

Haemodialysis in Jordan: Socio-Demographic Data, Clinical Analysis and Projecting Burden

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Abstract: Haemodialysis is a destructive medical, social and economic difficulty for patients and health care system. The purpose of the study was to explain the Socio-demographic characteristics of haemodialysis patients, their economic burden, besides the Projected cost in upcoming. A cross sectional research was performed in 2010 at Ministry of Health, Jordan. One hundred and thirty eight male and female patients with mean age 45 years were engaged in the study. The total number of patients was 2890 and the prevalence was 473 per million populations. Approximately 68% of them not working and about 20% of patients were dialyzed 12 hours/week. The yearly cost per patient was USD 9976 and the cost per treatment was USD 72. Consequently, the nationwide burden of haemodialysis patients was USD 38.26 million annually and by 2028; the estimated burden of haemodialysis will be USD 147.65 million. Eventually, focus on approaches and treatments to reduce the disease progress and to accelerate the set up of National Kidney Registry, which will be the precise and formal source of statistics of dialysis patients.

Key words: Haemodialysis • Socio-Demographic Data • Projecting Burden

INTRODUCTION

Chronic kidney disease (CKD) is an extremely tense condition, which causes a wide variety of complications [1]. The burden of CKD is growing and during the past three decades, the incidence and prevalence of End Stage Renal Disease (ESRD) have risen progressively. The burden of CKD, in terms of human suffering and economic costs, is exploding makes it a significant public health issue [2]. In addition to other medical consequences such as vascular calcification which affected 50% of the dialysis patients [3].

Renal replacement therapy (RRT) is carried out by haemodialysis, peritoneal dialysis or renal transplant, with haemodialysis is the common modality. The number of patients involved in the ESRD program is growing every year [4].

Demand on the RRT was increased for many reasons. First, growth in Chronic Kidney Failure (CKF) population,

related to population aging and changing in life style. Second, expansion in health services, which makes RRT growth more than desired. Third, rise in patients' and families expectation. Fourth, increase in the ability of patients to pay for treatment. Finally, improve in the quality of health services [5, 6]. RRT is not a cure for CKD, but helps to prolong life and improve patients' Quality of Life (QOL) [7, 8]. The total cost for haemodialysis is raised, which enforces a large economic burden on clients, health care system and public system [2, 9, 10].

Even though only a small portion of the population is affected by ESRD, it consumes a significant part of the health resources. As a result, there is a vital need to find a way, to offer a high quality service with low cost for RRT [11]. In addition, an accurate evaluation of the ESRD programs will be particularly helpful in offering the appropriate data for policy makers to make the correct decision.

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In Jordan there is no accurate evaluation for the cost of ESRD patients, which can assist in estimating the burden of the disease, to help in the decision making and to build up a better approach [12, 13]. The current study highlights the national wide economic burden of haemodialysis at MOH in Jordan from the point of health care provider view. Moreover, the data, which were collected, will give an idea about the socio-demographic figures of patients.

This study attempts to answers the following questions: (1) How many patients receive haemodialysis therapy now? (2) What is the socio-demographic data of haemodialysis patients (previous study and latest)? (3) How much is the health care cost of haemodialysis patients? (4) What is the present dialysis population and its cost will likely grow in the future?

MATERIALS AND METHODS

This research has employed an economic and demographic evaluation study, to determine the economic burden of haemodialysis throughout Jordan, including MOH. A cross sectional study was used to calculate the burden of haemodialysis treatment, from the perspective of health care system. A structured questionnaire designed by the authors was used to collect demographic data from patients.

The study was carried out in MOH hospitals in Jordan. Jordan is an Arab country with an area of 89.2 thousands square kilometres [14]. It is a low middle income country with a population of 6.113 million in 2010 [15].

Health care system in Jordan is a complex combination of three major sectors: public, private and donors. The two major public programs are Ministry of health and Royal Medical Services (RMS). In addition to a smaller public program, there are university based programs such as, Jordan University Hospital (JUH) in Amman and King Abdullah University Hospital (KAUH) in Irbid. The public programs are financed from the general budget, premium contribution of civil insurance program and user fees [16].

As mentioned above, the health care providers in Jordan are: MOH, private sector, RMS and universities. These sectors provide haemodialysis service as: 25%, 51%, 19% and 5%, respectively. In Jordan, the ratio of dialysis centre per million populations is 12 and the dialysis machine per million population is 123 [17].

In Jordan, 21 MOH hospitals offer haemodialysis service to ESRD patients. MOH insurance covers 2270 (79%) of patients with complaints of ESRD and provides haemodialysis treatment to 722 (32%) of them. The remaining patients are transferred to other sector hospitals for dialysis, either due to the excess of patients in MOH hospitals or due to the unavailability of dialysis unit in that area, however the payment is covered by MOH budget [18].

Three hospitals were purposely chosen for the sampling of hospitals. The following two criteria were used to choose the three hospitals: the geographic regions (north, middle and south) and the ratio of patients to dialysis stations (high, medium, low). The hospitals chosen were: Al-Bashir Hospital from the middle region with the highest ratio six patients per dialysis machine, Jarash Hospital from the north region with the medium ratio four patients per dialysis machine and Ghor Al-Safi Hospital from the south region with the lowest ratio of two patients per dialysis machine [15, 17].

Patients were selected according to specific inclusion and exclusion criteria, the inclusion criteria for patients were: patients who were 18 years and above of age, diagnosed as ESRD and had been on regular haemodialysis at MOH for more than three months. Exclusion criteria were patients who were too sick to give information and patients who refuse to give consent.

The total number of patients in the three hospitals was 173. All the patients were included in the study. The patients who met the criteria were asked to complete the questionnaires. Historical data were used from earlier studies started in 1992 until the recent one in 2010.

Cost Analysis: Cost analysis included the cost from perspective of health care system. The health care system data were collected through an interview with managers, medical staff and related personnel to fill up special questionnaire which was designed for that purpose.

Costs required for haemodialysis treatment were calculated in Jordan Dinar (JD) based on 2010 financial year and presented in JD and USD (1 JD = 1.4 USD). The burden of haemodialysis treatment borne by MOH is based on the total number of patients who received haemodialysis treatment (722 patients).

At national wide costing the cost include: cost of patient at MOH in addition to 1615 patients at private and university hospitals, their cost is JD11,300 per patient per year according to MOH estimation. The Royal Medical Services has 553 patients and their cost assumed to be the same as MOH (JD7126 per patient annually) [17].

Excluded costs were the inpatient cost and cost for patients with less than three months on dialysis because patients were unstable and under assessment. The cost borne by MOH-Jordan was calculated separately for each hospital. Then the average was computed to get the cost/patient/year and the cost/session. The health care cost was divided into capital and recurrent costs.

The capital cost includes: land, building, medical equipment, Arteriovenous Fistula (AVF) creation and water treatment system. Buildings and land cost life span was estimated at 30 years with annual depreciation of 5%. These values were applied in proportion to the haemodialysis unit, which depends on the percentage of floor space by meters. The total costs were then divided by the number of patients to get the annual cost per patient.

Recurrent costs include: salaries, maintenance, administration, medication, consumable, laboratory tests, supportive instruments and length of stay. Human capital approach was used to get the cost for health personnel engaged in the activity of the haemodialysis unit according to the time ratio and their salary. The total gross income of person was divided by the number of working hours per month, to get the cost per hour. Nurses and maids were employed full time for the unit. On the other hand, medical doctors, laboratory technicians, pharmacists, social workers and dietician's times were calculated according to their time ratio.

The projected cost for future was calculated based on the following formula:

$$FV = PV(1+r)^n$$

- FV : Future Value
- PV : Present Value
- r : Annual interest rate
- n : Number of periods

The interest rate used was based on average of inflation rate in Jordan through 1990 to 2009 that is 4.3% [19]. Statistical Package for Social Sciences (SPSS) version 11.5 and Microsoft Excel were used for data analysis. Percentages and frequencies were used for sample description according to socio-demographic data.

The research had obtained the approval from the Universiti Kebangsaan Malaysia Medical Centre Ethical Committee. In addition, the approval from MOH-Jordan was gained. The researcher has explained the purpose of the study to health workers and patients. The collected data were stored and kept confidential and used for research purposes only. Furthermore, formal consent signed by the participants was obtained before completing the questionnaires.

RESULTS

Data were collected between August and November 2010. One hundred thirty eight patients had returned the questionnaire and the response rate for patients was 80%. In 1992, the number of patients was 456, number of unit was nine and the prevalence rate was 114 per million populations (pmp). In 2003 the prevalence has become 312 pmp. In 2010, the number of patients has increased dramatically to 2890 patients with prevalence of 473 per million populations. At the same time, the number of unit has jumped to 72 (Figure 1) [9, 10].

Demographic Data: Table 1 shows the demographic characteristics of patients treated on regular haemodialysis as outpatients in the study; their mean age was 45.32 years, of which 69 (50%) were males. Ninety two of the patients were married (66.7%) and thirty two patients (23.2%) were single. Fifty two patients (37.7%) have grade one to eight and twenty one patients (15.2%) were illiterates.

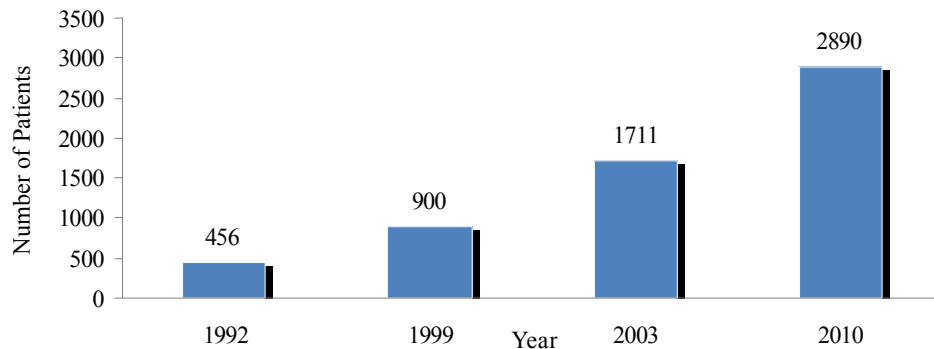


Fig. 1: Number of patients over the period from 1992 to 2010

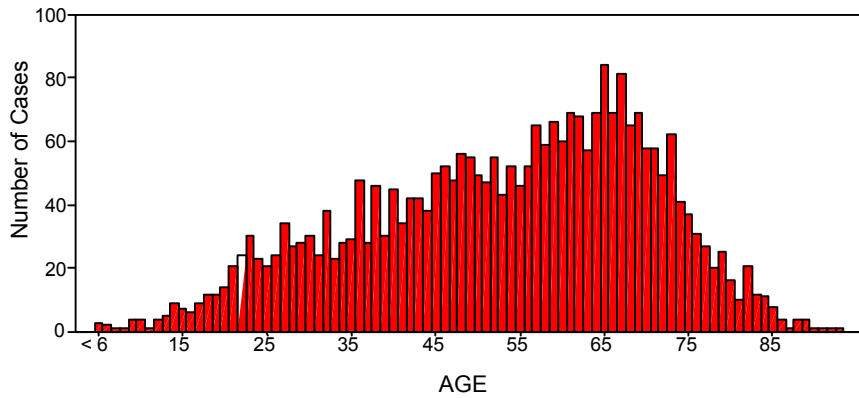


Fig. 2: The distribution of cases according to ageSource: MOH Data [18]

Table 1: Demographic characteristics of patients underwent haemodialysis treatment at MOH-Jordan, 2010

Variable	Status	Frequency (%)
Age: mean (SD)		45.32 (14.37)
Sex	Male	69 (50.0)
	Female	69 (50.0)
Marital Status	Single	32 (23.2)
	Married	92 (66.7)
	Divorce	3 (2.2)
	Widowed	11 (7.9)
Education Level	Illiterate	21 (15.2)
	Grade1-8	52 (37.7)
	High school 9-12	44 (31.9)
	College	8 (5.8)
	Bachelor	13 (9.4)
Employment Status	Not Working	94 (68.1)
	Work	35 (25.4)
	Retired	9 (6.5)
Type of Transportation	Taxi	56 (40.6)
	Bus	45 (32.6)
	Car	34 (24.6)
	Walk	3 (2.2)

Table 2: Dialysis duration, distance from the unit and number of length of stay days for patients underwent haemodialysis treatment at MOH-Jordan, 2010

	Minimum	Maximum	Median (IQR)
Dialysis Duration (year)	1	25	6 (9)
Distance (km)	1	80	10 (13)
Length of Stay (days/year)	0	240	3 (13)

In terms of employment status and conveyance, this study has identified that, 94 (68.1%) patients were unemployed and 35 (25.4%) patients were employed. Fifty six of patients (40.6%) used taxi for their transportation, forty five (32.6%) of them used bus and 34 (24.6%) of patients used cars. Usually the children were the

caregivers (55.1%). In the other cases, the father, mother, sister, husband, wife, or aunt were the caregivers (44.9%).

In 1992 the age of patients were concentrated between 40 to 69 years old [10] and in 2003 the mean age of patients was 48.9 years old; 55.9% of them were males [9]. The data from MOH in 2010 shows that, the mean age of patients in Jordan was 53.3 years old and they concentrate between 57 to 73 years old and 56.4% of them were males (Figure 2) [18].

The education level for patients in 1993, 52% of them have primary or middle school level and 23% were illiterates. In 2003, 37.8% of patients have grade 7 to 12 and 27.8% were illiterates. In terms of employment: 13.2% were employed and 73.5% were unemployed [9, 20].

The longest duration of haemodialysis was 25 years and the shortest was one year, the median was six years. Distance from the haemodialysis unit was 1 to 80 km, the median was 10 km. Length of stay in days ranged from zero to two hundred forty days with median of three days/year and the Inter Quartile Range (IQR) was 13 days/year (Table 2). In 1993 the duration on dialysis was 52 months and in 2003 the median was 28 months. The average distance from the unit was 13.6 Km in 2003 [9, 20].

Frequencies of Sessions: Ninety patients were (65.2%) dialyzed three sessions/week and 48 patients (34.8%) were dialyzed twice/week. Fifty eight of the patients (42.0%) have four hours dialysis and fifty two (37.7%) patients have three hours and 30 minutes (Table 3).

Table 4 illustrates the number of dialysis hours per week; only 20.3% of the patients were dialyzed 12 hours/week. In addition, number of total session carried out per week was 366 sessions (270 sessions for patients who dialyze three times/week and 96 sessions for patients who were dialyzed twice/week). Only forty seven (34.1%) patients accompanied with their caregivers.

Table 3: Frequency distribution of sessions and duration for patients underwent haemodialysis treatment at MOH-Jordan, 2010

		Number of patient (%)
Frequency of Haemodialysis	Two sessions/week	48 (34.8)
	Three sessions/week	90 (65.2)
Duration of Haemodialysis Session	3 hours/session	28 (20.3)
	3:30 hours/session	52 (37.7)
	4 hours/session	58 (42.0)

Table 4: Frequency distribution of sessions and duration for patients underwent haemodialysis treatment at MOH-Jordan, 2010

	2 sessions/ week	3 sessions/ week	Total
Hours/ session	no. (%)	no. (%)	no. (%)
3 hrs/ session	11 (8.0%)	17 (12.3%)	28 (20.3%)
3:30 hrs/ session	7 (5.1%)	45 (32.6%)	52 (37.7%)
4 hrs/ session	30 (21.7%)	28 (20.3%)	58 (42.0%)
Total	48 (34.8%)	90 (65.2%)	138 (100%)

Table 5: The average cost per session and per year at MOH' hospitals, 2010

Capital Cost	Jarash	Al-Bashir	Ghor Al-Safi	Average (JD)
Medical Equipment	1208	957	1173	1113
Building	400	125	176	234
Land	185	312	13	170
Water Treatment System	53	46	192	97
AVF Creation	92	92	92	92
Sub Total	1938	1532	1646	
Recurrent Cost				
Consumable	1952	3572	1881	2468
Salary	1399	1860	1660	1640
Medication	530	602	435	522
Maintenance	388	125	550	354
Laboratory Tests	336	330	324	330
Administration	99	36	64	66
Length of Stay	37	37	37	37
Supportive Instrument	3	2	3	3
Sub Total	4744	6564	4954	
TOTAL (JD/year)				7126
cost/session				52 (USD 72)

In 2003, only 54.2% of patients were dialyzed three times per week and 45.2% were dialyzed twice per week [9].

Cost Analysis: The health care system costs include, all recourses consumed by hospitals, to provide treatment for patients by haemodialysis. The capital costs for each hospital were calculated separately then the average has been presented (Table 5). In summary, in Jarash Hospital the capital cost was JD1938 and recurrent was JD4744. Thus, the total annual cost per patient was JD6682.

In Al-Bashir Hospital; capital cost was JD1532 and recurrent cost was JD6564. So, the total annual cost of patient was JD8096. The same calculation way was used in Ghor Al-Safi Hospital with differences in prices and values. The capital cost was JD1646 and recurrent cost was JD4954. Therefore, the total annual cost per patient was JD6600.

To sum up, the average costs/patient/year at MOH' hospitals was JD7126 (USD 9976) and the cost/session was JD52 (USD 72). In conclusion, for 722 patients (number of patients at MOH) the cost per year was JD5.14 million.

The economic burden of haemodialysis on national wide includes: royal services, universities and private sector in addition to MOH. The medical cost of MOH was JD5.14 million and 1615 patients at private and universities hospitals, where annual cost per patient cost was JD11,300 (according to health insurance by MOH) and 553 patients at royal services, where their cost is assumed similar to MOH's patients. So the total cost was JD 27.33 million per year (USD 38.26 million).

The cost per session in 1993 at MOH hospitals was JD38.90 and the cost per patient annually was JD4046 (USD 5950). The monthly income of 62% of patients was less than JD100 and 36% of them have JD100-199 per monthly [20].

In 2003, the total burden of 1711 patients was USD 29.72 million. The monthly income of 56.2% of patients was USD 140 to 420 and 35.6% of them has less than USD 140 [9]. In 2010 the average monthly income of patients was USD 212.

DISCUSSION

Prevalence and Number of Patients: In Jordan, the number of haemodialysis patients has increased by 6.3 fold within 18 years; this was the highest among other Arab countries. By using the linear trend line the projected number of patients in 2028 will be 5226; about 130 patients each year (Figure 3). In Saudi, the number of patients has jumped 3.4 folds during 18 years; from 3357 in 1993 to 11437 in 2010 [21].

Prevalence in Jordan was the highest compared with Arab region (473 pmp). The prevalence in other countries has ranged from 64 pmp in Baghdad to 143 pmp in Syria [22, 23]. The interpretations for the increase in prevalence rate were: first, the aging of the population; the increase in life expectancy at birth raise from 68 years in 1995 to 73 year in 2011.[24, 25] Second, the availability of services through 72 centres (12 pmp) enclosed 750 dialysis

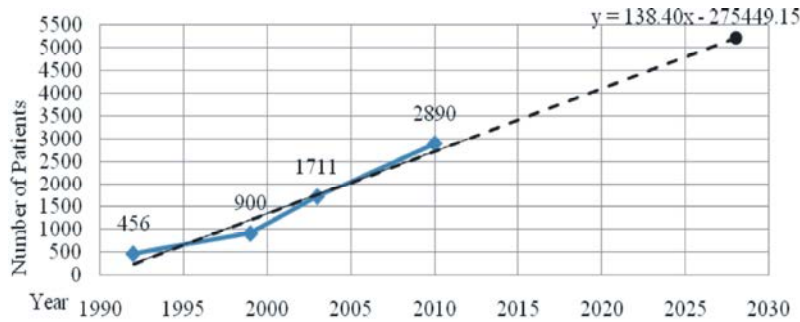


Fig. 3: Hemodialysis population in current and projected 1993-2018

machines (123 pmp).[25] And finally, the free charge of service for low income patients, because the patients whose monthly income less than USD 700, their dialysis cost is completely free [17].

Causes of ESRD: In Jordan the main causes of renal failure: diabetes mellitus, hypertension and unknown causes [9]. The prevalence rate of diabetes mellitus for people over 25 years of age was 13.4% [26] and hypertension was 16.3% [27].

Projected burden of chronic non-communicable diseases in Jordan from Centres for Disease Control and Prevention (CDC) report has showed that, 1 to 3 million people will have diabetes, hypertension or high blood cholesterol by 2050 and by 2030 the mortality rate will increase from 51% (as of 2005) to 66%.[28] Moreover, half of that prevalence was undetected [29]. Uttra *et al* (2011) mentioned that chronic hyperglycemias of diabetes is correlated to long-standing damage, dysfunction and failure of various organs, mainly the kidneys [30].

Many researcher stated that diabetic nephropathy is the leading cause of ESRD worldwide [31, 32]. In other countries the causes of renal failure: diabetes mellitus percentage range from 10.6% (Egypt) to 51% (Saudi) [33, 34]. Hypertension ranges from 4.4% (Emirates) to 49.3% (Saudi) [35, 36]. Unknown cause ranges from 9.6% (Emirates) to 42.7% (Saudi) [35, 37].

There is a similarity in the causes of the renal failure and their prevalence rate compared with Arab countries, where the prevalence rate increasing by time. So, more actions and strategies should be done to prevent this progress. Controlling those comorbidities diseases will help in minimizing the incidence and prevalence of chronic renal failure. Moreover, the high percentage of unknown causes of renal failure can be explained by the late diagnosis or unawareness, which can be overcome by early detection and follow ups.

Demographic Data: The mean age and standard deviation of haemodialysis patients in Jordan was 45.32 (14.37) years old. In Saudi the patients' age was concentrated between 26 to 75 years [21]. The mean age of haemodialysis patients in many Arab countries was in forties [22, 37, 38] and concentrated between 26 to 75 in Saudi, 45 to 65 in Qatar, 25 to 45 in Emirates [21, 35, 39].

The percentage of male patients are: 50% (Jordan), 60% (Saudi) [34], 66.3% (Baghdad) [22], 43.2% (Egypt) [33], 62% (Tripoli) [38] and 57% (Turkey) [40]. In terms of marital status, in Jordan, 66.7% were married and 23.3% were single. In Saudi, 61.2% were married and 20.1% were single [36].

In Jordan, 37.7% were having g1-8 and 31.9% have g9-12. In Egypt, 48.4% have low education level [33]. In Saudi, 44.8% were able to read and write and 41.8% were illiterates [36]. The majority of patients in Jordan were not working (68.1%) and only 25.4% were working. In Iraq only 14% of patients were working [22], in Saudi, working patients were 17.2% [36].

Data from MOH has showed that the mean age of patients in total was 53.3 years old and the distribution of age was concentrated between 57 and 73 years old [18]. So, more attention should be focused on elders and their medical follow up with screening program and treatment.

The majority of patients were not working and according to Shdaifat and Manaf (41); working haemodialysis' patients in Jordan have better QOL than non working. So, more effort should be focused to support patients and try to involve them in suitable working conditions to make them financially independent and improve their QOL.

Session Frequency: In Jordan, about 35% of the total patients were dialyzed two times per week and only 20.3% were dialyzed three times per week, four hours each session. In Baghdad, 70% of patients were dialyzed two sessions per week and 8% were dialyzed three sessions

per week [22]. In Qatar, 32% were dialyzed twice per week and 68% were dialyzed thrice per week [39]. In Tripoli, 57% were dialyzed thrice per week [38]. In Turkey, 70% of patients were dialyzed thrice per week [40]. In Saudi, 13.4% were dialyzed twice per week and 85.1% were dialyzed thrice per week [36].

The majority of patients were under dialyzed, which affects their morbidity, mortality and QOL. The international renal associations in US, British, Canada and European countries have recommended that, the minimal adequate dose of haemodialysis is given three times per week for 2.5 to 5 hours [42]. Powell, Oluwaseun, Woo, Padmanabhan, Narasinghan, Latta, Tortolano, Jardine and Geddes (43) have stated that, most of haemodialysis are carried out through 3 to 5 hours, three times a week in routine practise in most of haemodialysis units. On the other hand, Shdaifat and Manaf (41) have found that the QOL of Jordanian haemodialysis patients were considerably impaired compared with general population. Therefore, the commitment and compliance with international guidelines to achieve the desired frequency of dialysis will help in improving the health status and QOL of patients.

Cost Analysis: The cost per session at MOH hospitals was JD52 (USD 72) and the annual cost per patient was JD7126 (USD 9976.4). In Saudi, the cost per session was USD 297 and the annual cost per patient was USD 46332 [34]. In Turkey, the annual cost per patient was USD 22644 [44]. Rezapoor *et al.* (2011) found that the cost per session was USD 84 and the annual cost per patient was USD 13508 in Iran [20].

By 2028, the expected growth in cost per patient will be USD 21285 and their projected of their economic burden will be USD 147.65 millions with about four-fold. So, more effort should be taken to treat the patients within MOH hospitals because it is more cost saving (JD7216 compare with JD11300 in private sector). In addition, the costs of other modality such as peritoneal dialysis need to be evaluated.

Transplantation: In Jordan, 5% of patients have undergone transplantation; the cost for the first year was USD 20000 to 22000 and for second year 10,000 to 12,000 and for subsequent years was 8,000 to 10,000 [9]. Transplantation in Jordan is still intermittent and periodic and according to Abboud (45), the average cost of transplantation was USD 15000.

Many studies have found that transplantation is a cost saving treatment, offering better QOL, less mortality rate and better health status [6]. Therefore,

kidney transplantation will help in reducing the economic burden of haemodialysis and to improve the patients' QOL.

The main limitation of the study is that the data for prevalence and number of patients were obtained from published articles, which is limited and need a systematic arrangement by authorized section such as national registry system.

In conclusion, Prevention is better than cure, so health screening program for medical history and family for renal disease, hypertension, diabetes mellitus, hypercholesterolemia and obesity should be adopted to reduce the incidence. In addition, Jordan government should increase the awareness of its population by educational campaign so that the life style could be changed in order to reduce diabetes and hypertension. Focus on strategies and treatments to slow disease progress in order to delay RRT and save the resources should be implemented.

Kidney transplantation program should be adopted as a national strategy and activated to reduce the overall socio-economic burden, as well as the establishment of national renal registry should be activated, to be the accurate and official source of data for dialysis patients and their caregivers.

ACKNOWLEDGEMENTS

We would like to thank the patients and staff of dialysis units, for contributing the data via their national and regional renal data.

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