

Therapeutic Adherence among Chronic Kidney Disease Patients under Hemodialysis in Selected Hospitals of Kathmandu Valley

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ABSTRACT

Introduction: Chronic Kidney Disease (CKD) is an emergent public health problem in Nepal. Hemodialysis is the best treatment for this disease to reduce morbidity and mortality. Therapeutic adherence is crucial factor that influences morbidity and mortality among patients under hemodialysis. The objective of the study was to find out the therapeutic adherence among CKD patients under hemodialysis in selected hospitals of Kathmandu valley.

Methods: Descriptive cross-sectional study design was adopted. Altogether 164 patients with CKD under hemodialysis were selected by using non-probability purposive sampling technique. Data were collected through face to face interview using structured interview schedule. Frequency, percent, mean and standard deviations were used for data analysis. Non-parametric Kruskal Wallis test and Mann Whitney U test were applied to measure the mean difference in therapeutic adherence among CKD patients under hemodialysis according to selected variables.

Results: Therapeutic adherence levels were 33.5%, 62.8% and 3.7% for good, satisfactory and unsatisfactory respectively. Concerning about hemodialysis, 92.7% respondents had good, 6.1% had satisfactory and 1.2% had unsatisfactory level of adherence to hemodialysis. Furthermore, it was found that 29.9%, 1.8 % and 87.8% respondents had good; and 59.1%, 42.1% and 9.1% had satisfactory level of adherence to diet, fluid and medicine respectively. The results showed that therapeutic adherence was statistically significant with mean difference according to sex ($p=0.009$), duration of hemodialysis ($p=0.001$), total session of hemodialysis ($p=0.001$) and providing health information by dietician and other hemodialysis patients ($p=0.001$).

Conclusion: Therapeutic adherence was found to be satisfactory but adherence to fluid intake is still unsatisfactory. It is recommended that regular education and counseling should be provided in order to increase level of therapeutic adherence.

Keywords: *Chronic kidney disease, patient compliance, renal dialysis*

INTRODUCTION

About 400,000 people worldwide are suffering from chronic renal failure, of these; more than 300,000 are under hemodialysis treatment.¹ In the USA, it was reported that 64.9% of CKD patients received hemodialysis.² It is estimated that the number of new cases who need dialysis is about 100 – 150 per million populations per year in developing countries. The population of End Stage Renal Disease (ESRD) patients requiring dialysis in Asia is expanding at a rate higher than elsewhere in the world. In Nepal, the prevalence of CKD is 6.0%.³ It is also estimated that the number of new cases of end-stage renal failure is around 2800-4200 per year needing dialysis or transplantation.⁴ Government has made dialysis service free however; it does not cover the associated medication cost. Government of Nepal pays NRs 2500 to hospitals per dialysis. The median monthly out of pocket expenditure among hemodialysis patients was NRs. 32,810.⁵

Adherence by patients to prescribed treatment regimens can be considered as the interface between effective therapy and effective disease management.⁶ Adherence to drug therapy in CKD patients globally varies from as low as 38.0 to as high as 83.0% in which social factors like age, marital, socio-economic status and level of education may also play a role.⁷ Poor adherence to treatment is common in patients on hemodialysis which may increase risk for poor clinical outcomes and mortality.⁸

Non-adherence to chronic drug therapy is known to significantly increase the disease burden in developing economies. The major predictors of the poor adherence include cost of medication, missed appointments, side effect of medication, psychological

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problems, treatment complexity, asymptomatic disease, inadequate follow up, poor patient provider relationship, patients lack of insight in illness, patients' lack of belief in benefit of treatment and barrier to access the healthcare facilities.⁷ Good adherence to therapeutic regimen reduces morbidity and mortality; and gives longevity of life. Therapeutic adherence is the superior means to control, to avoid from any complications and to maintain quality of life. But very few literatures can be found on this issue in Nepal. Therefore, this study aimed to find out the therapeutic adherence among chronic kidney disease patients under hemodialysis in selected hospitals of Kathmandu valley.

METHODS

A descriptive cross-sectional study was conducted to find out therapeutic adherence among CKD patients under hemodialysis in Shahid Dharmabhakta National Transplant Centre (SDNTC), Bhaktapur and Tribhuvan University Teaching Hospital (TUTH), Kathmandu. Those study sites were purposively selected. Altogether 164 adult patients were selected by using non-probability, purposive sampling technique. Both male and female adult patients with 20 years and above age; and diagnosed as CKD and doing hemodialysis at least one month before study were included in the study.

Sample size of this study was 164 which was calculated by using following formula.⁹

$n = Z^2pq/E^2$ with the desired precision of 6.0% (94.0% confidence limits at an allowable error of 6.0%).

Where,

n = the desired sample size

Z = the standard deviate (set for a 94.0% CI) = 1.96

P = the prevalence of therapeutic adherence is 61.0% = 0.61¹⁰

$q = 1 - p = 1 - 0.61 = 0.39$

Level of significance = 6.0%

Absolute allowable error (E) = 0.06

$n = (1.96)^2 \times 0.61 \times 0.39 / (0.06)^2 = 253$

Here,

$n = 253$

For the finite population, sample size could be adjusted by using the formula

$(n) = n/1 + n-1/N$

Where N = Known population of given area = 360 (As TUTH hemodialysis department = 60 cases and SDNTC = 300 cases per month). This gives $n = 149$, $n = 149 + 15$ (Adding the 10.0%

non-response rate). So, the final sample size was 164 (57 from TUTH and 107 from SDNTC).

A pretested structured interview schedule and five points Likert Scale developed by researchers were used as data collection tools. Pretesting of the data collection tools were done among 10.0% of sample size (i.e. 16) in SDNTC which were excluded in the final study. Content validity was established from extensive review of available literatures, consultation with panel of nephrologists, nurses working in dialysis and nephrology wards; and dietician of TUTH. Revision was made as per suggested by them. Translation of data collection tools from English to Nepali language and again back translation was done by researchers with the help of nephrologists and dietician. Ethical approval was obtained from Nepal Health Research Council. Respondents were explained about the purpose, technique, duration, risks and benefits of the study; and formal informed consent was obtained from each respondent prior to interview. Confidentiality of the information was maintained. Data were collected by researcher through face to face interview technique. Interview was done during the period of dialysis. Average 5-7 respondents were interviewed per day. The data collection period was from 2 to 28 September, 2018. Data were checked daily for completeness and accuracy. Then data were classified, coded and entered into Microsoft Excel 10.0 and analyzed by SPSS 16.0 version. Frequencies, percentage, mean and standard deviation were calculated to illustrate demographic and clinical characteristics; and level of therapeutic adherence. Therapeutic adherence was calculated based on respondents' self-reported adherence to hemodialysis schedule, fluid, diet and medicine as per health care provider's recommendation which was measured with respect to scoring obtained from interview with structured schedule and five points Likert Scale. The quartile was used to categorize the level of treatment adherence as good (>75.0%), satisfactory (50.0-75.0%) and unsatisfactory (<50.0%).¹¹ Non-parametric Kruskal Wallis test and Mann Whitney U test were calculated to measure the difference in therapeutic adherence among CKD patients under hemodialysis according to selected variables.

RESULTS

Socio-demographic and Clinical Characteristics

Findings of the study showed that 32.3% respondents were age of above 50 years with mean age was 43.8 years (SD± 14.19). Likewise, 58.5% respondents were male and 79.9% were married. Regarding the level of education, 26.2% respondents received secondary level education. Similarly, 70.1% were unable to work and 75.0% respondents reside outside the Kathmandu valley (Table 1).

Table 1: Socio-demographic characteristics n=164

Characteristics	Number	Percent
Age (in years)		
≤ 30	33	20.1
31 – 40	43	26.2
41 – 50	35	21.3
>50	53	32.3
Mean ±SD: 43.85 ±14.19, Range: 20-89		
Gender		
Male	96	58.5
Female	68	41.5
Types of family		
Nuclear	84	51.2
Joint	80	48.8
Marital status		
Unmarried	25	15.2
Married	131	79.9
Widow/widower	4	2.4
Separated	4	2.4
Level of education		
Unable to read and write	30	18.7
Informal education	35	21.3
Primary (up to 5)	17	10.4
Secondary (6-10)	43	26.2
Higher secondary (11-12)	20	12.2
Graduate and above	19	11.6
Occupation		
Service	13	8.0
Self-employed	11	6.7
Homemaker	14	8.5
Retired	7	4.3
Unable to work	115	70.1
Business	4	2.4
Residence		
Outside Kathmandu valley	123	75.0
Inside Kathmandu valley	41	25.0

Out of total respondents, 87.2% respondents had family history of CKD and 95.1% had history of other co-morbid diseases. Similarly, 97.7% respondents were suffering from hypertension and 98.8% respondents had done hemodialysis as per prescription. The mean duration of hemodialysis was 2.87 years and mean number of hemodialysis was 353.9. An average number of daily prescribed medicine (pills) was 6.88±3.099 ranging from 1 to 16 (Table 2).

Table 2: Clinical characteristics

Variables	Number	Percent
Family history of CKD	21	12.8
Co-morbid diseases (n=156)**	156	95.1
Diabetes Mellitus	24	15.3
Hypertension	152	97.7
Heart Disease	7	4.5
Hypothyroidism	10	6.4
Others [#]	7	4.5
Dialysis done regularly as per prescription	162	98.8
Duration of hemodialysis (in year)		
≤ 2	70	42.7
2.01 – 4	55	33.5
4.01 – 6	23	14.0
≥6.01	16	9.8
Mean ±SD 2.87±2.36		
Total number (session) of hemodialysis		
≤ 350	96	58.5
≥351	68	41.5
Mean ±SD	353.90±308.90	
Number of medication taking as prescriptions		
≤ 5	60	36.6
6 – 10	85	51.8
≥11	19	11.6
Mean ±SD	6.88±3.09, Range: 1-16	

**Multiple Responses, [#]others= Glomerulonephritis and Benign prostatic hyperplasia

Level of Therapeutic Adherence

Out of total respondents, 92.7% had good and 1.2% had unsatisfactory level of adherence to hemodialysis. Concerning about diet, fluid and medicine, 59.1% had satisfactory, 56.1% had unsatisfactory and 87.8% had good level of adherence respectively. It was found that 33.5% had good and 62.8% had satisfactory level of therapeutic adherence among the respondents (Table 3).

Table 3: Level of therapeutic adherence n=164

Variables	Good Number (%)	Satisfactory Number (%)	Unsatisfactory Number (%)
Adherence to hemodialysis	152 (92.7)	10 (6.1)	2 (1.2)
Adherence to diet	49 (29.9)	97 (59.1)	18 (11.0)
Adherence to fluid	3 (1.8)	69 (42.1)	92 (56.1)
Adherence to medicine	144 (87.8)	15 (9.1)	5 (3.0)
Therapeutic adherence	55 (33.5)	103 (62.8)	6 (3.7)

Difference in Therapeutic Adherence according to Different Study Variables

Regarding the difference between therapeutic adherence, there was statistically significant difference in therapeutic adherence with gender ($p=0.009$). This findings showed that there was more adherence in male (mean score=71.0%) than female (mean

score = 67.2%). No statistically significant difference was found among other socio-demographic variables. Similarly, there was statistically significant difference in therapeutic adherence with duration of hemodialysis ($p= 0.001$) and total number of hemodialysis ($p= 0.001$) (Table 4).

Table 4: Mean difference in treatment adherence according to socio-demographic and clinical characteristics n=164

Characteristics	Number	Mean score (%) of treatment adherence	Std. Deviation	p-Value
Age				
≤ 40	76	54.0	5.3	0.135 ^m
≥41	88	55.0	5.1	
Gender				
Male	96	71.0	8.7	0.009* ^m
Female	68	67.2	9.4	
Type of family				
Nuclear	84	54.6	5.0	0.971 ^m
Joint	80	54.5	5.4	
Educational status				
Able to read and write	134	54.8	5.1	0.402 ^m
Unable to read and write	30	53.7	5.5	
Occupation				
Job holders	38	70.0	9.6	0.773 ^m
Dependents	122	59.5	9.0	
Residence				
Outside valley	123	54.5	5.4	0.708 ^m
Inside valley	41	54.9	4.7	
Co-morbid diseases				
Hypertension				
No	12	67.6	12.8	0.832 ^m
Yes	152	69.6	8.8	
Diabetes Mellitus				
No	140	69.2	9.4	0.683 ^m
Yes	24	70.7	7.2	
Heart Disease				
No	157	69.5	9.2	0.929 ^m
Yes	7	68.9	9.8	
Duration of hemodialysis				
≤2	70	73.0	7.9	0.001* ^k
2.01 – 4	55	67.4	8.5	
4.01 – 6	23	65.5	9.9	
≥6.01	16	66.5	10.6	
Total number (session) of hemodialysis				
≤ 350	96	71.6	8.4	0.001* ^m
≥351	68	66.4	9.4	
No of medicine (pills)prescribed per day				
≤ 5	60	68.4	10.5	0.129 ^k
6 – 10	85	69.4	8.2	
≥11	19	73.2	8.2	

*p -value significant at ≤ 0.05 , m= Mann- Whitney U test, k= Kruskal Wallis test.

Respondents were provided health information regarding different therapeutic regimens from different sources. It was found that there was significant difference in therapeutic adherence with various sources of information. Respondents

who received health information from other hemodialysis patients and dietitian had high adherence than information provided by other than other hemodialysis patients and dietitian ($p=0.001$) (Table 5).

Table 5: Mean difference in treatment adherence according to service related variables $n=164$

Variables	Number	Mean score (%) of treatment adherence	Std. Deviation	p-value
Frequency of professional talk				
Always	29	69.8	8.1	0.514 ^k
Very often	76	68.4	9.0	
Often	24	71.0	10.5	
Seldom	32	70.5	9.4	
Never	3	69.5	9.6	
Times taken to come to the hospital (in a minutes)				
≤30	70	68.8	9.2	0.123 ^k
31 - 60	66	70.6	9.4	
61 -120	24	67.1	8.4	
>120	4	75.4	4.7	
health information provided by**				
Doctor				
No	1	77.1		0.451 ^m
Yes	163	69.4	9.2	
Nurses				
No	1	68.4		0.441 ^m
Yes	163	69.5	9.2	
Dietitian				
No	58	73.4	6.5	0.001 ^{*m}
Yes	106	67.3	9.7	
Other hemodialysis patients				
No	58	73.4	6.5	0.001 ^{*m}
Yes	106	67.3	9.7	
Booklet/pamphlets/leaflets				
No	26	70.3	9.3	0.473 ^m
Yes	138	69.3	9.9	

**Multiple Response, *p- value significant at ≤ 0.05 , m= Mann- Whitney U test, k= Kruskal Wallis test.

DISCUSSION

This study showed that 87.2% of the respondents had no family history of CKD whereas 12.8% had family history of CKD. Similarly, 95.1% of the respondents had co-morbid diseases with 92.7% were suffered from hypertension and 14.6% were suffered from diabetes. These findings are supported by the study done in Saudi Arabia reported that 93.9% of the respondents had hypertension and 39.6% had diabetes.¹²

In this study, mean duration of hemodialysis was 34.8 months and ranged from 12 months to 168 months. These findings in contrast this finding, finding of study done in Okinawa, Japan reported the mean duration of dialysis was 61.9 months and ranged from 1 to 233 months.¹³ This study found that 98.8% of

the respondents had regularly done hemodialysis as prescribed by physician. This finding is higher than the study done in California and Malaysia¹⁴⁻¹⁵ where adherence to hemodialysis was 90.7% and 91.5% respectively. Another study done in India reported that an adherence to hemodialysis was 90.0%.¹⁶ In contrast with this findings, adherence to hemodialysis was only 55.96% in Saudi Arabia.¹² The findings of this study reported that 92.7% respondents had good adherence, 6.1% had satisfactory adherence to hemodialysis and very few (1.2%) had unsatisfactory adherence to hemodialysis. In contrast to these findings, the study done by Deif reported that the level of therapeutic adherence to hemodialysis was good in 76.36%, satisfactory in 23.64%.¹¹ The probable reason for these variations

could be due to the sample size and methodological difference.

This study found that 29.9% respondents had good and 11.0% had unsatisfactory level of adherence to diet. These findings are contradictory with the findings of the study done by Deif who reported that the level of therapeutic adherence was good in 30.91% and unsatisfactory in 18.18% respondents.¹¹ Likewise, dietary adherence was 88.37% in Saudi Arabia,¹² 8.9% in Iran¹⁷ and 27.7% in Malaysia.¹⁵ In this study, 59.1% of the respondents had satisfactory level of adherence to diet. This finding is also contradictory with the finding of study done in Cairo University Hospitals of Egypt where 50.91% of the respondents had satisfactory level of adherence to diet.¹¹ This variation also might be due to difference in study setting, sample size and methods.

Concerning about adherence to fluid, the findings of this study reported that 1.8% respondents had good, 42.1% had satisfactory and 56.1% of the respondents had unsatisfactory level of adherence to fluid. Several studies were published from different world regions regarding prevalence of adherence to fluid management among CKD patients under hemodialysis. Studies done in Saudi Arabia, Kenya, Malaysia and China and found that rates of adherence to fluid were 87.78%, 58.9%, 40.3% and 27.7% respectively.^{12, 15, 18, 19} These differences in findings might be due to different in population characteristics and study settings.

Regarding adherence to medicine, findings of this study found that level of adherence to medicine was good, satisfactory and unsatisfactory in 87.8%, 9.1% and 3.0% of the respondents respectively. These findings are almost similar with study done in Palestine²⁰ and Saudi Arabia¹² reported that adherence to medicine was 81.0% and 87.9% respectively. Similar findings are also reported by another one study where the level of adherence was good in 87.27% and satisfactory in 12.73%.¹¹ In contrast to these findings, study done in Kathmandu found that 28.6%, 35.3% and 36.1% of the respondents had high, medium and low adherence to medicine respectively.²¹ Likewise, adherence to medication in USA and Malaysia were 68.2% and 50.5% respectively.¹⁴⁻¹⁵ Similarly, study done in India reported that medication adherence was high in 7.3%, medium in 55.3% and low in 37.3%.²² These differences might be due to different motivation level of patients in different set up.

Regarding overall therapeutic adherence, findings of this study showed that level of therapeutic adherence among the respondents was good in 33.5%, satisfactory in 62.8% and unsatisfactory in 3.7%. These findings are similar to the study done in Palestine reported that the level of adherence was good (55.5%) satisfactory (40.5%) and unsatisfactory (4.1%).²⁰

A similar study done in Rwanda reported that 51.0% of the respondents had high adherence, 42.0% of the respondents had

moderate adherence and 7.0% of the respondents had low level of adherence.²³ These variations might be due to difference in setting, population and sample size.

In this study, there was significant difference in therapeutic adherence with sex. Males had high adherence than females ($p=0.009$). These findings are supported by the study done in Saudi Arabia showed that males had high adherence than females ($p=0.034$).¹² Furthermore, findings of this study showed that there was significant difference in therapeutic adherence with total number (session) of hemodialysis ($p=0.001$); and providing health information by other hemodialysis patients and dietitian ($p=0.001$). In contrast with these findings, frequencies of education by health care workers about importance of not missing dialysis ($p = 0.000$) was significantly associated with adherence to hemodialysis in the study of Rwanda.²³

LIMITATION OF THE STUDY

This study was conducted in small sample size representing only two settings. Data was collected by using face to face interview method which might have introduced information recall biases. Therefore, these findings lack the generalization in other setting and population.

CONCLUSION

Although therapeutic adherence of CKD is dynamic behavior, changed in adherence to different therapeutic regimen is still big concern in Kathmandu valley. Level of therapeutic adherence is satisfactory. But adherence to fluid is not satisfactory which may leads life threatening complications. Therefore, constant monitoring with regular education and counseling are essential to increase level of adherence.

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CONFLICTS OF INTEREST

There is no conflict of interest in this study.

REFERENCES

1. Chilcot J, Davenport A, Wellsted D, Firth J, Farrington K. An association between depressive symptoms and

- survival in incident dialysis patients. *Nephrol Dial Transplant* [Internet]. 2011 May;26(5):1628–34. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/20921294>/doi:org/10.1093/ndt/gfq611
2. U.S. Renal Data System, USRDS 2012 Annual Data Report: Atlas of Chronic Kidney Disease and End-Stage Renal Disease in the United States [Internet]. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases; 2012. Available from: <https://www.usrds.org/atlas12.aspx>
 3. Dhimal M, Karki KB, Sharma SK, Aryal KK, Shrestha N, Poudyal A et al. Prevalence of selected chronic non-communicable diseases in Nepal. *J Nepal Health Res Counc* [Internet] 2019 Jul-Sep;17(44): 394-401. Available from: <http://nepmed.nhrc.gov.np/index.php/jnhrc/article/view/648>. <https://doi.org/10.33314/jnhrc.v17i3.2327>
 4. Mnadhar B, Raman R. A comparative Analysis of dermatoglyphic traits on patients with chronic kidney disease. *Int J Contem Res Review* [Internet] 2018;9 (6). Available from: <https://www.researchgate.net/deref/http%3A%2F%2Fwww.ijcrr.in%2F> .doi:<https://doi.org/10.15520/ijcrr/2018/9/06/538>
 5. Thapa N, Sharma B, Jnawali K. Expenditure for hemodialysis: a study among patient attending at hospitals of Pokhara metropolitan city, Nepal. *J Health Allied Science*. [Internet] 2019;9(1):46-50. Available from: [http://nepmed.nhrc.gov.np/index.php/JHAS/article/download/618/551#:~:text=In%20Nepal%2C%20health%20system%20incurs,4148%20\(US%2464\)13](http://nepmed.nhrc.gov.np/index.php/JHAS/article/download/618/551#:~:text=In%20Nepal%2C%20health%20system%20incurs,4148%20(US%2464)13).
 6. Clark-Cutaia MN, Ren D, Hoffman LA, Burke LE, Sevick MA. Adherence to hemodialysis dietary sodium recommendations: influence of patient characteristics, self-efficacy, and perceived barriers. *J Ren Nutr*. 2014;24(2):92–9. [PMC free article] [PubMed] [Google Scholar]
 7. Ahlawat R, Tiwari P, D'Cruz S. Prevalence and predictors of medication non-adherence in patients of chronic kidney disease: Evidence from a cross sectional study. *J Pharma Care Health Sys* [Internet]. 2016;3:152. Available from: <https://www.longdom.org/archive/jpchs-volume-3-issue-1-year-2016.html/doi:10.4172/2376-0419.1000152>
 8. Griva K, Mooppil N, Seet P, Krishnan DSP, James H, Newman SP. The NKF-NUS hemodialysis trial protocol - a randomized controlled trial to determine the effectiveness of a self management intervention for hemodialysis patients. *BMC Nephrol*. 2011;12(1):1–11. Available from: <https://www.ncbi.nlm.nih.gov/pubmed/21272382/> doi: [org/10.1186/1471-2369-12-4](https://doi.org/10.1186/1471-2369-12-4)
 9. Cochran WG. *Sampling Techniques*. 3rded. New York: John Wiley & Sons; 1977. Available from: http://archive.org/details/Cochran_1977_Sampling_Technique_201703
 10. Khatiwada N. Treatment adherence of patients undergoing hemodialysis. *Nephrol* [Internet]. 2016;21:1767. Available from: <http://www.embase.com/search/s?subaction=viewrecord&from=export&id=L612313154%5Cn>. dx./doi:org/10.1111/nep.12888
 11. Deif HIA, Elswawi K, Selim M, NasrAllah MM. Effect of an educational program on adherence to therapeutic regimen among chronic kidney disease Stage5 (CKD5) patients under maintenance hemodialysis. *J EduPrac* [Internet]. 2015;6(5):21-33. Available from: <https://files.eric.ed.gov/fulltext/EJ1083638.pdf>
 12. Al-khattabi GB. Prevalence of treatment adherence among attendance at hemodialysis in Makah. *IntJ MedSci Public Health* [Internet]. 2014 May;3(5):592-8. Available from: <https://www.bibliomed.org/?mno=154928/>doi:org/10.5455/ijmsph.2014.170320141
 13. Kunitoshi I, Masahiko, T. Shuichi, T. Effect of the duration of dialysis on survival in a cohort of chronic haemodialysis patients. *Nephrol Dialysis Transp* [Internet]. April 2003: Volume 18(4):782–7. Available from: <https://doi.org/10.1093/ndt/gfg145> <https://academic.oup.com/ndt/article/18/4/782/1836324>
 14. Kim Y, Evangelista LS. Relationship between illness perceptions, treatment adherence, and clinical outcomes in patients on maintenance hemodialysis. *NephroloNursJ* [Internet]. 2010 May-Jun; 37(3): 271-281. Available from: <http://www.ncbi.nlm.nih.gov/pubmed/20629465>.
 15. Chan YM, Zalilah MS, HiiSZ. Determinants of compliance behaviours among patients undergoing hemodialysis in Malaysia. *PLoS ONE* [Internet]. 2012 Aug; 7(8): e41362. Available from: <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0041362>doi:org/10.1371/journal.pone.0041362
 16. Beerappa H, Chandrababu R. Adherence to dietary and fluid restrictions among patients undergoing hemodialysis: An observational study. *ClinEpi Glob Heal* [Internet]. 2018 May;7(1):127-130. Available from: [https://www.ceghonline.com/article/S2213-3984\(18\)30108-8/fulltext/doi:10.1016/j.cegh.2018.05.003](https://www.ceghonline.com/article/S2213-3984(18)30108-8/fulltext/doi:10.1016/j.cegh.2018.05.003)
 17. Ahrari S, Moshki M, Bahrami M. The relationship between social support and adherence of dietary and fluids restrictions among hemodialysis patients in Iran. *J Car Sci*. 2014;3(1):11–9. [PMC free article] [PubMed] [Google Scholar]
 18. Opiyo RO, Nyasulu PS, Olenja J, Zunza M, Nguyen KA, Bukania Z et al. Factors associated with adherence to dietary prescription among adult patients with chronic kidney disease on hemodialysis in national referral hospitals in Kenya: a mixed-methods survey. *Ren Replace*

- Ther [Internet]. September 2019; 5) 41). <https://doi.org/10.1186/s41100-019-0237-4>
19. Lee SH, Molassiotis A. Dietary and fluid compliance in Chinese hemodialysis patients. *Int J Nurs Stud* [Internet]. 2002;39(7):695–704. doi: 10.1016/S0020-7489(02)00007-X. [PubMed] [CrossRef] [Google Scholar]
 20. Naalweh KS, Barakat MA, Sweileh MW, Al-Jabi SW, Sweileh W M, Zyoud SH. Treatment adherence and perception in patients on maintenance hemodialysis: a cross – sectional study from Palestine. *BMC Nephrol* [Internet]. 2017;18(1): 178. Available from: [https://bmcnephrol.biomedcentral.com/articles/10.1186/s12882-017-0598-2/](https://bmcnephrol.biomedcentral.com/articles/10.1186/s12882-017-0598-2) doi:org/10.1186/s12882-017-0598-2
 21. Ghimire A. Evaluation of medication adherence in patients with chronic kidney disease. *Kidney International Reports* [Internet]. 2019; 4, S1–S437. Available from: [https://www.kireports.org/article/S2468-0249\(19\)30465-6/pdf](https://www.kireports.org/article/S2468-0249(19)30465-6/pdf)
 22. Sontakke S, Budania R, Bajait C, Jaiswal K, Pimpalkhute S. Evaluation of adherence to therapy in patients of chronic kidney disease. *Indian J Pharmacol* [Internet]. 2015;47:668-71. Available from: <http://www.ijp-online.com/article.asp?issn=0253-7613;year=2015;volume=47;issue=6;spage=668;epage=671;aulast=Sontakke/doi.org/10.4103/0253-7613.169597>
 23. Mukakarangwa MC, Chironda G, Bhengu B, Katende G. Adherence to hemodialysis and associated factors among end stage renal disease patients at selected nephrology units in Rwanda: a descriptive cross-sectional study. *Hindawi Nurs Resea and Practi* [Internet]. 2018; 4372716:8. Available from: <https://www.hindawi.com/journals/nrp/2018/4372716/> doi:org/10.1155/2018/4372716.