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SPECIAL COMMUNICATION

Projecting Requirements for End Stage Renal Disease Services in Libya 2014-2024

Khalid Bel'eed Akkari

Department of Kidney and Pancreas Transplantation, King Fahad Specialist Hospital, Dammam, Saudi Arabia

Corresponding author: Dr Khalid Bel'eed Akkari Email: khb0663@hotmail.com
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Abstract

Chronic kidney disease is a public health issue with significant humanitarian and economic implications. Between 2007 and 2009, the number of patients on dialysis in Libya increased from 2116 to 2417. It is projected that the number of patients on dialysis will increase from 2417 in 2009 to 7667 in 2024. The proportion of patients on peritoneal dialysis is projected to rise from 1.2% in 2014 to 16% in 2024. To maintain a patient to dialysis machine ratio of 1: 3.4, the number of dialysis machines will need to grow from 1045 in 2014 to 2255 in 2024. Hemodialysis units are better organized into main and satellite units, with a potential use of mobile hemodialysis units to deliver a local service to much smaller number of hemodialysis patients. The required number of general nephrology beds in 2014 is estimated around 468, with 59 additional regional transplant beds. These numbers are expected to be around 547 and 69 respectively by 2024. Required staff to deliver service to these rising numbers of patients is estimated to be 78 nephrologists, 9 vascular access surgeons, 4 transplant surgeons and 4 hepatologists in 2014. The corresponding numbers in 2024 are 123, 51, 18, and 7, respectively. The number of required renal nurses in 2014 is 1767, rising to 3400 by 2024. A steady increase in the number of required transplant coordinators, histocompatibility and immunogenetics laboratory consultants and scientists, dialysis technicians, renal dietitians, social workers, clinical psychologists and clinical renal pharmacists is to be expected. Recently published data showing great variability in patient mortality, hepatitis sero-conversion rates and the lack of consistent practice to check dialysis dose and adequacy are strong indicators for the nephrology community in Libya, the regulatory authorities and decision makers to urgently agree national nephrology clinical practice guidelines, and to adequately plan to train and develop the skills of the personnel required to cope with the rising number of end stage renal disease patients.

Key Words: End stage renal disease (ESRD), Hemodialysis, Peritoneal dialysis, Health Care Systems, Nephrology Care, Transplant Services.

Introduction

Healthcare Services in Libya

In the latest census of 2006 (1), and based on previous population growth rates the population of Libya in 2013 is estimated to be 6,002,347 (2). Libya provides free of charge universal healthcare services. During 2010, Libya is said to have spent 4% of GDP on healthcare (3). In 2009, life expectancy in Libya was 70 years for women, and 75 years for men, while infant mortality was 13 per thousand live births (4). Despite its oil revenue and spending on healthcare, there has been a mounting dissatisfaction with the quality of health services provided to citizens and more than six decades after independence, Libya has poorly structured, corruption-ridden healthcare sector. The February 2011 people's uprising, and the war that followed, stressed all government departments and services. Almost 3 years later, the healthcare sector continues to suffer the consequences of long years of poor planning. The healthcare sector in Libya is clearly in need of major restructuring. The projections in this paper are intended to provide decision makers with a blueprint of major requirements to develop renal services in the country. Where available, published Libyan health statistics are used, while the projections are benchmarked against available data from the Middle East, and in the case of workforce planning on recommendations from the UK (5).

Burden of kidney disease

Over the years chronic kidney disease (CKD) emerged as a public health problem affecting around 11% of the population (6). It has been established for many years that end stage renal disease (ESRD) patients have higher mortality and accelerated cardiovascular disease compared to general population, (7). Although a minority of the CKD patients with stage 5 CKD (0.2%), requiring renal replacement therapy (RRT) either by dialysis or renal transplantation, the number of patients on dialysis continues to rise (8,9). This rise may be due to better survival on dialysis (10) combined with shortage of organs available (11) for transplantation. Countries resorted to various strategies to tackle this problem such as early detection and better management of CKD (12). Some countries expanded the kidney donor pool by promoting live donation, adopting living unrelated, pair exchange, and deceased organ donation: opt out policy. For patients on dialysis, clinical practice guidelines were developed and published to streamline care and improve outcome such as KDIGO (13), UK Renal Association Clinical practice Guidelines (14), and The National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF KDOQI)™ (15). In addition, registries publish detailed results pertaining to each dialysis unit annually in the spirit of openness to allow patients, policy makers and taxpayers access to outcome results. Examples of such good practices include the UK Renal Registry (16), The United States Renal Data System (USRDS) (17), Saudi Council of Organ Transplantation (SCOT) (8), and The Australia and New Zealand Dialysis and Transplant Registry (ANZDATA) (18).

Renal Services in Libya

In a series of publications Alashek and colleagues recently reported the results of cross-sectional study of dialysis patients in Libya (19-23). The study, conducted in 2009, has potentially laid the ground for a future Libyan renal registry. It involved the interview of the medical directors of all dialysis units (40) using structured interview technique. It was not clear if the investigators have set out to do one comprehensive survey of all units, but what seemed like multiple sub-studies included collecting longitudinal data on patient mortality, vascular access, characteristics of incident patients and data on hepatitis B and C sero-conversion.

Models of care

The study found 2417 prevalent dialysis patients. Of these 2382 were on hemodialysis (HD), and 35 were on peritoneal dialysis (PD). These patients were dialyzing in 40 dialysis units (19). Data obtained prospectively between September 2009 and October 2010, showed 1093 incident patients. The authors reported a dialysis patient population prevalence of 624 per million population (pmp), and incidence of 282 pmp. The relatively high number of incident patients per million population could possibly have resulted from poor case definition, given the common practice of dialyzing acute kidney failure patients among maintenance dialysis patients. High mortality rates have been reported in the period that follows the initiation of dialysis (24,25) and poor case definition may, at least partially, explain the relatively high mortality rate reported (19). International comparisons are made difficult by differing reporting practices. For example, the UK renal registry reports prevalence of RRT (dialysis and kidney transplant) per adult population (794 pmp) (7), while the Saudi registry reports prevalent dialysis patients per whole population (457 pmp) (8). In the case of Libya,

recalculated per million of whole population (5.6 million), the prevalence of dialysis patients becomes 432 pmp (vs. 409 and 457 in the UK and KSA respectively). One in eight (12.5%) of the surveyed units were stand-alone units and only 3 units offered PD as an alternative modality to HD (19). Adult and paediatric age patients were treated in 83% of units, and one unit accepted only paediatric age patients. There were 713 functional hemodialysis machines, with a dialysis machine to patient ratio of 1:3.4. The median age among prevalent and incident patients was 49 years (range 36- 61), and 58% of prevalent dialysis patients were males (19). The authors reported that "information about primary kidney disease was complete for all prevalent dialysis patients, but was missing in 75 (6.9%) of incident dialysis patients" (19). The five most common causes of ESRD among prevalent patients were: diabetic nephropathy, glomerulonephritis, hypertensive nephropathy, congenital and hereditary diseases and polycystic kidney disease. Among the incident patients, the same top 4 causes were reported, with the fifth being obstructive nephritis, while polycystic kidney disease came sixth. The cause of ESRD was reported as unknown in 7.3% and 10.2% of prevalent and incident patients respectively. The completeness of data on ESRD aetiology was remarkable, and there could have been an over representation of glomerulonephritis as the second most common cause of ESRD in Libya, given the poorly developed renal histopathology services.

The Hepatitis Problem

Over a third of prevalent patients were either HBV or HCV infected (HCV 31.1%, HBV 2.6%, both 1.2%) (21). Although the prevalence of HBV and HCV infection in this study is rather similar to that in other countries in the region (26), it is of concern that only 4.7% of patients were known to be infected with HBV or HCV before starting dialysis. The reported overall sero-conversion rate of 7.7% (HCV 7.1%, HBV 0.6%) during the study period. HBV and HCV infection prevalence varied across the surveyed units from 0 to 75.9%, while HCV sero-conversion rates ranged between 1.5- 31% during the study period (21).

Case-load and Outcomes

The survey found a total of 61 "nephrologists" (nephrologist to patient ratio 1:40), and 641 nurses (nurse to patient ratio 1: 3.7) (19). Only 8 units had dietitians, and 6 units had a social workers. Half the surveyed units operated 2 shifts a day, 27% one shift, 17% three shifts, and one unit operated 4 shifts daily. The 2007 Ministry of Health annual report, showed that 25% of units provided dialysis for 20 or less patients (1). During the study period there were 67 kidney transplants (3%) (23), while the crude mortality rate was 21.2%. Of concern was the great variability in annual mortality (0-70%), and 7 centres had mortality of over 30%. Previously, Buargub reported a five-year mortality of 51% among patients of the main dialysis centres in Tripoli (27). It would, however, be difficult to reach any conclusions from the reported crude mortality rate in the study by Alashek and colleagues (19) without access to data on patient numbers per unit and their comorbidities.

Projections for Libya's Renal Services 2014-2024

Based on published data about the renal services in Libya, the current projection is of patient numbers and staffing requirements for renal services between 2014 and 2024. Projections are benchmarked against data, where available, from the UK (5) (staffing requirements), and Saudi Arabia (9) (patient numbers).

Predicted Numbers of Patients

The start is with the dialysis cohort reported in 2009 of 2417 patients (HD 2382, PD 35). It is projected that the Libyan dialysis population (combined HD and PD) will continue to grow at a rate of 8% per year, from 2417 in 2009 to 7667 in 2024 (Figure 1). Peritoneal dialysis populations may be expected to continue to drop by 5% per annum till 2014, when with re-launch of PD programs, the PD population will grow at 50% per annum through 2019. The rate of growth will fall to 40% in 2010, and drop by 5% per year until 2024.PD as dialysis modality will account for 1.2% in 2014 and 16% of the total dialysis population by 2024. There is no accurate data as to the number of kidney transplant patients in Libya that the author is aware of. An assumption is made that a number equivalent to 45% of the prevalent dialysis patient are transplant patients undergoing follow up in 2014 (n= 1088). The number of kidney transplant patients can be expected to drop 2.5% yearly till 2019, when re-launch of national organ transplant program will result in growth of kidney transplant population at 2.5% per year through to 2024 (5% Transplant rate with a 2.5% annual over all kidney transplant mortality). Figure 1 shows the projected growth of the RRT population between 2014 and 2024. The annual growth rate of the RRT population of 8% per year was chosen based on previously published Libyan data and data from the region. Based on the 2007 Ministry of Health published health statistics annual report (1), there were 2116 dialysis patients, and taken into account data from Alashek et al (19), there have been 14.2% increase in

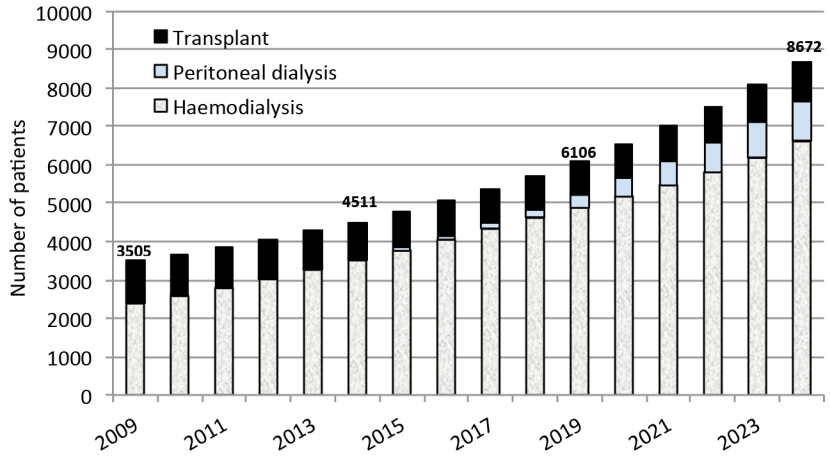

Figure 1. Growth in Libyan RRT population 2014- 2024

patient numbers between 2007 and 2009 (7.1% annually). Data from the Saudi annual renal services 2011 report (9) showed an annual average yearly growth in RRT population of 7.7%. The chosen rate of 8% per year may well be a conservative rate of rise given the interaction between the effects of a lower mortality rate among dialysis population and higher transplant rate, in addition to more established and structured primary and secondary healthcare services in Saudi Arabia.

Dialysis Units

In order to maintain a 1: 3.4 patient to machine ratio, the required number of hemodialysis machines is 1045, 1535 and 2255 in 2014, 2019 and 2024 (Figure 2). Current data suggest that 12.5% of dialysis units are stand-alone units. Although setting dialysis units away from a main healthcare facility and without a dedicated inpatient service may be necessary for reasons to do with the wide geographic span of the country and sparse population, this trend may be better avoided. Maintenance dialysis units require the back up and support of hospitals with access to medical cover, a sizable bed space, access to operating room and laboratory facilities. Given the rather small number of patients in many of the units, an alternative approach is to set main dialysis units with several other satellite units. These units are staffed by qualified nursing staff, and are covered with medical staff from the facility where the unit is located, but with specialized nephrology service from the medical staff in the parent dialysis unit, who can visit such satellite units on a weekly or fortnightly basis. This approach will make better use of the scarce resource of nephrology expertise while still locating units within easy reach of patients. For smaller clusters of patient numbers, mobile hemodialysis units of 2- 4 dialysis stations can cover several locations every week.

Renal and Transplant Beds

Benchmarking against UK recommendation of renal beds and regional kidney transplant beds (5), with a 33% additional capacity, the required renal beds for the years, 2014, 2019 and 2024 are 468, 506 and 547 respectively (Figure 3). The number of required regional transplant beds for the same time points is 59, 64 and 69 beds.

Renal Services Staff

The study by Alashek and colleagues included total number of nephrologists and dialysis nurses (19). Data however, is lacking about peritoneal dialysis nurses, nephrology ward nurses, transplant coordinators, histocompatibility and immunogenetics laboratory scientists, renal pharmacists,

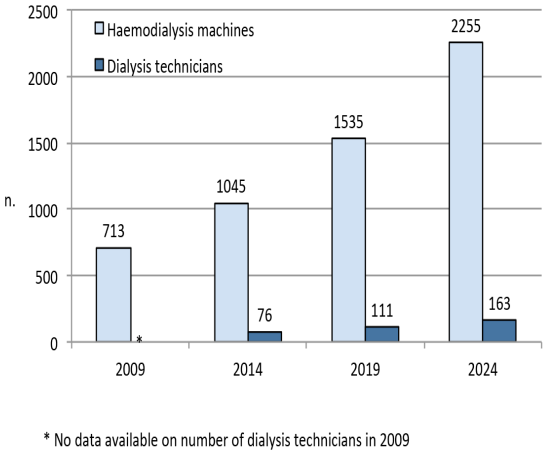

Figure 2. Number of dialysis machines and dialysis technicians required in Libya 2014- 2024.

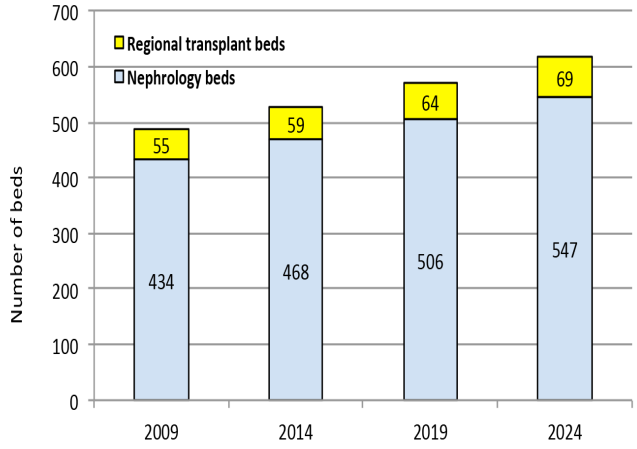

Figure 3. Number of renal beds in Libya 2014- 2024

dietitians, social workers, vascular and transplant surgeons. Where data about current staffing levels is lacking, the recommended staffing levels in the UK renal work force report(5) will be used to reflect the required staff numbers, after adjustment for the Libyan healthcare service status in the run up to 2014.

Medical staff

According to the 2009 survey by Alashek and colleagues (19), Libya had 61 nephrologists (consultants), with a doctor to dialysis patient ratio of 1: 39.6 (Based on RRT patient numbers the ratio is 1: 57.5). The survey did not indicate presence of formal trainees but reported 53 junior doctors. The survey did not report transplant or vascular surgeons' numbers.

Nephrologists: In view of the situation of the existing renal services and the time it will take to build multidisciplinary renal units, the same ratio will be maintained between 2014 and 2019. The doctor to patient ratio will then progressively decrease by 4% per year through to 2024, when the nephrologist to dialysis patient ratio is expected to be1: 48.7 (RRT 1: 70.6). The corresponding number of nephrologists will grow from 61 in 2009 to 158 in 2024 (Table 1).

Vascular access surgeons: Due to lack of data about the number of vascular surgeons covering the vascular access (VA) surgery, and starting with 9 VA surgeons (30% of the number of VA surgeons needed based on 1:120 dialysis patients (UK recommendation) (5), this number will progressively grow to 51 by 2024 (85% of the target 1: 120 ratio above) (Table 1).

Transplant surgeons: Kidney transplant programmes operated for short periods of time in 1980's and between 2005 and 2011. There is no accurate data about the number, or training of transplant surgeons in Libya, but as of 2013, and to the best of the author's knowledge, there is not a single fully trained transplant surgeon in Libya. Starting in a single center with 4 transplant surgeons (30% of the number of transplant surgeons needed based on 2 pmp (UK recommendation) (5), this number will progressively grow to 10 by 2019 (80% of the target), operating in two centers, and continues to grow by 12.5% year on year through to 2024 (18 transplant surgeon) (Table 2). This will allow the operation of 2 transplant centers in Tripoli and Benghazi.

Hepatologists: The overall prevalence of HBV and HCV infection in dialysis patients was reported to be around

Table 1. Number of consultant nephrologists, vascular access surgeons and hepatologists required to support renal services in Libya 2014-2024.

Professionals	2009	2014	2019	2024
Nephrologists	61	78	105	123
Vascular Access Surgeons	*	9	24	51
Hepatologists	*	4	5	7

* No data available

Table 2. Number of transplant surgeons, transplant coordinators, HIL consultants and scientists required to support renal services in Libya 2014-2024.

Professionals	2009	2014	2019	2024
Transplant Surgeons	*	4	10	18
Transplant coordinators	*	6	32	42
HIL Consultant Clinical Scientists	*	2	5	77
HIL Healthcare Scientists	*	6	33	63

** No data available*

34.9% (HCV 31.1%, HBV 2.6%, both 1.2%) (21). Such high prevalence and sero-conversion rates will require the support of a full hepatology services to manage this significant cohort of patients, while on dialysis and in order to prepare and manage those eligible for transplantation. This is until the wider better implementation of preventive strategies of blood borne virus transmission like HBV vaccination and universal precautions translate into much lower sero-conversion rates. It is estimated that 4 to 7 hepatologists are required to cater for the needs of RRT programs.

Nursing staff: In 2009, 641 nurses were reportedly working in 40 dialysis units (dialysis nurse to patient ratio 1:3.8) (19). No details were reported on the skill mix, and it is presumed that all 641 were dialysis nurses. Libya has witnessed an exodus of foreign nurses during and after the February 2011 revolution. It is assumed that there has been a 20% drop in number of nurses during 2009 through 2013, and that there were no nurse assistants before 2014.

Hemodialysis nurses: Aiming to maintain dialysis nurse to patient ratio of 1: 3.8, and a nurse to Healthcare assistant (HCA) ratio of 2:1. In 2014 the number of nurse started to grow at 10% per annum until 2019 and 9% per annum after that till 2024. In 2014, 141 HCAs (25% of nurse numbers) are recruited, with annual increase of 25% until 2019 (Table 3). The nurse assistant to nurse ratio is fixed after that to 1:2 until 2024 to maintain an overall nurse to dialysis patient ratio of just under 1:3.8.

Peritoneal dialysis nurses: The reported number of peritoneal dialysis patients in 2009, 35 will drop by 5% per year until 2014, when PD patient numbers start to grow by 50% per annum through to 2019. Falling progressively to 10% annual increase in 2024 (Figure 1). No details were provided about the number of PD nurses in 2009, but targeting a nurse to patient ratio of 1: 15 and a PD: HCA ratio of 4:1, the service starts with 3 nurses, and 3 HCA in 2014, reaching 24 nurses and 6 HCA in 2019, and 71 nurses and 14 HCA in 2024 (Table 3).

Ward based nursing staff: In order to obtain a nurse cover ratio of 1.4 wte per bed, with skill mix ratio of 2.5 nurses to 1 HCA, it is projected that 783 (587 nurses and 196 HCA) are required to cover renal wards in 2014, rising to 846 in 2019 and 914 in 2024, maintaining the same skill mix ratio.

Transplant coordinators: Using a work model that requires both pre and post-transplant coordinators, and not just donor transplant coordinators, it is projected that the number required is 4 pre and 2 post- transplant coordinators per million population. The kidney transplant service will

Table 3. Number of renal nurses required to support renal services in Libya 2014- 2024

Nurses Grades and Subspeciality	2009	2014	2019	2024
Total hemodialysis nursing	641	705	1339	2097
- Hemodialysis nurses	641	564	908	1398
- Hemodialysis health care assistants	*	141	430	699
Total peritoneal dialysis nursing	*	6	22	71
- Peritoneal dialysis nurses	*	3	16	57
- Peritoneal dialysis health care assistants	*	3	6	14
Total renal ward nursing	*	1056	1140	1232
- Renal ward nurses	*	792	855	924
- Renal ward health care assistants	*	264	285	308

** No data available*

Table 4: Number of renal dieticians, social workers, clinical psychologists and pharmacists required to support renal services in Libya 2014-2024

Professional Groups	2009	2014	2019	2024
Renal Dieticians	*	23	31	44
Social Workers	*	32	44	62
Clinical Psychologists	*	9	12	17
Clinical Pharmacists				
- for dialysis services	*	14	21	31
- for transplant services	*	16	15	17

** No data available*

relaunch with 6 transplant coordinators in 2014, with progressive increase in numbers to 2019 when the number reaches 32. Between 2020 and 2024 the ratio is maintained at 6 coordinators pmp (42 coordinator in 2024).

Histocompatibility and Immunogenetics Laboratory (HIL) Scientists: Starting with 2 consultant clinical scientists and 6 scientists in 2014, it is expected that corresponding numbers required are 5 consultant scientist, and 22 scientists in 2019 (2024, 7 consultant scientists and 63 scientists), in order to obtain a consultant to 1200 patients and 1 scientist to 135 RRT patients ratio.

Dialysis Technical Staff: Modifying the recommended UK ratio(5) of technical staff to dialysis patients of 1: 59, the number of technicians is expected to rise from 76 in 2014 to 176 in 2024 (ratio of 1: 47).

Staff of Allied Health Professionals: The number of required renal dietitians, social workers, and clinical psychologists required are shown in table 4.

Renal pharmacists: Clinical renal pharmacists target ratio is1: 250 dialysis patient and 1:60 transplants, based on the UK workforce recommendation (5). The required clinical renal pharmacists in Libya are: 14, 21 and 31 (dialysis); and 16, 15 and 17 (transplant) in 2014, 2019 and 2024, respectively.

Conclusions

Any projections of future patient numbers, and consequently staffing and facility requirements will be based on assumptions that take into account available data and previous trends. This paper is no exception. The recently published data showing great variability in patient mortality, hepatitis sero-conversion rates and the inconsistent practices among dialysis units are strong indicators for the nephrology community in Libya, the regulatory authorities and decision makers to urgently agree national standards for nephrology services, and to adequately plan to train, and develop the skills of the staff required to cope with the rising number of ESRD patients.

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