0 0.110	7.073	0.013	Significant
Characteristic Factor (X2) - > Appraisal (X6)	0.152	0.234	0.198	10.527	0.009	Significant
Emotional Factor (X3) - > Appraisal (X6)	0.106	0.089	0.196	3.103	0.032	Significant
Disease Representation (X4) - > Appraisal (X6)	0.336	0.335	0.190	3.946	0.029	Significant
Motivation (X5) - > Appraisal (X6)	0.482	0.470	0.192	5.734	0.018	Significant
Motivasi (X5) - > Koping (X7)	0.064	0.063	0.062	1.666	0.088	Not significant
Motivation (X5) - > Self-care adherence (Y1)	0.151	0.240	0.146	4.324	0.021	Significant
Appraisal (X6) - > Coping (X7)	0.820	0.820	0.148	17.274	0.001	Significant
Coping (X7) - > Self-care adherence (Y1)	0.251	0.260	0.155	11.500	0.003	Significant

effectiveness, hypertension, congestive heart failure, pulmonary edema, and death. Dialysis patients may often have difficulty understanding, assimilating, and following dietary recommendations. Although a typical diet provides about 1,500 mg of phosphorus per day from milk, meat, poultry, fish, cereals, and eggs, the recommended dietary intake for phosphorus intake for dialysis patients is 700 mg/day [33]. Diet is a very important factor in the management of ESRD patients undergoing hemodialysis. Avoiding eating foods that contain potassium, sodium, and phosphate needs to be done, and managing the right food consumption can be done to maintain the body's nutritional needs [16].

The adherence of hemodialysis patients in carrying out physical activities can be seen from how patients carry out recommended activities such as sports and take advantage of free time. Physical activity is defined as any bodily movement by contraction of skeletal muscles that increases energy expenditure above the basal level. Activities can be categorized by mode, intensity, and purpose. Exercise (or sports training) is a subcategory of planned, structured, repetitive, and purposeful physical activity in the sense that the improvement or maintenance of one or more components of physical fitness [3].

Conclusion

Information factors (knowledge, awareness of disease, and media), characteristic factors (age, gender, education, marital status, occupation, income, and Hb levels), emotional factors (stress, anxiety, and depression), representation of the patient's disease condition hemodialysis (disease identification, ability to recognize the cause of disease, timeline, consequences, and control), and motivation improve appraisal through so that the appraisal of hemodialysis patients becomes positive. Information factors increase the coping and compliance of HD patients through knowledge, awareness of the disease, and media. The motivation of hemodialysis patients increases self-care adherence through personal motivation and social motivation. Positive appraisals of hemodialysis patients improve coping strategies through primary appraisal and secondary appraisal. Coping strategies determine the level of self-care adherence through problem-focused and emotion-focused coping.

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