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Factors Affecting Employment in Maintenance Hemodialysis Patients in Egypt

Magdy El-Sharkawy, Yahya Makkeyah, Doaa Elwasly*
Department of Internal Medicine and Nephrology, Faculty of Medicine, Ain Shams University, Cairo, Egypt
***Corresponding author:** Doaa Elwasly, **Email:** dr.dodoelwalsy@hotmail.com

ABSTRACT

Background: Most of hemodialysis patients are unemployed and the few who are working are at risk of losing their jobs. Therefore, factors affecting employment need to be studied.

Objective: Our aim was to access factors affecting employment among working-age patients on hemodialysis all over Egypt as it was not assessed before.

Patients and Methods: This study was conducted between October 2012 and April 2015 in multiple hemodialysis centers by direct interview of the patients and collecting the data from the medical record in a special data collection sheet. **Results:** The study was conducted on 16280 hemodialysis patients in 19 Egyptian governorates. 21.2% of the patients were employed, 81.6% of the employed patients were men, and their mean age was 47.25+11.31. Hypertension was the most common etiology of end-stage renal disease (ESRD) and was the commonest comorbidity in employed patients. Employment was affected by age, gender, ESRD etiology and most comorbid conditions apart from comorbid chronic liver disease and chronic obstructive pulmonary disease. Factors affecting employment was dialysis frequency, duration, complications, dialyzer type, material, and surface area, dialysate type, dialysate Na, K and vascular access, haemoglobin (Hb) level, Ca/PO_4 ratio, parathormone (PTH), iron injection, blood transfusion, erythropoietin intake, vitamin B complex intake, L carnitine intake, phosphate binders, cinacalcet and folic acid intake while Kt/v and urea reduction ratio and vitamin D supplements did not affect employment.

Conclusion: Similar to the other studies we found that employment was not common among hemodialysis patients, which was affected by age, gender, ESRD etiology and comorbidities apart from chronic obstructive pulmonary disease (COPD) and chronic liver disease (CLD) which differed from other studies.

Keywords: Employment, ESRD, hemodialysis, hypertension.

INTRODUCTION

Dialysis is a life-changing event for patients at multiple levels. Employment is one of several challenges faced by individuals with progressive chronic kidney disease (CKD) transitioning to ESRD. Such patients face multiple disincentives to employment, including medical, logistical, and financial disincentives [(1)].

A prospective study investigating 659 patients undergoing dialysis in The Netherlands reported that at the start of hemodialysis treatment, 31% of the patients were employed, but that the proportion decreased to 25% within 1 year after dialysis initiation [(2)]. Another study of 4026 patients undergoing dialysis in the US Renal Data System (USRDS) reported that 41.9% of the patients were employed before starting hemodialysis treatment, but the proportion decreased to 21.1% after hemodialysis treatment and decreased even further to 6.6% a year later [(3)].

The factors associated with job loss after starting dialysis are older age (i.e. over 49 years), female gender, concurrent chronic diseases, hemodialysis rather than peritoneal dialysis as first treatment modality, poor health insurance coverage, and low or no erythropoietin usage before ESRD [(4)].

The factors associated with increased employment after initiation of dialysis were studied before [(5)], but the data on employment rates of the ESRD on hemodialysis patients from Egypt and the factors affecting their employment were not investigated before.

There are several different types of interventions that may assist an adult on dialysis to retain employment. These can include 1)vocational interventions such as flexible working hours, working from home arrangements, 2) workplace adjustments such as a private room for peritoneal dialysis exchanges, 3) government policies such as paid caregiver-assisted home dialysis, 4) skills training after extended time away from work due to hospitalisation, 5) psycho-social interventions to assist with re-adjustment to new roles, 6)drug interventions to reduce uremic symptoms, 7) provision of nocturnal dialysis therapies such as automated peritoneal dialysis or nocturnal home hemodialysis may also be considered, as well as 8) dialysis machine adjustments to facilitate work-based tasks [(4)].

The aim of this study was to investigate the factors affecting employment in maintenance hemodialysis in Egypt.

PATIENTS AND METHODS

This study is a cross sectional study that was conducted in multiple hemodialysis centers from 19 different governorates across Egypt between October 2012 and April 2015 by direct interview of the patients and collecting the data from the medical record in a specialized data collection sheet.

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Ethical approval:

The study was approved by the Ethics Board of Ain shams University.

Written informed consents were obtained from the participants, in accord with the ethical standards of the Committee on Human Experimentation of our institutions.

Two definitions utilized in the study were:

- Unemployed: Patients outside the labour force – homeworkers, students, those on disability pension, retired, or unknown.

-Employed: Patients who perform either manual labour, physical work or professional, managerial, or administrative work

The data collected included, patient's age, sex,, etiology of ESRD, the presence of comorbid conditions, the employment, the dialysis session duration, frequency, dialyzer type, material, dialysate type, dialysis complications and other dialysis related data also some blood tests results and therapeutic agents were recorded. Patients who changed from hemodialysis to peritoneal dialysis and vice versa for medical indication were not included in the study. All patients' dialysis was funded by government, private and military agencies.

Data analysis

All Data were collected, tabulated and subjected to statistical analysis, which was performed by SPSS in general (version 20), also Microsoft office Excel was used for data handling and graphical presentation.

Quantitative variables were described by the mean, standard deviation (SD) together with the 95% confidence interval (CI) of the mean. Independent samples t-test was used for comparing means of the two groups.

Qualitative categorical variables were described by numbers and percentages, presented in contingency tables. Chi-squared test of independence was applied. Pearson contingency coefficient C was used to express the strength of the relation. ODDs ratio with 95% confidence interval limits were also calculated. Univariate logistic regression analysis was used.

Significance level was considered at $P < 0.05$ (S); while for $P < 0.01$was considered highly significant (HS). Two Tailed tests were assumed throughout the analysis for all statistical tests.

RESULTS

Only 21.2% of the studied hemodialysis patients were employed. The unemployed patients were elder than employed ones with male predominance in both employed and unemployed groups. Hypertension (HTN) was the most common cause for ESRD in all hemodialysis patients. There were highly significant difference between employed and unemployed groups regarding age, gender, and etiology of ESRD (Table 1).

Table (1): Demographic data of the hemodialysis patients (employed and unemployed)

	Unemployed N (%)	**Employed N (%)**	**Total**	**P value**
Age	13246 (53.33± 13.39)	3562 (47.25± 11.31)	16808	P < 0.001 HS
	Unemployed N (%)	**Employed N (%)**	**Total N (%)**	**P value**
Gender	13248 (100.0%)	3563 (100.0%)	16811 (100.0%)	
Male	7321 (55.3%)	2906 (81.6%)	10227 (60.8%)	P < 0.001 HS
Female	5927 (44.7%)	657 (18.4%)	6584 (39.2%)	
Etiology of ESRD	13250 (100.0%)	3563 (100.0%)	16813 (100.0%)	
Others and unknown	2563 (19.3%)	787 (22.1%)	3350 (19.9%)	
DM	2471 (18.6%)	427 (12.0%)	2898 (17.2%)	P < 0.001 HS
HTN	4376 (33.0%)	1246 (35.0%)	5622 (33.4%)	
Chronic GN	635 (4.8%)	261 (7.3%)	896 (5.3%)	
Chronic pyelonephritis	518 (3.9%)	137 (3.8%)	655 (3.9%)	
Obstructive uropathy	1283 (9.7%)	338 (9.5%)	1621(9.6%)	
ADPKD	397 (3.0%)	169 (4.7%)	566 (3.4%)	
SLE	213 (1.6%)	58 (1.6%)	271 (1.6%)	
Pregnancy related	181 (1.4%)	27 (0.8%)	208 (1.2%)	
Analgesic nephritis	613 (4.6%)	113 (3.2%)	726 (4.3%)	

Data on age is shown as mean± standard deviation.

There was highly significant difference between employed and unemployed groups regarding certain comorbidities including comorbid HTN, DM, ischemic heart disease (IHD), peripheral vascular disease (PVD), cerebrovascular disease (CVS), while there was no significant difference regarding comorbidities of chronic liver disease (CLD), chronic obstructive pulmonary disease COPD as seen in table 2.

Table (2): Comorbid conditions of the hemodialysis patients and their viral markers positivity

	Unemployed N (%)	Employed N (%)	Total N (%)				
				P value	OR	95%CI	P value
Comorbid HTN	7099/ 13248 (53.6%)	2064/ 3561 (58.0%)	9163/ 16809 (54.5%)	< 0.001 HS	1.19	1.11-1.29	0.000002
Comorbid DM	2167/ 13190 (16.4%)	454/ 3553 (12.8%)	2621/ 16743 (15.7%)	<0.001 HS	0.75	0.67-0.83	0.000001
Comorbid IHD	2686/ 13244 (20.3%)	511/ 3561 (14.3%)	3197/ 16805 (19.0%)	< 0.001 HS	0.66	0.59-0.73	0.000001
Comorbid CVS	790/ 13102 (6.0%)	111 /3539 (3.1%)	901/ 16641 (5.4%)	< 0.001 HS	0.50	0.41-0.62	0.000001
Comorbid PVD	553/ 13234 (4.2%)	99 / 3561 (2.8%)	652/ 16795 (3.9%)	< 0.001 HS	0.66	0.53-0.81	0.00007
Comorbid CLD	2502/ 13242 (18.9%)	673/ 3561 (18.9%)	3175/ 16803 (18.9%)	> 0.05 NS	1.00	0.91-1.10	0.497431
Comorbid COPD	502/ 13243 (3.8%)	138/ 3561 (3.9%)	640/ 16804 (3.8%)	> 0.05 NS	1.02	0.84-1.24	0.407400
HCV+ve	5808/ 13062 (44.5%)	1528/ 3548 (43.1%)	7336/ 16610 (44.2%)	0.136905 NS	0.94	0.88-1.02	0.068466
HBV+ve	263/ 12420 (2.1%)	82/ 3475 (2.4%)	345/ 15895 (2.2%)	0.386514 NS	1.12	0.87-1.44	0.193373
HIV+ve	4/ 12405 (0.0%)	2/ 3472 (0.1%)	6/ 15877 (0.0%)	0.496790 NS	1.79	0.33-9.76	0.251394

OR: Odd ratio, CI confidence interval, HTN; hypertension, DM ; Diabetes mellitus , IHD ; Ischemic heart disease, CVS; cerebrovascular stroke, PVD ; Peripheral vascular disease ,CLD; chronic liver disease, COPD ; chronic obstructive pulmonary disease.

There was highly significant difference between employment and unemployment groups regarding the dialysis frequency, session duration, dialysis complications (Table 3).

Most of the employed and unemployed patients dialyzed with low flux dialyzer using polysulfone dialyzer. Bicarbonate buffer was the predominant buffer used. Most of the hemodialysis patients dialysed in governmental centers and most of them dialysed by AV fistula, as seen in table 3.

Table (3): Dialysis sessions and associated data

	Unemployed N (%)	Employed N (%)	Total N (%)	P value	OR	95%CI	P value
Dialysis frequency	13250 (100.0%)	3563 (100.0%)	16813 (100.0%)	< 0.002 HS			
Once per week	12 (0.1%)	2 (0.1%)	14 (0.1%)				
Twice per week	826 (6.2%)	161 (4.5%)	987 (5.9%)				
Thrice per week	12405 (93.6%)	3398 (95.4%)	15803 (94.0%)				
4 times per week	7 (0.1%)	2 (0.1%)	9(0.1%)				
Session duration	13250 (100.0%)	3563 (100.0%)	16813 (100.0%)	< 0.001 HS			
3 or less hours/session	1252 (9.4%)	219 (6.1%)	1471 (8.7%)				
less than 4 hours/session	1319 (10.0%)	323 (9.1%)	1642 (9.8%)				
4hours/session	10658 (80.4%)	3016 (84.6%)	13674 (81.3%)				
Up to 5 hours/session	21 (0.2%)	5 (0.1%)	26 (0.2%)				
Dialysis complication:	12936 (100.0%)	3529 (100.0%)	16465 (100.0%)		0.63		0.000001

	Unemployed N (%)	Employed N (%)	Total N (%)	P value	OR	95%CI	P value
hypotension	5010 (38.7%)	1004 (28.4%)	6014 (36.5%)	< 0.001 HS		0.58-0.68	
Dialysis complication	12911 (100.0%)	3528 (100.0%)	16439 (100.0%)				
fracture	414 (3.2%)	51 (1.4%)	465 (2.8%)	< 0.001 HS	0.44	0.33-0.59	0.000001
Dialyzer type	13210 (100.0%)	3555 (100.0%)	16765 (100.0%)				
Low flux	12332 (93.4%)	3136 (88.2%)	15468 (92.3%)	< 0.001 HS			
High flux	714 (5.4%)	403 (11.3%)	1117 (6.7%)				
High performance	164 (1.2%)	16 (0.5%)	180 (1.1%)				
Dialyzer material	12096 (100.0%)	3354 (100.0%)	15450 (100.0%)	P < 0.001 HS			
Polysulfone	10087 (83.4%)	2747 (81.9%)	12834 (83.1%)				
Polyether sulfone	229 (1.9%)	42 (1.3%)	271 (1.8%)				
Helixone	869 (7.2%)	255 (7.6%)	1124 (7.3%)				
Polyamix	911 (7.5%)	310 (9.2%)	1221 (7.9%)				
Dialysate type	12812 (100.0%)	3440 (100.0%)	16252 (100.0%)	P < 0.001 HS	0.68		
Bicarbonate buffer	8957 (69.9%)	2657 (77.2%)	11614 (71.5%)			o.63-0.75	0.000001
Acetate buffer	3855 (30.1%)	783 (22.8%)	4638 (28.5%)				
Center ownership	13139 (100.0%)	3531 (100.0%)	16670 (100.0%)				
Governmental	9851 (75.0%)	2675 (75.8%)	12526 (75.1%)	0.633853 NS			
Private	3115 (23.7%)	811 (23.0%)	3926 (23.6%))				
Military	173 (1.3%)	45 (1.3%)	218 (1.3%)				
Vascular access	13246 (100.0%)	3562 (100.0%)	16808 (100.0%)				
Catheter	770 (5.8%)	172 (4.8%)	942 (5.6%)				
AV graft	223 (1.7%)	54 (1.5%)	277 (1.6%)	0.056910 NS			
AV fistula	12253 (92.5%)	3336 (93.7%)	15589 (92.7%)				

There was highly significant difference between employed and unemployed patients as regards average weight gain, dialyzer surface area and dialysate potassium concentration (Table 4).

Table (4): Dialysis related data.

	Unemployed N (mean±SD)	Employed N (mean±SD)	Total N	T test	P value
Number of failed access	3396 (1.57±0.93)	788 (1.54±0.94)	4174	0.79	0.432141 NS
Average weight gain (kg)	10004 (2.38±1.02)	2643 (2.50±1.05)	12647	-5.13	P < 0.001 HS
Dialyzer surface area(m2)	13247 (1.37±0.15)	3498 (1.38±0.16)	16745	-4.42	P < 0.001 HS
Dialysate sodium(mmol/l)	11851 (137.50±1.85)	3113 (137.43±1.92)	14964	1.87	0.061835 NS
Dialysate potassium (mmol/l)	12812 (1.89±0.21)	3440 (1.90±0.20)	16252	-3.60	P < 0.001 HS
Dialysate calcium (mmol/l)	12588 (1.55±0.21)	3367 (1.55±0.19)	15955	-1.36	0.174977 NS
Dialysate magnesium (mmol/l)	11513 (0.57±0.15)	3043 (0.57±0.17)	14556	0.90	0.370341 NS
Kt/v	1612 (1.09±0.18)	403 (1.08±0.18)	2015	1.37	0.170954 NS
Urea reduction ratio	2588 (59.89±8.44)	609 (60.42±8.95)	3197	1.38	0.167135 NS

There was highly significant difference between the 2 groups regarding Hb categories and Ca/PO_4 ratio. Meanwhile transferrin saturation, different calcium and phosphorus levels did not show any significance differences. Parathormone level was significantly different between them as seen in table 5.

Table (5): Blood tests for hemodialysis patients.

	Unemployed	Employed	Total				
	N (%)	N (%)	N (%)	P value	OR	95%CI	P value
Hb category (g/dl)	12190 (100.0%)	3322 (100.0%)	15512 (100.0%)	P < 0.001 HS			
<8	2259 (18.5%)	511 (15.4%)	2770(17.9%)				
8-9	2505 (20.5%)	617 (18.6%)	3122 (20.1%)				
9-10.5	3783 (31.0%)	950 (28.6%)	4733 (30.5%)				
10.5-11.5	2221 (18.2%)	719 (21.6%)	2940 (19.0%)				
>11.5	1422 (11.7%)	525 (15.8%)	1947 (12.6%)				
Transferrin saturation	1373 (100.0%)	449 (100.0%)	1822 (100.0%)	0.037647 S	1.25	1.01-1.55	0.018914
<30	738 (53.8%)	216 (48.1%)	954 (52.4%)				
>30	635 (46.2%)	233 (51.9%)	868 (47.6%)				
Phosphorus level (mg/dl)	6058 (100.0%)	1797 (100.0%)	7855 (100.0%)	0.107778 NS			
<3.5	541 (8.9%)	148 (8.2%)	689 (8.8%)				
3.5-5.5	3087 (51.0%)	879 (48.9%)	3966 (50.5%)				
>5.5	2430 (40.1%)	770 (42.8%)	3200 (40.7%)				
Calcium level(mg/dl)	6478 (100.0%)	1891(100.0%)	8369 (100.0%)	0.178458 NS			
<8.4	2733 (42.2%)	825 (43.6%)	3558 (42.5%)				
8.4-10.2	3395 (52.4%)	950 (50.2%)	4345 (51.9%)				
>10.2	350 (5.4%)	116 (6.1%)	466 (5.6%)				
Ca X PO4 Product category	5924 (100.0%)	1731 (100.0%)	7655 (100.0%)	P < 0.001 HS	1.28	1.12-1.45	0.000128
<55	4824 (81.4%)	1341 (77.5%)	6165 (80.5%)				
>55	1100 (18.6%)	390 (22.5%)	1490 (19.5%)				
Parathormone level (pg/ml)	1820 (529.48±533.30)	691 (476.09±450.02)	2511	2.33	0.019641P < 0.05 S		

There was highly significant difference between the 2 groups regarding iron injection, blood transfusion, erythropoietin intake, vitamin B complex intake, L carnitine intake, phosphate binders, cinacalcet intake. There was

significant difference for folic acid intake and non-significant difference was noted for vitamin D supplements intake as shown in table 6.

Table (6): Treatment provided to hemodialysis patients.

	Unemployed N (%)	**Employed N (%)**	**Total N (%)**				
				P value	**OR**	**95%CI**	**P value**
Iron injection	8309/13210 (62.9%)	2093/3554 (58.9%)	10402/16764 (62.0%)	P < 0.001 HS	0.84	0.78-0.91	0.000006
Blood transfusion	6395/12854 (49.8%)	1487/3414 (43.6%)	7882/16268 (48.5%)	P < 0.001 HS	0.78	0.72-0.84	0.000001
ESA type	13199 (100.0%)	3549 (100.0%)	16748 (100.0%)	P < 0.001 HS			
None	2059 (15.6%)	571 (16.1%)	2630 (15.7%)				
Originator	2652 (20.1%)	881 (24.8%)	3533 (21.1%)				
Generic	8488 (64.3%)	2097 (59.1%)	10585 (63.2%)				
Folic acid	3032/10822 (28.0%)	770/2961 (26.0%)	3802/13783 (27.6%)	P < 0.05 S	0.90	0.82-0.99	0.014991
Vitamin B complex	10624/13245 (80.2%)	3052/3562 (85.7%)	13676/16807 (81.4%)	P < 0.001 HS	1.48	1.33-1.64	0.000001
L -carnitine	5735/12236 (46.9%)	1678/3285 (51.1%)	7413/15521 (47.8%)	P < 0.001 HS	1.18	1.10-1.28	0.000009
Phosphate binders	13166 (100.0%)	3551 (100.0%)	16717 (100.0%)	P < 0.001 HS			
None	1139 (8.7%)	370 (10.4%)	1509 (9.0%)				
Calcium only	11915 (90.5%)	3109 (87.6%)	15024 (89.9%)				
Sevelamer only	62 (0.5%)	3 2(0.9%)	94 (0.6%)				
Calcium and Sevelamer	50 (0.4%)	40(1.1%)	90 (0.5%)				
Vitamin D supplements	10069/12940 (77.8%)	2723/3489 (78.0%)	12792/16429 (77.9%)	0.769281 NS	1.01	0.93-1.11	0.384641
Cinacalcet dose (mg/day)	71 (100.0%)	45 (100.0%)	116 (100.0%)	P < 0.001 HS			
30 mg	41 (57.7%)	9 (20.0%)	50 (43.1%)				
60 mg	25 (35.2%)	35 (77.8%)	60 (51.7%)				
90 mg or more	5 (7.0%)	1 (2.2%)	6 (5.2%)				

DISCUSSION

Only a small proportion of ESRD patients are employed at the start of dialysis compared with the general population. Staying on job can benefit the patients in many ways such as a source of social support, a higher quality of life, increased self-esteem, more stable or higher financial situation. Moreover, maintenance of work is also important for healthy society in preventing loss of production [(6)].

Our study found that 21.2% of the studied hemodialysis patients were employed. Employment rates among patients on dialysis in the United States have been reported to be as low as 18.9% in one study. This seems to be a worldwide problem [(1)].

The purpose of this study was to identify the factors either modifiable or not affecting employment in hemodialysis patients, especially that there is no study from Egypt published data on factors affecting employment rates in dialysis patients before.

Our study detected that male patients with mean age 47.25+11.31 are more likely to be employed taking into consideration that 60.8% of studied patients were men and it was noted that working patients had hypertension as the most common etiology of ESRD; this could be because the highest number of patients' etiology of ESRD was hypertension followed by others and unknown etiologies, DM, obstructive uropathy, chronic GN, analgesic nephritis, chronic pyelonephritis,

ADPKD, SLE, and finally pregnancy related etiologies. So the age, gender and etiology of ESRD seems to affect employment in hemodialysis patients. Another study by **Muehrer *et al.*** [7] stated that certain causes of ESRD were associated with the likelihood of maintaining employment, where they found that patients with cystic kidney diseases, glomerulonephritis, or other urologic diseases were more likely to maintain the same level of employment as compared with patients with diabetes and hypertension.

Many possible factors infusing employment status were reported such as age, gender, education levels, lifestyle, dialysis modality, medical insurance, serum albumin, anemia, physical and psychological functioning, disease etiology (diabetes), availability of late-shift dialysis, training, and high-frequency hemodialysis [6].

Given the limitations of the collected database, as no data was available before dialysis initiation because accessing the patient employment status before dialysing and following him up with dialysis imitation and continuation would have been better. So further studies are needed to better understand other factors that may also be contributing to unemployed such as socioeconomic status and education level. A better understanding of these factors will help to develop interventions to help hemodialysis patients maintain employment.

Alongside hypertension, DM, ischemic heart disease, peripheral vascular disease, cerebrovascular disease, were the comorbidities most likely to render a patient unemployment. For example a patient with comorbid HTN would have an odds ratio of 1.19 for being employed versus being unemployed. On the other hand comorbidities of chronic liver disease, and chronic obstructive pulmonary disease (COPD) did not affect employment in our patients. One possible explanation for this finding is that individuals had those 2 comorbidities in a mild form that did not affect their employment; (Odd's ratio 1) as presence of renal failure with respiratory failure or renal failure with liver cell failure increases the rate of mortality, on the other hand **Muehrer *et al.*** [7] found that certain comorbidities were associated with a decreased likelihood of maintaining employment including congestive heart failure, ischemic heart disease, cardiac arrest, cerebrovascular disease, chronic obstructive pulmonary disease, cancer, and inability to ambulate, and they found that having combinations of certain comorbid conditions further decreased a person's ability to maintain employment. The variation between our results for comorbid COPD patients could be due to performing their study within 3 time frames and due difference of the severity of COPD grades in both studies.

Regarding viral markers HBV, HCV, HIV positivity; it did not affect employment mostly because hemodialysis patients were asymptomatic having mild viral load only discovered while screening

Our study detected that dialysis frequency, and session duration were associated with employment where most of the employed patients dialysed trice per week for 4 h/session. On the contrary a study by **Curtin *et al.*** [8] showed that education emerged as a significant correlate of employment, as noted by previous investigators, whereas, unlike previous research, neither mode of dialysis, length of time on dialysis, number of comorbid conditions, nor cause of renal failure (e.g., diabetes) were associated with employment status.

Others mentioned that the choice of dialysis modality is another important factor predicting employment. In a retrospective study using USRDS data, **Muehrer *et al.*** [7] reported that United States patients who started peritoneal dialysis had higher employment rates compared with patients who started hemodialysis. Studies from Finland [5] and India [9] also showed significantly higher employment rates among patients receiving home therapies compared with those receiving in-center hemodialysis. The reason is obvious given that home therapies offer more scheduling flexibility and independence. But unfortunately we had no data on employment in other dialysis modalities.

Our study showed highly significant difference between employed and unemployed groups as regards dialyzer type, material and dialysate type, indicating that those factors influence employment. Most of the patients either employed or not dialysed with low flux polysulfone dialyzer with bicarbonate buffer.

Our study revealed that average weight gain, dialyzer surface area and dialysate potassium, and sodium concentration affects employment while dialysate magnesium and calcium did not affect it

Patients who had complications on hemodialysis session in the form of hypotension and fracture were more likely to be unemployed.

In our study the center ownership did not differ significantly between employed and unemployed groups, most of the patients in Egypt are dialysing in governmental centers covered by their health insurance due to financial burden. On the other hand the study by **Muehrer *et al.*** [7] showed that the type of health insurance the CKD patient affects employment. Patients with employer group health plans may have more comprehensive coverage and lower out of pocket costs, which could motivate them to keep their jobs and their health plans.

In general, patients with employer group health insurance or other insurance have access to better health care. Patients with access to better health care have fewer comorbid conditions and are at a lower risk of hospitalization after reaching kidney failure [7].

Most of the hemodialysis patients either employed or not was dialysing by AV fistula in our study; which showed a significant association with employment, meanwhile number of failed access had no association with employment but it was higher in unemployed

We found that average weight gain affects employment as it was higher in employed group. Our study detected that the dialyzer surface area is associated with employment as it was higher in employment group and the dialysate Na and K possibly can affect employment while dialysate Ca and Mg did not affect it.

Regarding Kt/v and urea reduction ratio they did not affect employment as per our study similar to a study by **Holley *et al.*** [10] mentioned that the mean weekly delivered KT/V (1.4 $\pm$ 0.7 v 1.3 $\pm$ 0.6 for hemodialysis in the working and nonworking patients, respectively) were not different among the working and nonworking patients.

Our study found that hemoglobin level, and anemia alongside with its treatment either, iron injection, blood transfusion or erythropoietin therapy affected employment, same as **Muehrer *et al.*** [7] who noticed that patients treated with EPO for anemia were more likely to maintain their employment. This is probably due to the improvement of fatigue and well-being reported by ESRD patients treated with erythropoietin. Despite the increasing knowledge of the association of advanced CKD and anemia, it is unfortunate that only 21.19% of their sample of employed patients received ESA. However, additional research is needed to clarify the optimal hemoglobin range that can be safely reached to optimize patient outcomes including maintaining employment [11].

Also we noticed that Ca/PO_4 ratio affected employment while Ca level and phosphorus level separately did not affect it. The parathormone level affected employment as it was higher in unemployed patients. Since Ca, phosphorus and parathormone have direct effect on maintaining normal bone health and causing if increased vascular calcification leading to cardiovascular hazards, which will affect physical fitness and mobility hence employment.

We found that folic acid, vitamin B12 complex, L carnitine supplements, phosphate binders, and cinacalcet intake was associated with employment. On the other hand vitamin D intake was not associated with employment.

Therefore managing mineral bone diseases, myopathy and neuropathy will affect physical wellbeing, mobility hence employment.

CONCLUSION

Similar to the other studies we found that employment was not common among hemodialysis patients, which was affected by age, gender, ESRD etiology and comorbidities apart from chronic obstructive pulmonary disease (COPD) and chronic liver disease (CLD) which differed from other studies. Also we assessed dialysis complications, dialyzer, dialysate relation and vascular access relation to employment, which was not found to be investigated before along with anemia, Ca/PO_4, PTH and different therapeutic modalities effect on employment.

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