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# Treatment Compliance and Associated Sociodemographic Factors among Haemodialysis Patients in Sabah A Cross Sectional Analysis

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**ABSTRACT**

Haemodialysis requires sustained adherence to treatment sessions, medicines, fluid limits, dietary guidance, and self-care, but these behaviours may be constrained by health, household resources, and access to care. Objective: To assess treatment compliance and its sociodemographic and clinical associations among adults receiving maintenance haemodialysis in Sabah. This single-centre cross-sectional census invited all 80 active patients at a tertiary referral centre in Kota Kinabalu; 68 completed the study. A 27-item instrument assessed five compliance domains. Total scores ranged from 0 to 27, with scores of 22 to 27 classified as high compliance. Descriptive statistics, group comparisons, effect sizes, and Pearson correlations were calculated. Mean compliance was 18.3 of 27 points (67.8%), and 27.9% achieved high compliance. Attendance (84.0%) and self-care (83.8%) exceeded medication adherence (67.5%), dietary adherence (60.8%), and fluid restriction (56.7%). The largest group differences involved employment ($d = 0.94$, $p = 0.001$), tertiary education ($d = 0.84$, $p = 0.003$), and marital status ($d = 0.76$, $p = 0.003$). Younger age, household income below RM1,000, and travel beyond 30 km were also associated with lower scores. Interdialytic weight gain correlated inversely with fluid-compliance scores ($r = -0.543$, $p < 0.001$), providing convergent evidence for the fluid domain rather than validation of the full questionnaire. The main adherence gaps involved daily fluid and dietary decisions rather than attendance. The associated social and access factors identify groups who may need practical, culturally appropriate support, but the single-centre cross-sectional design does not establish causality or broad generalisability.

## 1. Introduction

Haemodialysis is a life-saving treatment for those who have end stage renal failure, but it requires a lot more than showing up for dialysis. Patients must be seen at recommended times, be taking multiple medications properly and limiting fluid and potassium/sodium/phosphorus intake, keeping an eye on symptoms, and following clinical recommendations quickly and thoroughly. These

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demands continue and add to the burden of physical stress of kidney failure, dialysis, and working and with family and friends.

The number of people needing renal replacement therapies (RRT) is still increasing in Malaysia and haemodialysis is still the most common treatment [10]. Haemodialysis is the most common dialysis treatment in the world and successful long-term dialysis depends on following the recommended treatment [6]. Failure to comply may lead to a variety of adverse effects including fluid overload, hypertension, electrolyte disturbance, treatment intolerance, emergency admission and premature death [11] The clinical implications are thus the sum of its parts: incremental deviations over multiple days can sum to significant physiological risks to the next dialysis session. In particular, the latter is a concern in the state of Sabah. They may come from any neighbourhood in the urban area, rural areas or even faraway areas in tertiary centers in Kota Kinabalu. Recommendations may be impacted by travel expense, transport availability, income, job requirements, food access and household assistance. A patient may have a good idea of what a fluid target is, but in the heat may not be thirsty enough or they may know what they should eat but not what they can afford. Given these situations it is important to make a difference between unwillingness and barriers to a person's ability to comply.

Compliance is also multi-faceted. Dialysis attendance is immediately apparent and regularly scheduled, while dietary and fluid choices are made privately and repeatedly. Medication use falls in between these extremes: on one hand, prescriptions are clinically organized, but on the other hand, people have to remember, access and establish a routine for taking the medicine. Overall scores are not always a good indicator of specific behaviours that need to be addressed. Results will be required in the domain to determine if the main issue is attendance, medication, food, fluid or a more general issue of self-care.

The aim of this study was to determine the extent and trend of adherence of adults on maintenance haemodialysis in Sabah and to identify clinical and sociodemographic factors associated with adherence. Five behavioural domains were analyzed and differences were assessed across age, employment, education, marital status, income, travel distance, dialysis duration, and objective clinical indicators. The study highlights specific weak behaviours and patient groups in the dialysis services who are more likely to have barriers to care, offering evidence to support targeted support.

## 2. Literature Review

### *2.1 Patterns of Non-Adherence in Haemodialysis*

Non-Adherence in Haemodialysis (NAH) and its Pattern. Failure to comply is common in haemodialysis patient populations, but definitions of non-adherence and the instruments used to measure it differ among studies and objective indicators of non-adherence are scarce. In a systematic review and meta-analysis of 11,209 patients, Vijay and Kang [15] reported adherence to dietary restrictions rates of 47.3 percent to 72.5 percent and adherence to fluid restrictions rates of 50.0 percent to 70.7 percent. The ranges are wide because they are actual variations from setting to setting and because of the difference in measurement. However, all of the studies have shown that for many patients it is hard to manage on a daily basis. The integrative review by Win *et al*., [16] also revealed significant non-adherence to fluid allowances and diet restrictions. Fluid restriction is particularly challenging because thirst is a need that has to be satisfied at this very moment, while the positive consequences of abstaining are only felt later. Patients need to be able to comprehend intricate dietary instructions, to assess portion sizes and to choose an appropriate diet within the context of their household and cultural dietary practices. Taking medicines also presents an added challenge as haemodialysis patients often have several medicines to take at various times which may

include instructions to take the medicine with food. This is because these demands are overlapping, which means that they are demanding a large cognitive and behavioural workload. The impacts of attendance are unique in that they are more direct, easier to see when they are missing and have a shorter time of absence. A schedule for dialysis is also provided, which includes an external program. In contrast, choices regarding your diet, medicines and water consumption on a daily basis are less dramatic and are not immediately rewarded. This difference may account for the sometimes higher attendance scores than the scores for self-managed behaviours, even in the same patients. It also demonstrates the importance of not relying on a single global adherence label because one patient's adherence to dialysis, while reliable, can still lead to dangerous inter-dialysis fluid accumulation. Malaysian studies have shown that diet and fluid management are important. Lim *et al*., [9] associated low nutrition literacy with low adherence to the diet of maintenance haemodialysis patients in the Klang Valley. Siti Noorkhairina and Nor Amalina [12] reported moderate adherence to diet and fluid restriction in Kuantan, and emphasized the effect of marital status. The results indicate that besides knowledge there is a need for the patient's ability to implement recommendations into household routines for adherence. Family members may help with adherence by providing support (such as cooking the right foods and reminding them to take medications) or may inadvertently contribute to nonadherence by following the same eating habits. Social support is also highlighted from the chronic kidney disease population. Budhiana *et al*., [4] identified a relationship between family involvement and therapy routines and wellbeing of patients. This approach might overlook the persons in the family who are responsible for the food, meal preparation, transportation and medication monitoring if the counselling is targeted at the patient alone, which is the norm in the Malaysian context. It is important, therefore, to consider a family-inclusive approach in application to clinical practice and interpretation of sociodemographic factors.

### *2.2 Sociodemographic and Structural Factors*

Resources, opportunity, and support influence adherence. A positive effect of education could be an increase in health literacy and numeracy, and in feeling confident about the advice given in the clinic. Jobs can help people earn income, have a regular schedule, and have a source of function, but can also interfere with dialysis. Income is a factor that affects transportation, access to medicine and access to recommended foods. When using public transport, there are direct costs, fatigue and uncertainty associated with travel distances, especially if travel is limited or treatment times are early. These factors are not independent, but rather they all work together. This is a wider interpretation, which is supported by international evidence. The use of the Internet and mobile phones, as well as education, and transport access, were identified as factors associated with adherence in an in-centre haemodialysis population by Alhamad *et al*., [1]. Baye *et al*., [3] have illustrated the burden imposed by treatment related costs; the economic burden can impair the capacity to adhere to treatment plans. Financial restrictions can affect attendance and they can also affect the way people use their medicines, by rationing them; the way people eat, choosing lower-cost, higher-sodium foods; or the decision not to take medicines as recommended for their health. This is not just about lack of compliance and hides the structures that are causing this. “Marital status may be used as an indicator of available support, but is not necessarily an indicator of support. It is important to provide a spouse or partner with meals, transportation, encouragement and reminding medicines, but it is more important the quality and consistency of the support. In the same way, younger patients may have to deal with work, child care issues, and social pressures that can make this regimen challenging, while older patients may have more experience with illness but fewer

physical or cognitive capabilities. Hence, the results that follow must be interpreted in the context of age.

### *2.3 Health Belief Model*

The Health Belief Model is a helpful model to understand daily treatment decisions. It suggests that action is dependent upon perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy [2]. A patient will be more receptive to fluid restriction when the risk of fluid overload is personally relevant, the benefit of fluid restriction is believable, if the patient is thirsty the fluid restriction can be supervised, reminders can be given, and the patient is able to meet the fluid restriction target. The same reasoning applies to diet, medication and attendance. Sousa *et al*., [13] mapped patients' perceived barriers and facilitators to haemodialysis attendance within this model and highlighted perceived benefits and self-efficacy. The cues to action in the Sabah context can include nurse counselling, family reminders, a visual reminder of the weight, or a visible record of any symptoms or treatment. The link between intention and behaviour may be reinforced or weakened by structural factors like transport and income. Therefore, for the purposes of this analysis compliance is not considered to be a personal property of the patient, but rather an outcome of the interplay of beliefs, personal resources, clinical experience, and environmental constraints.

## 3. Research Methodology

### *3.1 Design, Setting, and Participants*

The present study employed a cross sectional descriptive design using quantitative approach to describe the level of treatment compliance and explore the associated factors. The study was carried out in the main tertiary centre in the haemodialysis unit in Kota Kinabalu, Sabah. The unit had a constant number of 80 adults on maintenance haemodialysis. The data collection was carried out for 8 weeks in April-May 2025, permitting patients attending various treatment shifts to be approached. The accessible population was small and well defined, leading to the adoption of a census strategy. All 80 active patients were invited. At a 95 percent confidence level, the Krejcie and Morgan [8] table suggests that 66 should be the minimum number of people to have in a population of 80. Having the whole population invited also helped prevent non-response to the study. A total of 73 patients agreed to participate and 68 patients fulfilled all the study criteria, yielding an analyzable response rate of 85.0 percent.

### *3.2 Measures and Scoring*

The questionnaire contained sociodemographic and clinical information and a 27-item treatment-compliance scale. The compliance instrument covered five domains: dialysis session attendance, medication adherence, fluid restriction, dietary adherence, and self-care management. Binary items were summed to produce an overall score from 0 to 27. Scores of 81-100 percent were classified as high compliance, 52-80 percent as moderate compliance, and 0-51 percent as low compliance. The scale demonstrated excellent internal consistency in the sample, with a Cronbach's alpha of 0.89 [14].

Objective clinical information was extracted from medical records for the three months preceding the survey. Interdialytic weight gain was especially relevant because it is related to fluid intake between sessions. Laboratory values and dialysis-related characteristics were used to contextualise

self-reported behaviour. Agreement between the fluid score and weight gain provides convergent evidence for that domain, but it does not validate the entire questionnaire.

### *3.3 Data Collection and Analysis*

Eligible patients were approached during routine treatment. The purpose of the study was explained, informed consent was obtained, and assistance was provided when participants required clarification. Responses were handled confidentially. Data were analysed using SPSS Version 29.0. Descriptive statistics summarised the participant profile and compliance domains. Group comparisons examined differences across sociodemographic categories, Pearson correlations assessed continuous relationships, and effect sizes were used to judge practical importance. Statistical significance was set at $p < 0.05$.

The cross-sectional design supports description and association but not causal inference. For example, employment may facilitate adherence through income and structure, while better health and adherence may also make employment more feasible. The analytical emphasis was therefore placed on identifying patterns that can guide risk assessment and future longitudinal research rather than claiming temporal direction.

## 4. Results

### *4.1 Participant Profile*

A total of 68 subjects (54.4% male) aged a mean 52.4 years (SD 12.6) were included in the final sample. The participants of the cohort were composed of ethnic diversity of the people of Sabah, Kadazan-Dusun participants 35.3 percent, and Bajau participants 23.5 percent. Kidney disease was the major disease cause due to diabetes mellitus in 47.1 percent; and 94.1 percent received dialysis three times a week. The socioeconomic profile exhibited high vulnerability. Nearly half of the participants (45.6 per cent) experienced no work due to illness, while 38.2 per cent reported their monthly household income of less than RM1,000. These properties are clinically significant as adherence requires transport, food choices, access to medicines, and the maintenance of adherence routines. There was consequently a significant portion of the sample who were running a heavy workload for which they had restricted financial or functional resources.

### *4.2 Overall and Domain-Specific Compliance*

The mean overall compliance score was 18.3 out of 27, equivalent to 67.8 percent. Only 27.9 percent achieved high compliance, meaning that nearly three quarters of the sample remained below the optimal category. The domain profile separated highly structured behaviours from activities that depended on continuous self-management in the home and community.

**Table 1**
Treatment compliance scores by domain

| Domain | Percentage score | Rank |
|---|---|---|
| Dialysis session attendance | 84.0 | 1 |
| Self-care management | 83.8 | 2 |
| Medication adherence | 67.5 | 3 |
| Dietary adherence | 60.8 | 4 |

*Source Kinansi [7]*

Dialysis attendance and self-care management both exceeded 80 percent, whereas medication adherence was 67.5 percent, dietary adherence was 60.8 percent, and fluid restriction was 56.7 percent. The lowest scores therefore occurred in behaviours that require repeated decisions without direct clinical supervision. This pattern identifies the precise domains in which general education should be replaced by practical, behaviour-specific support.

### *4.3 Sociodemographic and Clinical Associations*

Employment status showed the largest group difference in compliance. Participants who were able to work had a mean score of 20.8 compared with 17.1 among those unable to work ($p = 0.001$; $d = 0.94$). Tertiary education was associated with a higher mean score than non-tertiary education (21.2 versus 17.7; $p = 0.003$; $d = 0.84$). Married participants also had a higher mean than unmarried participants (19.4 versus 16.2; $p = 0.003$; $d = 0.76$). These statistically significant differences identify associated factors; they do not establish causal or independently predictive effects.

**Table 2**
Factors associated with treatment compliance

| Factor | Result | Effect size |
|---|---|---|
| Employment | Able to work: M = 20.8; unable: M = 17.1; p = 0.001 | d = 0.94, large |
| Education | Tertiary: M = 21.2; non-tertiary: M = 17.7; p = 0.003 | d = 0.84, large |
| Marital status | Married: M = 19.4; unmarried: M = 16.2; p = 0.003 | d = 0.76, medium |
| Age group | 18-40 years lowest at M = 16.0; p = 0.006 | Medium |
| Income | Below RM1,000 lowest at M = 16.4; p = 0.008 | Medium to large |
| Travel distance | Over 30 km: M = 15.9; under 10 km: M = 19.3; p = 0.018 | Medium |

*Source Kinansi [7]*

There were also statistically significant group differences with respect to age, income and distance. The age-group mean for participants aged 18-40 was 16.0 ($p = 0.006$), the lowest of all age-groups. Household income of less than RM1,000 had the smallest income-group mean of 16.4 ($p = 0.008$). This was statistically significantly different from a mean score of 19.3 for patients living less than 10 km from the hospital, but higher than the mean score of 15.9 for patients who lived more than 30 km away ($p = 0.018$). These associations indicate real-life challenges with treatment, though they are not independent predictions.

The longer dialysis duration was associated with increased compliance, although it was not a strong correlation ($r = 0.267$, $p = 0.028$) which might be explained by adaptation to dialysis. There was an inverse relationship between interdialytic weight gain and self-reported fluid compliance ($r = -0.543$, $p<0.001$). This relationship does not constitute convergent evidence for the fluid-compliance domain, nor is it to be interpreted as definitive validity for the full questionnaire.

Specific behaviours were consistent to the domain results. Nearly three-quarters (73.5%) exceeded the recommended limit for interdialytic weight gain (2kg) and 88.2% ate high potassium foods at least once a week. These indicators, along with the lower fluid and dietary scores are used to help prioritize practical assistance in these areas.

## 5. Discussion

### *5.1 Why Structured Behaviours Perform Better*

The overall compliance percentage of 67.8 percent provides a clinically significant gap and the domain pattern is the more actionable finding. Factors facilitating dialysis attendance are appointments, transport, staff contact and the immediate consequences of non-attendance at dialysis. Patients are often aware that they can rapidly deteriorate to more severe stages if they don't get the help. With fluid or food restrictions, on the other hand, you have to make numerous small choices that require discipline and patience, and don't provide the instant gratification that food and drink do. The cumulative damage is after the time, typically the next treatment session.

This gap between formal and informal conduct is similar to the worldwide findings. Vijay and Kang [15] reported non-adherence to diet and fluid restriction over a wide spectrum of haemodialysis patients. This is similar to the results of Lim *et al*., [9] nutrition-literacy findings in Malaysia, which indicates that dietary management is an issue of wider concern in Malaysia. There may be information available, but patients must have the skills needed, resources available, and cooperation within the household to use the information.

There are also two aspects to fluid restriction: physiological and behaviour. Factors such as thirst, dry mouth, certain medications, weather, frequent drinking and social dining can contribute to consumption. Drinking less might then be not enough. Patients require particular targets, strategies to control thirst, mechanisms to track intake, and feedback that will link the interdialytic weight gain with their daily choices. A significant negative correlation value ($r = -0.543$) was obtained between fluid compliance and weight gain, which confirmed the clinical significance of this domain.

Adherence with the diet is also complex as recommendations are given for a number of nutrients and not one forbidden food. The patient needs to take into account medications, the timing of eating them, portion size, protein, potassium, sodium, and cooking methods. Guidance can also go against customary meals or the family's budget. Any further input from a dietitian should focus on more specific lists and locally available foods, realistic portions and participation of family members. Dietary counselling should be evaluated for understanding and implementation because foods with potassium were consumed on a weekly basis.

Medication adherence was in the middle. The results showed that a prescription is not enough to ensure proper use of the medication, with a score of 67.5 percent. This may be due to pill burden, changing schedules, side effects, the cost of medicines, or uncertainty regarding the timing of phosphate binders or other medicines. These barriers can be overcome using medication reconciliation, simplified drug schedules (where clinically appropriate), reminder systems, and teach-back. It is preferable to describe all patients with one single undifferentiated compliance score, rather than domain specific interventions.

### *5.2 Interpreting Associated Factors*

The most measurable impact was from employment but this cannot be interpreted to mean that one automatically leads to adherence. The ability to work can be associated with improved functional status, earning power, a sense of daily structure, and motivation to stay healthy. On the other hand, a person may be ill enough to affect their work or ability to take medications. These directions cannot be distinguished in the cross sectional design, however, the employment status is still very

informative for the purpose of identifying risk factors, as it represents many dimensions of social and functional benefit.

Education can have an impact on how well people can read labels on food, instructions on medications, feedback from the laboratory, and the implications of their choices across the day. The large education effect is a factor that encourages the application of health-literacy sensitive communication. Written materials to use plain language, visual examples and practical demonstrations, and staff to confirm understanding – don't assume it. Education is part of the process of delivering information, and should not be used as a measure of support that a patient is entitled to receive.

This difference in marital status is consistent with the marital status reported in the research on chronic kidney disease in Malaysia [4]. Partners can remind about recommendations, cook suitable meals, arrange for transport and observe medications missing. For unmarried patients, however, parents, siblings, adult children or friends are able to provide them with equivalent care. Clinicians should therefore inquire directly of whom their patients are getting assistance from, and not rely on marital status alone.

Income and distance reveal structural barriers which are not easily addressed by the education system. Patients going longer than 30 km may need to pay for transport costs, wait too long, be affected by the weather and can be tired. It may be difficult for lower income households to afford the recommended foods or to cover multiple travel expenses. Baye *et al*., [3] demonstrated that the economic impact of haemodialysis on treatment behaviour. Adherence care involves transport assistance, coordinated appointment times, social-welfare referral and flexible support.

The lowest age-group compliance was amongst younger adults. This could be due to expectations of work, child care responsibilities, social involvement and decreased awareness of immediate vulnerability. This can be explained through the constructs of the Health Belief Model: possible long-term consequences may not be as apparent as the inconvenience of the day, and perceived barriers are very obvious. Counselling needs to link adherence to goals relevant to the younger adult, and to build self-efficacy by setting targets that are achievable.

Combined, these factors represent variations in patients' ability to adhere to treatment guidelines. Stable income, education, household support, and shorter distance to travel may enable patients with more resources to manage recommendations. Any individual who is experiencing multiple disadvantages may require a combination of clinical, nutritional, transportation, and social services. When assessing risk, it is important to take into account cumulative vulnerability, rather than individual demographic factors as causes of non-adherence.

## 6. Clinical and Policy Implications

Short term adherence assessment at the domain level should be adopted along with a regular review of clinical status in dialysis units. Thirst management coaching, targets should be individualised, tools to monitor intake and feedback based on interdialytic weight trends should be given to the patients with fluid difficulty. Foods, culturally relevant meals, portion demonstrations, and family involvement should be used in dietary support. Pill burden, timing issues, side effects, cost and misunderstanding are examples of what should be discovered during a medication review. Reassessment is critical, as barriers to adherence evolve over time in terms of health, work and family situation.

A risk-based pathway could focus on those who are younger; unable to work; less educated; unmarried or unsupported; low income or geographically distant. More frequent counselling, telephone follow-up, coordinated transport, social-work referral, peer mentoring and flexible

scheduling may be beneficial for high-risk patients. The measures acknowledge that compliance is a product of the behavior of the patient and access to services. Self-reported domains and objective measures like interdialytic weight gain should be monitored for quality improvement.

## 7. Limitations and Future Research

The study was conducted at one tertiary centre, which limits generalisability to other facilities and rural dialysis settings. Its cross-sectional design identifies associations but cannot determine causal direction. Most domains relied on self-report and may be influenced by recall or social-desirability bias, although the relationship with interdialytic weight gain supports the fluid findings. The sample size also limited detailed multivariable examination of smaller subgroups. Future multicentre longitudinal studies should assess how adherence changes over time and test culturally tailored education, family interventions, transport support, and digital monitoring.

## 8. Conclusion

Treatment compliance among haemodialysis patients in this Sabah cohort was suboptimal at 67.8 percent. Fluid restriction and dietary adherence were the weakest domains, whereas attendance and general self-care were comparatively strong. Employment, education, marital status, age, income, and travel distance were associated with adherence, and interdialytic weight gain was consistent with the fluid-compliance findings. The results identify both behaviours and patient groups that may require additional support. Improvement should combine practical education with family engagement and assistance for structural barriers.

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**Ethics Statement**
The underlying student research project, titled Quality of Life and Treatment Compliance in Haemodialysis Patients at Queen Elizabeth Hospital Kota Kinabalu Sabah, was reviewed by the Open University Malaysia Research Ethical Committee. The supplied approval form records approval with minor correction on 5 December 2025 and does not show a separate approval number. Written informed consent was obtained before questionnaire administration, participation was voluntary, and confidentiality and anonymity were maintained.

**Author Contributions**
Abdul Raimi Bin Abd Kadir contributed to conceptualisation, formal analysis, manuscript integration, original drafting, project administration, and correspondence. AP Dr Alias Bin Mahmud contributed to supervision, methodology review, validation, interpretation, and critical revision. Joemmaicca Augustta Anak Joggery, Siti Maisarah Amdan, Mohd Azroy Ag Rajak, Kamariah Hussein, and Ts Mohd Tajuzzaman Hassanor contributed to the literature review, interpretation, and manuscript revision. Muhammad Zaki Saat and Ab Farid Fajilah Ab Aziz contributed to clinical interpretation and critical revision. All authors reviewed and approved the final manuscript.

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