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Global Dialysis Perspective: Nepal

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Introduction:

Nepal, a newly proclaimed Federal Democratic Republic, is a landlocked country situated between India and China in South Asia (Figure 1)(1). Popularly known as the home of Mt. Everest and birthplace of Gautam Buddha, Nepal has an area of 147,516 Square kilometers. The population of Nepal is estimated to be 29.49 million as of March 9, 2021(2). Nepal’s GDP per capita was US$ 1155.1 and the health expenditure as a percentage of GDP was 5.84 as per 2018 data(3). The average life expectancy of a Nepalese is 71 years. As of June 29, 2020, there were 23,146 medical doctors and 7,185 specialist physicians in Nepal. The doctor to population ratio of Nepal is 1:1721 and nurse to population ratio is 1:500. There were 56 nephrologists registered in the Nepal Society of Nephrology in 2021; the majority of them (44 out of 56) practice in the capital city, Kathmandu. Hospitals that provide advanced medical care are mainly located in the major cities of Kathmandu, Pokhara, Bharatpur, Dharan, Butwal, Biratnagar, Birgunj and Nepalgunj.

Figure 1: Map of Nepal(1)

Health Care Model and Economics of Health Care:

Health care delivery in Nepal is comprised of a mixed model of public sector, private sector and non-government organizations. Health care policy is developed and stipulated by the Ministry of Health at the national level. The major source of health care financing is out-of-pocket spending. Consultation fee and basic diagnostic investigation costs are relatively inexpensive in public hospitals. There is a governmental provision for free essential drugs, but patients are responsible for paying for the cost of drugs not included on the essential drug list.

Nepal’s legislative parliament endorsed the National Health Insurance (NHI) bill on October 10, 2017. The governing body for this is the National Health Insurance Board that aims to achieve universal health coverage (UHC) by 2030(4). This is considered a welcomed, although ambitious, commitment from the government.

Patients are charged a nominal fee for health care cost in government hospitals. This attracts a massive volume of patients. According to the NHI bill, an insured patient would pay a premium of US$ 29 per year for a family of five to receive a health care reimbursement worth up to US$ 840. In the case of impoverished patients, the premium payment is waived by the government. The government of Nepal provides subsidy under the Disadvantaged Citizens Medical Treatment Fund to any citizen who is unable to bear their healthcare costs if they carry a diagnosis of any of eight eligible chronic illnesses; these include cardiovascular diseases, cancer, renal failure, Alzheimer’s disease, Parkinson’s disease, head and spinal cord injury, sickle-cell anemia, and stroke. In order to receive healthcare services and treatment for these chronic illnesses, patients must obtain appropriate medical documentation from their local government health officials. Care and treatment can be obtained only at healthcare facilities and hospitals officially recognized and enlisted by the government. Wealthier individuals often forgo government-sponsored healthcare and seek care from the private sector. In fact, private sector health care comprises over two thirds of the total hospital bed capacity in Nepal and 60% of the physician workforce rely on income received by providing services in the private sector. Many physicians who are primarily employed in public hospitals also work after hours in private hospitals and dialysis centers. Consequently, many physicians are overworked due to this ‘dual practice’.
In 2011, The Department of Health Services, under the Ministry of Health and Population, began providing financial support to patients diagnosed with chronic kidney disease (CKD); US$ 97 was provided annually for hemodialysis (HD). This was increased to US $483 in 2012. With the start of this financial support, Nepal has seen a rapid increase of dialysis services by government hospitals, medical colleges, private hospitals, and non-government organizations. From 2010 to 2016, there was a 223% increase in the number of hemodialysis centers bringing the total HD centers in the country to 42 in 2016(5). Free HD was started in 2014, with twice weekly treatments provided for one year. This was increased to twice weekly service for two years in 2015. Financial support was extended to include kidney transplantation in the same year, with US $1931 provided for the surgery and US $966 provided for post-transplant medication and medical care. Currently, Government of Nepal provides total sum of NPR 550,000 (~US $4580) and also provides NPR 5000 (~US $40) per month to the kidney transplant recipients to bear the expenses of medications. In 2016, Ministry of Health started free lifetime hemodialysis in Nepal (5). Hemodialysis is free in the public hospitals. It is also free in selected private hospitals and dialysis centers who have signed agreements with the Health Ministry. The cost of free dialysis in those private hospitals and dialysis centers is reimbursed by the government. As of March 2021, there were 60 HD centers, 570 HD machines and approximately 3,775 patients receiving hemodialysis(6)(5). The government also provides 90 bags of free dialysate per month for continuous ambulatory peritoneal dialysis (CAPD).

Epidemiology of Chronic Kidney Disease in Nepal:

CKD is a major public health problem worldwide with a significant burden of morbidity and mortality. It is now recognized as a major public health problem in Nepal(7). It was the tenth leading cause of death in Nepal in 2019.

The celebration of World Kidney Day on the second Thursday of March every year in different parts of Nepal has increased awareness of the public and media on CKD, leading to screening of more people who are symptomatic and at risk. This has also increased the pick up of CKD cases. Furthermore, there has been increasing awareness of health and kidney disease in the eastern part of Nepal made possible by a community screening program led by Dr. Sanjib Kumar Sharma. Whether mass screening for CKD is beneficial and cost-effective in Nepal needs more study before final recommendations can be made. Screening based on estimated glomerular filtration rate (eGFR) determined from serum creatinine and urine protein quantification from the albumin creatinine ratio in high risk individuals would likely be more practical.

In urban areas of Nepal, the estimated prevalence of CKD is 10.6%(8). A study performed in twelve low and middle income countries by the International Society of Nephrology’s Kidney Disease Data Center (ISN-KDDC) reported an approximately 20.1% prevalence of CKD in the cohorts from Nepal(9). According to the hospital based data for CKD, the mean patient age was 50.92 years, male to female ratio was 1.8:1 and 51% were active smokers(8). Chronic interstitial nephritis has been implicated with the use of some popular Ayurvedic and herbal medicinal agents. However, there are no data for the incidence of chronic interstitial nephritis related to Ayurvedic or herbal medicines in Nepal apart from anecdotal evidence.

Epidemiology of ESKD in Nepal:
From a tertiary hospital based study from Chitwan, Nepal, the prevalence of new ESRD is 11.36 % (10). The estimated incidence of ESKD in Nepal is around 100 per million per year and may even be higher based on the incidence rates reported in other developing nations, including India (11). There are some hospital based data for ESKD, but there is no formal renal registry. The absence of a national renal registry likely accounts for the lower reported incidence compared to the global average. Furthermore, a substantial number of impoverished patients in need of hemodialysis go without treatment despite HD being free of cost. This may be due to other indirect costs that patients have to bear including transportation, food, lost wages, cost of diagnostic investigations, or medicines. The most frequent causes of ESKD in Nepal, derived from different hospital-based studies, are listed in Table 1 (8)(10)(12). The attributed etiologies of ESKD may be erroneous at times because the diagnosis of CGN is presumed most of the time and HTN may be the consequence of CKD. Similar to worldwide prevalence, diabetes mellitus (DM) is becoming the leading cause of ESKD in Nepal due to its rising prevalence. The high prevalence of chronic glomerulonephritis is striking in Nepal and similar to other developing nations; this is thought to be a sequela of untreated acute glomerulonephritis, probably a higher prevalence of IgA nephropathy and comparatively high prevalence of repeated untreated infections.

Table 1: Top causes of ESKD in Nepal from different hospital based studies at different times (8)(10)(12)

Table 2. Overview of Nephrology in Nepal (5)(6)(11)(13)(14)(15)(16)(17)(18)

Dialysis Access:

Studies pertaining to types of vascular access in ESKD patients in Nepal are scarce. There are a few small institution based studies. The most common vascular access utilized to initiate HD in ESKD patients has been non-cuffed vascular catheters. In the incident hemodialysis patients 55% have non-tunneled cuffed catheter (non-TCC), 42% have arteriovenous fistula (AVF), and 3% have tunneled cuffed catheter (TCC). The proportion in the prevalent hemodialysis patients are 90 % for AVF, 8 % for non-TCC and 1% for TCC. The use of arteriovenous graft is < 1%. (19). With the advancement in the field of interventional nephrology in recent years, there has been an increasing trend of AV fistula placement performed by both vascular surgeons as well as nephrologists with a goal of reducing the overall numbers of vascular catheters. In a cross-sectional study performed in a teaching hospital in Biratnagar, Nepal, the functional outcome of the arteriovenous fistulas placed by a nephrologist had similar success rates as reported in the literature i.e., 75.6% for radiocephalic, 90.7% for brachioccephalic and 100% for brachiobasilic arteriovenous fistulas at 3-months post-creation(20). There are very few vascular surgeons outside of the capital, Kathmandu. Therefore, if more nephrologists are trained in this surgical skill, this could help to reduce the existing backlog of elective AV fistula creation. This would also increase the number of pre-emptive AV fistula placements, reduce the complications related to dialysis catheters, and ultimately may confer improved survival benefit. There are relatively fewer reported problems with vascular access in the Nepalese ESKD population due to the higher proportion of relatively young patients with ESKD and a greater number of non-diabetic ESKD patients. As the survival of ESKD patients on maintenance HD increases, complications related to vascular access are expected to increase.

Kidney Replacement Therapy:
a) Hemodialysis:

The history of dialysis in Nepal dates back to 1973, with the initiation of intermittent peritoneal dialysis. Hemodialysis service was initiated in the country in 1987 in Bir Hospital with two functioning hemodialysis machines. Nine years later, in 1996, hemodialysis service was started at Tribhuvan University Teaching Hospital (TUTH). This was followed by the establishment of many dialysis centers by private hospitals and Health Care Foundation, Nepal(14)(6). In Nepal, most of the patients undergo twice weekly maintenance HD, each session lasting 4 hours. Government authorities do regular inspection for water quality, infection prevention measures, number of times dialyzers are reused etc but clearance adequacy of HD is not routinely evaluated by measuring the Kt/V. Dialysis patients are not typically seen by a doctor during their HD sessions unless there is a call from a dialysis nurse relating to complication. Most HD centers use a deionization and reverse-osmosis water treatment system. Home hemodialysis has not yet been initiated in Nepal; however, there may be opportunity to develop this modality in the future.

Peritoneal Dialysis:

Acute Peritoneal Dialysis used to be performed in Bir Hospital and Tribhuvan University Teaching Hospital. However, both of these institutions have discontinued acute PD due to the increased availability of emergency HD and Intensive Care Unit (ICU) dialysis. According to a study in the eastern part of Nepal, the most common indications for the initiation of acute peritoneal dialysis in acute kidney injury were acute gastroenteritis (20%), sepsis (20%), and septic abortion (16%). For ESKD, the indications were metabolic acidosis(56%), uremic encephalopathy (45%), and fluid overload (44%)(21). ICUs without the availability of continuous renal replacement therapy (CRRT) or sustained low efficiency dialysis (SLED) continue to utilize acute peritoneal dialysis. With regard to chronic peritoneal dialysis, Continuous Ambulatory Peritoneal Dialysis (CAPD) is the only peritoneal dialysis being practiced in Nepal. There were only around 100 patients on CAPD till 2016(6) which have increased to few hundrededs by 2021.

Kidney Transplant:

Living donor kidney transplant was legalized in Nepal in 1998. In order to prevent organ trade, living donor transplantation is restricted to close relatives by Nepali law. The Human Organ Transplantation Act of 1998 limited the potential kidney donation from a relative only to immediate family members. The 1998 law was subsequently amended in 2016 by the Parliament of Nepal which paved the way for kidney paired donation and deceased donor kidney transplantation.

The first successful Kidney Transplant was performed in Nepal at Tribhuvan University Teaching Hospital (TUTH), Kathmandu, on August 8, 2008, by a team of Nepali and Australian transplant surgeons (Prof. Dr. David Francis, Prof. Dr. Bhola Raj Joshi, and others) and Australia-trained Nepali nephrologist, Dr. Dibya Singh Shah. Bir Hospital in Kathmandu subsequently started this service in December 2008(15). Currently, three government and six private kidney transplant programs have been licensed, though all of them are not regularly performing transplants. The total number of kidney transplants in Nepal is around 1500. As of March 2021, a total of 644 live donor kidney transplants have been performed in TUTH. The first deceased donor kidney transplant was done in Nepal on May 10, 2017(16). As of August 20, 2021, Human Organ Transplant Center (Sahid
Dharmabhakta National Transplant Center) has also performed 759 kidney transplants, including six deceased donor kidney transplants. The other remaining kidney transplants were in the following hospitals: 80 in Grande hospital, 9 in Sumeru hospital, and 3 in Nidan hospital. Gender imbalance in regards to living kidney donation in South Asia is not surprising. Nepal, like neighboring India, has an extreme gender imbalance with 75% of the donors being female and 84% of the recipient being male(22). This gender bias is due to a multitude of factors that are deeply rooted in Nepalese society. For example, the livelihood and well-being of a woman is dependent on her husband. Whether females are coerced or pressured into their decision to donate a kidney is not always apparent through physician interrogation, even though it may in fact be the case.

**Challenges/Barriers:**

There is lot of scope for improving Nepal’s health care delivery system. Public hospitals have significant delay in planned care. The public sector’s existing healthcare capacity is low. There is often a long waiting list for surgeries negatively impacting outcomes and satisfaction. Additionally, Nepal has a relatively small number of subspecialty physicians, including nephropathologists. Diagnostic pathology facilities and dedicated centers are either scarce or unavailable. For example, currently renal biopsy specimens still need to be sent to India for electron microscopy; immunofluorescence for renal biopsy has been available only recently within the country.

Efforts to improve the delivery of hemodialysis are needed. The practice of regular inspection of water quality and purity for hemodialysis needs to become mandatory policy to improve safety. Assessment and reporting of dialysis clearance adequacy (Kt/V) should be made mandatory to improve hemodialysis quality. Physician rounds during hemodialysis sessions should be reinforced.

PD solutions are not manufactured locally; they are imported from abroad. Due to Nepal’s challenging geography, a great deal of effort, resources, and time is required for transport of dialysate fluid to remote areas of the Nepal. In addition, there are other challenges including the lack of availability of properly trained personnel for peritoneal dialysis teaching, which contributes to increased risk of infectious complications. Another challenge is a general lack of adequate exposure to and training in peritoneal dialysis for physicians and nurses during their Nephrology training. Moreover, increased advocacy for PD at the national level is essential to expand this modality.

Complement-dependent cytotoxicity (CDC) crossmatch has recently been initiated in Nepal, but is only available during standard business office hours. This necessitates that kidney transplants are performed only during the day. Efforts are underway to make this service available 24/7 that would allow for more opportunities for transplantation at night especially deceased donor kidney transplantation. The absence of an ESKD registry is a significant challenge for Nepal’s kidney transplant programs. A standardized protocol for organ sharing should also be developed.

**Future of kidney health in Nepal:**

Providing easily accessible care to kidney patients in Nepal is challenging due to limited resources, relatively low number of nephrologists in the country, and challenging geography of the country. Interventions at the primary and secondary prevention levels would help to
slow the rising tide of the ESKD epidemic and help to allocate these scarce resources to those most in need. The following are some potential changes that could be implemented to improve kidney health in Nepal:

1. Development of a screening program for early detection and proper diagnosis of CKD patients is of utmost importance. Screening of the high-risk population by serum creatinine based eGFR and urine albumin creatinine ratio could be performed to start with. Chronic kidney disease support program (through ‘Bipanna Nagarik Sahayata Kosh’) of the government of Nepal should focus on the preventive aspect and early identification of disease.

2. To address the shortage of human resources, more ‘Doctorate of Medicine’ in Nephrology or fellowship training positions should be made available for aspiring candidates. More nurses should be trained for hemodialysis and peritoneal dialysis.

3. There is dissatisfaction among physicians and nurses on account of poor remuneration. This leads to many of them migrating abroad for better jobs and pay. The government and private sectors should devise appropriate methods to address this issue of “brain drain”.

4. Improving the existing Kidney transplant program and enabling new centers for kidney transplant services.

5. Since there is a paucity of data regarding kidney diseases, a national registry on CKD, ESKD, and other kidney diseases should be started by the government.

6. Renal pathology program for immunofluorescence and electron microscopy examination services of kidney biopsy samples should be developed and consolidated in Nepal.

7. Peritoneal dialysis has been underutilized. Incentive-based training of not only nephrologists, but also internists and general practitioners, for peritoneal dialysis could be helpful in expanding this service.

8. Continuing financial grants for immunosuppressive drugs from the government could help with adherence to post-transplant medications.

9. Ensuring job opportunities for renal transplant recipients could encourage more patients to opt for kidney transplant because they would be able to work full time and not need to hold out for jobs that accommodate their dialysis schedule.

10. Establishment of better record keeping and a registry system could also support kidney paired donation (KPD) programs for kidney transplant.

11. Establishment of in-center tissue cross match facilities in different transplant centers and promoting and supporting deceased donor kidney transplant programs in the country

12. Strengthening the deceased donor kidney transplant program in the country

International donors and institutions already working or interested in working for the betterment of kidney health in Nepal can make significant contributions by helping the government of Nepal and private sectors in establishing a national CKD and ESKD registry, providing technical expertise, and logistic support. They can help by providing expert training, assistance with establishment of services, and reduced-price immunosuppressive medications. Policy making should be solely made by the government alone so that the agenda is not driven by external donors and institutions.
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Author Contributions:

Ishwor Sharma: Conceptualization; Investigation; Writing - original draft; Writing - review and editing. Manoj Bhattarai: Conceptualization; Writing - review and editing. Mahesh Raj Sigdel: Supervision; Writing - review and editing.

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Figure 1: Map of Nepal (1)
Table 1: Top causes of ESKD in Nepal from different hospital based studies at different times (8)(10)(12)

| Causes of ESKD               | Prevalence (2021) | Prevalence (2018) | Prevalence (2009) |
|------------------------------|-------------------|-------------------|-------------------|
| Diabetes Mellitus            | 35.6%             | 31.9%             | 24%               |
| Chronic Glomerulonephritis   | 34.4%             | 36.2%             | 15%               |
| Hypertension                 | 24%               | 21.7%             | 55%               |
| Others                       | 6%                | 10.2%             | 6%                |
**Table 2. Overview of Nephrology in Nepal** (5)(6)(11)(13)(14)(15)(16)(17)(18)

*cost of hemodialysis is reimbursed by government to the accredited hospitals (public, private and university hospitals) that are periodically inspected by government for quality assurance

**subject to change based on inspection by Medical Education Commission, Government of Nepal.

| Parameter                                                                 | Value                                                      |
|---------------------------------------------------------------------------|------------------------------------------------------------|
| Number of Nephrologists registered in Nepal Society of Nephrologists       | 56                                                        |
| Incidence of ESKD                                                         | 100/million/year                                          |
| Number of centers licensed for renal transplant service                   | 9 (3 Government and 6 private centers)                    |
| Total number of renal transplants performed in the country from Aug 8, 2008 through Aug 20, 2021 | Approximately 1500                                      |
| Total number of HD Centers in the country                                 | 60                                                        |
| Total number of HD machines in the country                                | 570                                                       |
| Average cost of Renal transplant                                          | $3450                                                     |
| Average cost of HD in public sector                                       | Free of cost                                              |
| Average direct cost of HD in private sector*                              | Approximately $208/month                                  |
| Total number of patients on Hemodialysis                                  | Approximately 3775                                       |
| Total no of patients on Peritoneal Dialysis                               | >100 - <500                                               |
| Total Doctorate of Medicine (DM)/Fellowship in Nephrology slots available each year | 8**                                                       |
| Major Historical Landmarks                                                |                                                           |
| Initiation of intermittent peritoneal dialysis in Nepal                   | 1973                                                      |
| Initiation of hemodialysis in the Nepal                                   | 1987                                                      |
| Hemodialysis was made completely free of cost                             | 2016                                                      |
| Living related renal transplant legalized                                 | 1998                                                      |
| First successful Kidney Transplant (at Tribhuvan University Teaching Hospital) | 2008 (Aug 8)                                            |
| Paired exchange provision legalized                                       | 2016                                                      |
| First deceased donor kidney transplant                                    | 2017 (May 10)                                             |
| First ABO incompatible Kidney transplant                                  | 2017 (March 22)                                           |