



# Challenges for sustainable end-stage kidney disease care in low-middle-income countries: the problem of the workforce

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**Prevention and early detection of kidney diseases in adults and children should be a priority for any government health department. This is particularly pertinent in the low-middle-income countries, mostly in Asia, Africa, Latin America, and the Caribbean, where up to 7 million people**

**die because of lack of end-stage kidney disease treatment. The nephrology workforce (nurses, technicians, and doctors) is limited in these countries and expanding the size and expertise of the workforce is essential to permit expansion of treatment for both chronic kidney disease and end-stage kidney disease. To achieve this will require sustained action and commitment from governments, academic medical centers, local nephrology societies, and the international nephrology community.**

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Prevention and early detection of chronic kidney disease (CKD) and strategies to slow progression of CKD in adults and children should be a priority for any government health department. This is particularly pertinent in the low-middle-income countries (LMICs). However, despite such efforts to manage CKD, there will be an increasing burden of patients developing end-stage kidney disease (ESKD). Meeting the needs of these patients presents many ethical, financial, and practical challenges. Among these challenges is the problem of developing and training an adequate workforce to permit the creation and expansion of existing ESKD facilities, as well as to treat kidney diseases at all stages. How can this best be achieved in LMICs given their limited resources? This review describes a number of existing models and innovations that form the basis of a future strategic approach to this problem.

### Current status

It has been estimated that up to 7 million people, mostly from LMICs in Asia, Africa, Latin America, and the Caribbean, die due to lack of dialysis facilities.<sup>1</sup> Furthermore, it is forecast that the number of patients receiving dialysis in Asia, Africa, Latin America, and the Caribbean would double by 2030.<sup>1</sup> Meeting this need will require developing and expanding ESKD facilities. The creation of sustainable dialysis facilities and kidney transplant centers is hampered not only by socioeconomic and geographic factors, but also by lack of an adequate supply of and trained workforce, including technicians, doctors, pathologists, and nurses. Some details concerning the limited workforce in LMICs are well documented in the International Society of Nephrology (ISN) Global Kidney Health Atlas.<sup>2</sup>

### Opportunities and challenges

Workforce expansion in LMICs is essential if ESKD services are to increase. Transplantation, the best and most cost-effective treatment, requires a workforce trained in surgical techniques, appropriate laboratory support, nephrology support, dialysis back-up, and specialized nursing care. Provision of hemodialysis (HD) services requires trained physicians, nurses, and technicians who understand the basic principles of HD, water treatment, dialyzer reprocessing, infection control, access creation, and kinetics of solute and water removal. In addition, fundamental issues involved in patient care need to be understood, including the management of various metabolic parameters, anemia treatment, volume and blood pressure control, management and avoidance of hypotensive episodes, as well as HD emergencies. Training workforce personnel to manage peritoneal dialysis (PD) involves learning a somewhat different skill set in addition to the basic principles of ESKD care, including placement and management of PD catheters, understanding how to train and support patients for home therapy, treating peritonitis and exit-site infections, and managing ultrafiltration while limiting dextrose exposure.

How can this workforce training be provided? Organizing training within a country or region would be ideal using trained individuals who are on site. This could be provided by the government, academic centers, dialysis facility owners, philanthropic organizations, and/or nephrology societies. The major strategy to attract qualified trained nephrologists and dialysis nurses to low-income countries and LMICs would include the establishment of an infrastructure supportive of dialysis care and transplantation in those countries. This is challenging because such an infrastructure requires funding. The funding must be sustainable and preferably from government budgets. The education of these various governments is important for sustainable funding. Such government education can be achieved by utilizing examples set by successful nongovernmental organizations' programs and international societies (ISN's Saving Young Lives Program, discussed later, is such a program). Patients must also be encouraged to demand the care they need and, in so doing, force the implementation of public health policies.<sup>3</sup>

Involvement by industry via the formation of public-private partnerships or public-private investments, with appropriate government oversight, is another approach. For these ventures to be successful, training of staff is essential, and industry should be contractually obligated to provide adequate training for doctors, technicians, and nurses. Examples of cooperative public-private partnerships or public-private investments programs are to be found in India,<sup>4</sup> Russia,<sup>5</sup> Mexico,<sup>6</sup> and Swaziland (CR Swanepoel, personal communication, 2018).

International organizations and academic medical centers can provide support for training of staff and for developing programs for ESKD therapy. The major international nephrology organizations and several academic medical centers have played an important role in this regard.

### International Society of Nephrology

The ISN supports various educational initiatives to assist with training of staff, including ISN educational ambassador programs, sister renal centers, continuing medical education (CME) programs, fellowships for personnel from LMICs to train for up to 2 years in an advanced educational environment, and the online education resource, the ISN Academy. The ISN Educational Ambassadors Program sends experts to developing renal centers for 1 to 4 weeks to provide specific hands-on training or to help develop new services. The ISN Sister Renal Centers Program links academic centers in LMICs to well-established academic centers with well-run nephrology programs, providing valuable academic support in the development of nephrology services, including the training of workforce personnel. About 40 CME programs are supported by the ISN annually, with a recent emphasis on regional CME programs, encouraging a dialogue among participants from the region to share experiences. The ISN provides funding for about 60 to 80 fellows per year to receive training in academic centers in high-resource countries; most of these ISN Fellows return to their country of origin and

many have been instrumental in expanding nephrology programs in their countries.<sup>7</sup>

The ISN Fellowship program allows for trainees to be trained in host centers where research is practiced and promoted. Research methodology will—in most instances—be part of the training curriculum. However, it is also realized that many *home* countries do not have the infrastructure or regulatory expertise to monitor such research. Most trainees—from low-income countries and LMICs—return to their own country where no support is provided for research. This will therefore become the duty of the available academia based in the home country and, in particular, the newly trained fellow, to educate their government's health division on the advantages of doing research on local medical issues.<sup>8</sup> The ISN also provides research support and is easily accessible to interested medical personnel.

Experience has also shown that the trainees maintain contact with their host mentors after returning to their home institutions, expanding opportunities for clinical support as well as research collaboration. The ISN Fellowship Program has been very successful with 784 nephrologists from LMICs being trained since 1985, including 208 doctors from Africa, 144 from Latin America and the Caribbean, and 110 from South Asia (Table 1). The ISN Academy offers a wealth of educational material on the ISN website, consisting of a repository of existing materials derived from ISN meetings and other events, as well as an e-learning portal including self-paced learning (e-courses, presentations, podcasts, articles, videos, pathology materials) and virtual classrooms (webinars). The ISN has also been working to integrate interventional nephrology with regional and national meetings to enhance education and workforce training concerning the problems of vascular access. The ultimate goal of this initiative is to build awareness, develop skills to understand and manage vascular access-related problems, and improve overall dialysis vascular access care.

Ten regional training centers to facilitate regional training of physicians are being developed. Additional specific examples illustrate the cooperative and innovative approaches supported by the ISN:

- A recent interventional nephrology workshop was held in Nigeria where renal sister centers from Nigeria, Egypt, and South Africa participated together, focusing on developing training to deal with problems of vascular access and PD.<sup>9</sup>
- An ISN Educational Ambassador from the Pontifical Catholic University of Rio Grande do Sul, Brazil, visited Sudan and helped educate dialysis nurses; this ultimately resulted in the development of a continuing training curriculum for specialized nephrology nurses in the Sudan.<sup>10</sup>
- An ISN Educational Ambassador from India participated in a highly successful interventional nephrology workshop in Nepal, training nephrology teams on optimal techniques of establishing vascular access.<sup>11</sup>
- ISN Educational Ambassadors participated in a workshop held in Nicaragua where training was focused on HD

vascular and PD access, using simulation models to teach insertion of PD catheters and venous catheters; this training addressed the need for expanding ESKD services because of the rapid growth in patients requiring chronic dialysis due to the increasing incidence of Mesoamerican nephropathy in the country.<sup>12</sup>

- Working together with the Indonesian Society of Nephrology, the ISN is assisting with plans to increase access to integrated CKD and ESKD care in Indonesia by implementing capacity-building programs, increasing awareness of the advantages of integrated ESKD/CKD care, promoting policies that increase access to cost-effective and patient-friendly integrated ESKD/CKD care, developing consensus statements and guidelines, and promoting positive treatment incentives.

### International Society of Peritoneal Dialysis

The International Society of Peritoneal Dialysis (ISPD) has played a key role in expanding PD worldwide by establishing comprehensive and detailed guidelines of care that are available on its website. These guidelines cover all aspects of PD, have been instrumental in improving outcomes of PD globally, and serve as a manual for how to provide adequate PD care. The ISPD offers 3-month awards for individuals (nurses or physicians) to receive training in PD at well-established PD centers. Many of such awardees have played a key role in establishing and expanding PD therapy in their home countries.

### International Pediatric Nephrology Association

Similarly, the International Pediatric Nephrology Association (IPNA) has supported many pediatric nephrology educational programs. These have included a variety of innovative programs, including utilizing regional training sites. For example, since 2004 over 30 fellows from Africa have trained mainly in Cape Town, South Africa (Table 2), but also in Johannesburg, South Africa. Almost without exception, all these fellows have returned to their countries of origin and are working in pediatric nephrology programs. Both French and English teaching courses have been supported within Africa. And most recently, a junior masterclass concept has been introduced in Cairo involving 3 programs over the course of the year utilizing a *rolling* syllabus that covers most of the major topics of pediatric nephrology. The first sister center program has just been launched by IPNA, based on the ISN model, teaming 2 South American centers together as an emerging and supporting center. Lastly, IPNA has worked cooperatively with adult nephrology programs to enhance the educational mission of the organization. For the last 6 years, IPNA has worked with the African Pediatric Nephrology Association to actively participate in the African Association of Nephrology (AFRAN) meetings, enriching the educational experience for adult and pediatric nephrologists. IPNA is also working closely with the ISN on a number of initiatives such as the Saving Young Lives, 0by25, and Kidney Care Network programs.

**Table 1 | ISN Fellowship Program statistics: number of renal fellows sponsored by the ISN by home and host region**

Home region	Host region										
	Africa				OSEA				South Asia		
	1990–2000	2000–2010	2010–2018	Total	1985–1990	1990–2000	2000–2010	2010–2018	Total	2010–2018	Total
Africa	2	26	54	82			1		1	4	4
Eastern and Central Europe						1	1	1	3		
Middle East		5		5							
North and East Asia					2	4	1	1	8		
North America and Caribbean								1	1		
Newly Independent States and Russia		1		1							
Oceania and South East Asia						4	13	11	28		
South Asia		1	1	2	1	9	9	9	28		
Latin America and Caribbean						1			1		
Grand total	2	33	55	90	3	19	25	23	70	4	4

ISN, International Society of Nephrology; OSEA, Oceania and South East Asia.

Intraregional training vs. extraregional training 1985–2018; table updated and modified from Harris DCH, Dupuis S, Couser WG, et al. Training nephrologists from developing countries: does it have a positive impact? *Kidney Int Suppl.* 2012;2:275–278<sup>7</sup> by Marie-Pierre Smal.

### SYL Program

The Saving Young Lives (SYL) Program, a collaboration of ISN, IPNA, ISPD, and European Peritoneal Dialysis, has been instrumental in training nurses and doctors in the basic principles of acute kidney injury management, using PD as the preferred treatment modality for those patients needing kidney replacement therapy. Eighteen sites have been established in Africa and Southeast Asia and well over 600 patients have been treated with PD for acute kidney injury management. Workforce training for SYL has also involved establishing a 1-week residential program in Cape Town, South Africa, for teams of doctors and nurses (adult and pediatric) who learn about acute kidney injury, vascular access, and PD catheter insertion, with a strong emphasis on hands-on training. Similarly, SYL has supported a shorter course in French-speaking Senegal; the program followed on from the First International Conference of Dialysis in Dakar, Senegal, which was held in 2015. Nearly 100 doctors and nurses (adult and pediatric) attended the conference.<sup>13</sup>

### Academic medical centers

Global health programs at academic medical centers have, in selected circumstances, helped develop the workforce necessary to initiate and expand ESKD programs. For example, the University of Michigan in Ann Arbor, Michigan, USA, has helped develop a kidney transplant program at St. Paul's Hospital in Addis Ababa, Ethiopia, by making repeated site visits to Ethiopia. These visits entailed the training of laboratory, nursing, nephrology, and surgical staff to perform, manage, and care for transplant patients.

In Kenya, the East African Kidney Institute has recently been established with a mission of providing high-quality urological and nephrological education, service, and training. The institute currently accepts 8 trainees from East African countries and will be a major force in expanding the training of nephrologists in the region. The African Population and Health Research Centre in Kenya, which makes it possible for doctoral training at African universities via the

Consortium for Advanced Research Training in Africa, has developed a focus on chronic disease management.<sup>14</sup> The opportunity exists for this body to be directed to examine and comment on the shortcomings and inadequate management strategies for patients with CKD in Africa.

The Red Cross War Memorial Children's Hospital in Cape Town, South Africa, offers pediatric training that allows successful trainees to receive a diploma in pediatric nephrology as well as offering a masters qualification (Masters in Philosophy), through the University of Cape Town, South Africa (Table 2). In addition, the Red Cross Hospital has also created a short *kidney program* that provides 1 month of pediatric training for those fellows who are undergoing adult nephrology training elsewhere, allowing the trainees to be able to take care of at least the basics of kidney disease in children on their return to their home countries.

In India, there has been an expansion of academic centers training nephrologists. At present, there are approximately 150 nephrology training positions available each year at recognized universities and medical schools across India. This involves a 3-year training program overseen by The Medical Council of India and The National Board of Medical Examinations.

### Other innovative approaches

Workforce capacity can also be expanded by innovative utilization of technology and modern communication tools to not only train health care staff but also to provide clinical supervision from a remote site and monitor practice patterns. Web-based teaching programs accessible with commonly used devices, such as smart phones and tablets, can help with the inexpensive transfer of knowledge to LMICs.<sup>15</sup> Contact can be made and supervision provided with remote health care centers. An example of this is the *telenephrology* clinic that the National Institutes of Health in Bethesda, Maryland, USA, and the Indian Health Service in Zuni Pueblo, New Mexico, USA, have been practicing for many years and that have provided nephrology consultations and advice to



**Table 1 | (Continued) ISN Fellowship Program statistics: number of renal fellows sponsored by the ISN by home and host region**

Host region																	
Europe					North America					North and East Asia				Latin America			Grand total
1985–1990	1990–2000	2000–2010	2010–2018	Total	1985–1990	1990–2000	2000–2010	2010–2018	Total	1990–2000	2000–2010	2010–2018	Total	2000–2010	2010–2018	Total	
5	22	27	34	88		9	11	10	30		1		1		2	2	208
	14	17	9	40	1	14	16	2	33								76
	3	4	3	10	1	2	4		7								22
2	11	9	2	24	5	16	17	11	49	3	7	3	13				94
			3	3				3	3								7
	4	6	13	23		9	15	5	29								53
2		4	4	10		8	13	9	30	1	1		2				70
1	9	15	13	38	1	8	22	6	37			4	4		1	1	110
3	14	30	18	65	3	20	26	8	57					6	15	21	144
13	77	112	99	301	11	86	124	54	275	4	9	7	20	6	18	24	784

patients with advanced CKD living in remote areas using a collaborative telemedicine approach.<sup>16,17</sup> Health care personnel providing care to HD patients in Syria during the recent conflict utilized telemedicine, online consultations, and online training materials to support the workforce in the war-torn area.<sup>18</sup>

Web-based learning is becoming the preferred platform for younger trainees and its use has been expanding worldwide. For example, the ISN has developed several programs to draw the interest of the younger generation and facilitate training in LMICs. Some of these programs include:

- Webinars—these are topic-specific live sessions that offer the trainee an opportunity to interact remotely with the expert speaker. These sessions are recorded for on-demand viewing in the future. ISN offers webinars in a variety of languages, including English, Spanish, French, Chinese, and Japanese.
- E-curricula and e-modules—The ISN Academy is the online educational portal ([academy.theisn.org](http://academy.theisn.org)) that offers e-curricula and modules for self-paced learning and CME credit.
- Free Open Access Medical Education—this is an internet-based platform that provides unrestricted access to educational resources in various formats: podcasts, YouTube videos, conference presentations, live recorded interviews with experts presenting at conferences, for example.
- The ISN has supported dispersion of knowledge via @ISNEducation on twitter with the help of a social media

**Table 2 | Pediatric nephrology fellows from Africa 2003–2018**

Number	Origin	Start date	Masters or diploma obtained	Funding
1	Nigeria	September 2003	Cert Ped Neph	IPNA
2	Uganda	March 2004	Cert Ped Neph	IPNA and ISN
3	Kenya	August 2006	Cert Ped Neph	IPNA and ISN
4	Kenya	May 2006	Cert Ped Neph	IPNA and ISN
5	Benin	October 2005 January 2009	Cert Ped Neph	IPNA and ISN
6	Nigeria	March 2007	Cert Ped Neph, MPhil	IPNA and APFP
7	Ghana	October 2007	Cert Ped Neph, MPhil	Komfo Anokye Teaching Hospital/IPNA
8	Kenya	July 2009	Nil	IPNA and ISN
9	Nigeria	January 2010	Nil	IPNA
10	Kenya	August 2010	Cert Ped Neph	IPNA and APFP
11	Nigeria	April 2011	Nil	ISN and IPNA
12	Nigeria	June 2011	Nil	IPNA
13	Sudan	November 2011	Nil	IPNA and APFP
14	Nigeria	August 2012	Nil	IPNA
15	Nigeria	August 2013	Nil	IPNA and ISN
16	Nigeria	September 2013	Nil	IPNA
17	Nigeria	January 2012	Cert Ped Neph, MPhil	IPNA, ISN and part APFP
18	Zambia	December 2013	Cert Ped Neph	Beit Trust
19	Tanzania	January 2015	Diploma	ISN and IPNA
20	Nigeria	November 2017	Diploma	IPNA
21	Uganda	July 2017	In training	ISN and APFP
22	Ghana	August 2017	Masters	IPNA and APFP
23	Nigeria	October 2018	Nil	ISPD

APFP, African Pediatric Fellowship Programme; Cert Ped Neph, Certificate in Pediatric Nephrology; IPNA, International Pediatric Nephrology Association; ISN, International Society of Nephrology; ISPD, International Society for Peritoneal Dialysis; MPhil, Masters in Philosophy.

task force team. The popularity of twitter feeds in the nephrology community has been steadily growing with expansion into conducting journal clubs, infographics, and spreading World Kidney Day messages.

### Conclusion

If ESKD services are to be expanded worldwide over the next several years, there needs to be an expansion of a trained workforce involved in providing care to patients with CKD. To achieve this will require sustained action and commitment from governments, academic medical centers, local nephrology societies, and the international nephrology community. Innovative approaches will need to be explored to provide adequate training of doctors, nurses, and technicians.

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### REFERENCES

1. Liyanage T, Ninomiya T, Jha V, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *Lancet.* 2015;385:1975–1982.
2. Bello AK, Levin A, Tonelli M, et al. Assessment of global kidney health care status. *JAMA.* 2017;317:1864–1881.
3. Jha V, Arici M, Collins AJ, et al. Understanding kidney care needs and implementation strategies in low- and middle-income countries: conclusions from a “Kidney Disease: Improving Global Outcomes” (KDIGO) Controversies Conference. *Kidney Int.* 2016;90:1164–1174.
4. Vijayan M, Ravi R, Abraham G, et al. Chronic kidney disease, a herculean task: are there effective means of engagement in alleviating the burden? *Open Urol Nephrol J.* 2014;7:56–59. <https://doi.org/10.2174/1874303X01407010056>.
5. Tomilina NA, Andrushev AM, Peregudova NG, Shinkarev MB. Renal replacement therapy of ESRD in Russian Federation in 2010–2015. Report from the Russian Dialysis Society registry of patients on renal replacement therapy. Part one. *Nephrology and Dialysis.* 2017;19(4) Suppl. <https://doi.org/10.28996/1680-4422-2017-4suppl-1-95>.
6. Mendez-Durán A, Ignorosa-Luna MH, Perez-Aguilar G, et al. Current status of alternative therapies renal function at the Instituto Mexicano del Seguro Social. *Rev Med Inst Mex Seguro Soc.* 2016;54:588–593.
7. Harris DCH, Dupuis S, Couser WG, et al. Training nephrologists from developing countries: does it have a positive impact? *Kidney Int Suppl.* 2012;2:275–278.
8. Okpechi IG, Swanepoel CR, Venter F. Access to medications and conducting clinical trials in LMICs. *Nat Rev Nephrol.* 2015;11:189–194.
9. International Society of Nephrology. SRC supports interventional nephrology workshop in Nigeria. Available at: <https://www.theisn.org/news/item/33356-src-supports-interventional-nephrology-workshop-in-nigeria>. Accessed July 1, 2019.
10. International Society of Nephrology. ISN EAP kick starts dialysis nurse training in Sudan. Available at: <https://www.theisn.org/news/item/33344-isn-eap-kick-starts-dialysis-nurse-training-in-sudan>. Accessed July 1, 2019.
11. International Society of Nephrology. India and Nepal partner to build interventional nephrology training. Available at: <https://www.theisn.org/news/item/33455-india-and-nepal-partner-to-build-interventional-nephrology-training>. Accessed July 1, 2019.
12. International Society of Nephrology. EAP training to ease Nicaragua's need for more hemodialysis patient care. Available at: <https://www.theisn.org/news/item/3229-eap-training-to-ease-nicaragua-s-need-for-more-hemodialysis-patient-care>. Accessed July 1, 2019.
13. Abdou N, Antwi S, Koffi LA, et al. Peritoneal dialysis to treat patients with acute kidney injury—the Saving Young Lives experience in West Africa: proceedings of the Saving Young Lives session at the First International Conference of Dialysis in West Africa, Dakar, Senegal, December 2015. *Perit Dial Int.* 2017;37:155–158.
14. Green A. World report: the African Population and Health Research Center. *Lancet.* 2017;390:1940.
15. Vachharajani TJ, Phoon KS, Harris D. A global curriculum for training the next generation of nephrologists. In: Turner N, Lamiere N, Goldsmith DJ, et al., eds. *Oxford Textbook of Clinical Nephrology.* 4th ed. Oxford: Oxford University Press; 2015:2927.
16. Narva AS, Romancito G, Faber T, et al. Managing CKD by telemedicine: the Zuni Telenephrology Clinic. *Adv Chronic Kidney Dis.* 2017;24:6–11.
17. Nelson RG, Pankratz VS, Ghahate DM, et al. Home-based kidney care, patient activation and risk factors for CKD progression in Zuni Indians: a randomized, controlled clinical trial. *Clin J Am Soc Nephrol.* 2018;13:1801–1809.
18. Al-Makki A, Rifai AO, Murad L, et al. The Syrian National Kidney Foundation: response for the need of kidney patients during the crisis. *Avicenna J Med.* 2014;4:54–57.
19. Harris DCH, Davies SJ, Finkelstein FO, et al. Increasing access to integrated ESKD care as part of universal health coverage. *Kidney Int Suppl.* 2019;95:S1–S33.