IPNA International Pediatric Nephrology Association
GREAT CARE FOR LITTLE KIDNEYS. EVERYWHERE

Pediatric Nephrology Around the World

Birth and Progress of Pediatric Nephrology


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PEDIATRIC NEPHROLOGY AROUND THE WORLD

Pediatric nephrology is a well-established discipline in many countries around the world. However, there are still countries where pediatric nephrology services are not available or still in their infancy.

With help from international organizations like IPNA and ISN, and also from wealthier neighboring countries, many pediatricians from countries with less advanced economies have received training in pediatric nephrology and have returned to their home countries to serve children with kidney disease.

This series – compiled from the many articles contributed by IPNA members over the last few years about Pediatric Nephrology in their own countries, either written in their own capacity or on behalf of their national pediatric nephrology community – documents the progress and in many countries, the start or birth of pediatric nephrology services. It is hoped that articles from many more countries will be added to this collection.

The articles were written in English by native and non-native English speakers in their own unique styles. Only minor edits were made.

Well done to our fellow pediatric nephrologists for the progress made in pediatric nephrology around the world and thank you for helping to achieve IPNA's vision of "Great Care for Little Kidneys. Everywhere".

Maury Pinsk
IPNA Communications Committee

Joseph Flynn
Chair, Newsletter Committee 2013–2019

Yam-Ngo Lim
IPNA History and Archives Committee


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Europe

Pediatric Nephrology in France

The management of renal pathologies during childhood is carried out exclusively in academic and public health institutions. The teams involved in this discipline follows exactly this territorial distribution. The accurate distribution and volume of activity by region is imperfectly known, so that the comparison of these data with those in other European Union countries is not possible at the time we publish this paper.

Christine Pietrement
CHU Reims

Michel Tsimaratos
CHU Marseille

2017

Even if the demographic changes faced by pediatric nephrologists have not been studied precisely, they are recorded in the context of pediatrics, which includes the practice of several pediatric disciplines. Pediatric nephrology is present in all the 32 academic university hospitals (CHU), but all activities are not equally distributed as for example, renal transplantation in children requires the existence of a suitable technical platform, in particular with pediatric anesthesia and pediatric surgeons. A limited number of centers have organized the pediatric renal transplant activity with adult urology surgeons.

Thus, the organization responds to specific requirements depending on the regional needs. Indeed, two types of organizations can be observed. The departments dedicated exclusively to pediatric nephrology which are all in Paris. All the resources are allocated to pediatric nephrology, and all practitioners exercise exclusively

this discipline. It is possible that these centers occasionally receive patients suffering from other pathologies than renal pathologies, but this is an exception. Medical density is strong, attractiveness for fellows and interns is also strong, probably because they can devote themselves fully to the specialty they have chosen. On the other hand, multidisciplinary pediatric services accommodate children suffering from kidney diseases in shared structures. To a large extent, the staff assigned to take care of them has to take care of children suffering from other diseases as well.

The special case of pediatric dialysis should be highlighted because the regulatory texts specify that staff should be assigned to teams using this technique. Most often, medical teams are organized around the pediatric dialysis unit with dedicated staff (nurses, dieticians, psychologists …). However, when the workload allows it, this staff may also be involved in other activities (consultations, day-care hospitals, post-transplant follow-up). For these reasons, the number of medical staff may vary and depends on the type of organization used by the institution to meet the needs in terms of pediatric nephrology.

As it might be expected, the medical density in pediatric nephrology services is roughly proportional to activity, without a threshold effect being demonstrated. There is no level of activity from which the number of practitioners is stable. It appears, however, that centers declaring an exclusive exercise in pediatric nephrology have greater ease in attracting their collaborators. Overall, activities reported by pediatric nephrologists show annual growth of about 10–12 % of outpatient visits, 20 % of day-care hospital admissions, and a stable number of hemodialysis patients (In 2014, prevalence 145 patients), as well as number of dialysis and peritoneal dialysis sessions (In 2014, prevalence 46 patients).

Altogether, Pediatric nephrology departments are in charge of regions ranging from 0.5 to 11 million inhabitants (ie 0.128 to 3 million children), while the total population covered corresponds to 67 million inhabitants, of which 11.6 million are children under 15 years of age. It is therefore a comprehensive coverage on the territory to ensure the needs in pediatric nephrology. Some 200 beds and places are reported for the whole country with very probably large variations if some of these beds are counted within non-specific pediatric hospital beds. The number of chronic hemodialysis stations reported is 65, while there are also 16 acute hemodialysis stations. All centers have a water treatment system that meets current standards for this type of facility, and provide care in peritoneal dialysis, sometimes in partnership with an adult nephrology area. All Pediatric Nephrology departments allow their patients to attend school during their hemodialysis sessions within the hospital.

The cohort of transplant patients increases moderately, probably due to transition in adulthood, through transition care procedures. The prevalence of transplanted pediatric patients was 665 in 2014. Most centers report specific pediatric renal transplantation, but some teams need the help of the adult nephrology center. Many centers, collaborate for all or part of their kidney transplantation activity with one another center whose critical mass is greater. It may be a combination based on geographical or scientific criteria. All centers carry out renal biopsies for a total of about 800 renal biopsies per year and can use electronic microscopy. All are involved in clinical research and actively participate in the continuing education offered by the societies of the SNP (Société de Néphrologie pédiatrique), SFNDT (Société francophone de néphrologie dialyse transplantation), ESPN (European society for paediatric nephrology), and regional groups. They are also involved in the epidemiological surveillance through a formalized and funded national care network (REIN).

In addition to the pediatric population in the hexagon, a limited number of hospitals (about nine out of twenty) respond to requests from non-residents, mainly for renal transplantation. The number of non-resident claims reported is about 56 per year.

The main concerns of pediatric nephrology teams are:

- The dilution of the specific activity of pediatric nephrology in general pediatrics, leading to difficulties in maintaining a level of expertise for medico-technical activities such as hemodialysis.
- The significant increase in time-consuming activities such as telephone consultation for correspondents facing pediatric nephrology problems, participation in registries and networks requiring up-to-date records, lack of attractiveness and hence difficulty in the recruitment of young people and the lack of anticipation of retirements.
- The shortfall of staff in terms of medical time for certain centers.

It is common that hospital management underestimates the workload in pediatric nephrology. Even if the diversification of activity is not very reproducible from one center to another (pediatrics, hemapheresis, resuscitation, etc.), the continuation of a paediatric specific hemodialysis activity requires the recruitment of doctors and nurses trained in this technique.

The creation of rare diseases reference network marked a turning point in the organization of the management of rare diseases in the country. The public health goal has gradually replaced the single reference center model, usually central, by a functional network with the objectives of sharing information with patients and all type of practionners for improved efficiency. This development evolved towards few reference centers and a network of competence centers where the clinical management of these patients is taking place, all the centers being linked all together in « Filière de santé » ORKID.

An Overview of Pediatric Nephrology in Germany

Dieter Haffner
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2016

The German National Health System

The majority of the German population (82 million) is insured by the compulsory health insurance, their contributions are mainly geared to the level of income of the insured person. Under certain conditions, family members are co-insured without paying contributions. Approximately 10 % of the population have private health insurance. The healthcare costs (€ 234 billion) are about 10.6 of GDP. For every 1000 people there are 3.5 doctors and 9.8 nurses. Around 4.4 million people (10 % of employees) are employed in the healthcare industry.

History of the Development of Pediatric Nephrology in Germany

Since the early 1970s, pediatric nephrology has been established as a special field of pediatrics in Germany. Nineteen clinical centers for the care of children and adolescents with renal disease were established, mainly in university hospitals and often related to similar institutions in other European countries and in North America. In 17/19 centers dialysis and outpatient care are provided by the charity association "Kuratorium für Dialyse und Nierentransplantation – KfH" in cooperation with the university

hospitals. The relatively low incidence of pediatric patients with renal disease led to the challenge to resolve diagnostic and therapeutic problems by initiating cooperative clinical studies, which initially mostly concerned nephrotic syndrome and renal insufficiency. In 1976 the German-speaking Society of Pediatric Nephrology (APN; since 2008, GPN) was founded in the Federal Republic of Germany. In 1991 it was combined with a similar society existing in eastern Germany. The main activities of the GPN concern the performance of cooperative clinical studies, the organization of renal replacement programs and the establishment of clinical guidelines and postgraduate courses. Two main meetings are held each year, one being exclusively devoted to the discussion of cooperative studies. In addition, 27 several joint meetings with other societies for Pediatric Nephrology, i.e. with the French Society for Pediatric Nephrology in Strasburg, Dutch Society for Pediatric Nephrology in Amsterdam, and Working Group for Pediatric Nephrology of the Czech Pediatric Society in Prague, were held in recent years. The GPN has strong relationship to the adult nephrology community in Germany. The president of the GPN is one of the board members of the German Society of Nephrology (DGFN). The GPN is regularly involved in the organization and program development of the DGFN meeting. Currently the GPN has 320 active members and 13 working groups, dedicated to special topics, e.g. transplantation, dialysis, hypertension, Lupus nephritis, renal genetics, experimental nephrology, neonatology/intensive, and psychosocial care of children with CKD. The working groups primary focus on research projects. In addition, they established more than 40 SOPs and guidelines for the management of children with renal diseases during the last 10 years.

Pediatric Nephrology Training in Germany

Pediatric trainees enter sub-specialty Training in Pediatric Nephrology through regional medical associations. In general, training in Paediatrics and Adolescent Medicine takes a period of 5 years. Specialised training in Paediatric Nephrology is completed over a further period of a 3 years. Of which, up to 12 months can be carried out as part of the physician training in Paediatric and Adolescent Medicine in some centres. Trainees undergo a comprehensive curriculum, including diagnosis and treatment of congenital, hereditary and acquired kidney diseases, renal replacement therapy (dialysis, transplantation) and diagnostic procedures, e. g. renal ultrasound and biopsy. They have to attend local and nationally certified educational meetings. The GPN holds an annual training course in Pediatric Nephrology, which is regularly attended by approx. 40 trainees in Pediatric Nephrolgy.

Registries

Several registries have been established by the GPN working groups. QiN-Kid, a German registry for children on dialysis treatment was started in 1999. This registry is also a measure for quality control of medical care in children requiring dialysis treatment. In 2015, 111 children on peritoneal dialysis and 80 on hemodialysis were treated in Germany. Transplanted patients are followed-up in the In CERTAIN Registry, where approx. 120 pediatric transplant recipients from Germany are enrolled every year. This registry also includes patients from of other European countries with a total number of 1200 children. The Lupus nephritis registry and the registry on Henoch Schönlein nephritis currently include 150 and 200 patients, respectively. In addition, registries for patients with Wilms tumor suppressor gene 1 (WT1) mutations, those with renal oligo- and anhydramnios, and with nephropathic cystinosis were started in recent years. Finally, the BMBMF funded

registry on cystic kidney diseases (NEOCYST) was started in 2016.

Research

All 19 pediatric nephrology centers within Germany participate in research and contribute to the collaborative GPN studies. The GPN study group meets 2 times per year. One major research topic is Nephrotic Syndrome. The GPN performed several prospective randomized clinical studies on this topic. Currently, the prospective randomized INTENT study 28 investigates the efficacy and safety of treatment with mycophenolate mofetil versus standard treatment with prednisone for initial manifestation of idiopathic Nephrotic Syndrome. Several substudies including predictors for response to steroid therapy (PRESTINS) and on pharmacokinetics go along with this multicenter trial. In the EARLY PRO-TECT Alport trial the efficacy of an early treatment with ACEinhibitors for prevention of progressive renal failure in children with Alport syndrome is investigated. The DFG funded DiaSport trial is a prospective study assessing the benefit of a physical training program for improved global health and qualitiy of life in pediatric dialysis patients in Germany. Within the TRANSNephro trial (funded by the KfH Foundation for Preventive Medicine) the usefullness of case management and smartphone apps for improved transition from adolescent transplant recipients into adult medicine and long-term patient and transplant outcome is adressed. The BMBF funded NEOCYST consortium was established in 2016, which investigates the pathophysiology and therapeutic measures for children with cystic kidney disease. In addtion, all centers contribute to the ESPN/ERA-EDTA registry and many centers are part of the ESCAPE consortium and contribute to the IPPN, IPHN, and PODONET registry. It is through collaborative work such as this that the GPN hopes to achieve its stated aim of ensuring every patient is offered the opportunity to participate in research and to receive best medical treamtent.

Figure 1.

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Pediatric Nephrology in Italy

In Italy the treatment of renal diseases is generally entrusted to pediatric nephrologists, even though minor issues, as for instance uncomplicated urinary tract infections or self-limiting post-infectious glomerulonephritis may be managed by general pediatricians.

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2018

Pediatric nephrology centers are widely spread all over the country. There are around 100 pediatric nephrologists actively involved in the care of children with renal diseases, working in 15 centers specifically, identified as pediatric nephrology units, scattered in the whole country (Figure). In addition, there are several Pediatric Centres where good Pediatric Nephrology is carried out (Udine, Pordenone, etc) and several Adult Nephrology Centers where a Pediatric section exist (Bergamo, etc.) There is not a recognized specialty in the university. Physicians working in these centers are usually formally trained as pediatricians or adult nephrologists and gain their experience on the field.
In few Centers belonging to the University Pediatric Department nephrourological master courses and PhD are organized both for physicians and biologists.

All centers offer dialysis to children, both hemodialysis and peritoneal dialysis. Also continuous dialysis techniques are widely available and all the principal centers guarantee also CRRT for AKI in neonatology and intensive care units, also for pediatric

cardiac surgery . In addition, most of these Units also perform plasma-exchange treatment for severe renal disease (aHUS, immunomediated glomerulopathies, acute humoral rejection, etc.). Five of these centers are also transplant centers. Four additional adult centers occasionally perform transplants in older children or adolescents below the age of 18.

70–80 transplant per year are performed in children below the age of 18, usually starting from a minimum body weight of 8 Kg, almost matching the need for renal transplants. Living donor transplant accounts for around 20 % of the whole transplant activity almost completely guaranteed by 2–3 centers. A trend toward an increase of this activity is however currently evident over time. Organ distribution follows a nationwide sharing policy through a centralized allocation. This guarantees a better HLA matching and a uniform waiting time across the country.

Follow up responsibility obviously remains on the transplant center itself, but several pediatric nephrology units collaborate with the transplant centers. In all cases, there is a strict collaboration between transplant centers and the nephrology units to guarantee a rigorous post transplant management. National registries are active for dialysis and transplant patients and all large centers actively participate to European databases and to the European reference networks. Genetic diagnosis of the most common rare renal diseases is widely available by the lab of Genetic Units in the principal National Hospital-University, usually in tight connection with Pediatric nephrology Centers National health system in Italy guarantees a full coverage of costs for children with renal diseases. This includes any treatment: dialysis, transplantation and also provision of the most expensive treatments, such as eculizumab for life-long HUS treatment , growth hormone or erythropoietin. Pediatric nephrology Centers are also generally allowed to provide "off label" drugs for several rare diseases.

A non completely solved problem is the transition period. It is difficult to replicate the behavior of pediatric nephrology units in Adult centers. Pediatric centers do have a comprehensive approach, which is not often available in adults centers, that are mostly directed solely to the care of the renal disease . Following transition "former" children, grown up in the pediatric center don't feel anymore "at home" in the new center, may have a feeling of loss which may end in a less strict control and compliance, ultimately leading to a minor attention in the treatment itself. For renal transplant this may be a cause for graft loss.

In Conclusion

In Italy renal diseases, dialysis and renal transplantation in children are managed mainly by pediatric Nephrologists. In any case, a large network exist and all complicated cases initially referred to Pediatric centers can be easily referred to a proper pediatric Nephrology center. All children can be managed, as the cost for treatment is entirely supported by the National Health System.

Legend:
Pediatric Nephrology Centers in Italy. To these we should add several Pediatric Centres where good Pediatric Nephrology is carried out (Udine, Pordenone, etc) and several Adult Nephrology Centers where a Pediatric section exist (Bergamo, etc.).

An Overview of Pediatric Nephrology in the UK

The UK National Health Service – The NHS was launched in 1948, based on the principle that healthcare should be available to all, regardless of wealth. For most of the 64 million population of the UK, the NHS remains free at the point of use. The NHS employs more than 1.6 million people, putting it in the top five of the world's largest workforces.

Christopher Reid
UK The UK National Health Service

2015

GB

Funding for the NHS comes directly from taxation.

History of the development of Paediatric Nephrology in the UK

The specialty of paediatric nephrology started in 1950 with the development of the first regional referral unit for children with renal disease in Glasgow, under the leadership of Dr (later Professor) Gavin Arneil. Over the next 20 years individuals started to develop both research and clinical departments in the field of paediatric nephrology. In 1972 at the 6th meeting of the European Society for Paediatric Nephrology, Gavin Arneil initiated a meeting with 7 very well-known colleagues – Martin Barratt, Stewart Cameron, Ian Houston, Roy Meadow, Martin Moncrieff, Michael Winterborn and Richard White – The "Dublin eight". At this meeting they decided to form an association of professionals interested in renal disease in children. The first meeting was

held in London in 1973. There were 15 founder members of the British Association for Paediatric Nephrology (BAPN) of whom 10 were present at the inaugural meeting.[1] Since those early days paediatric nephrology in the UK has grown enormously. There are now 13 units providing tertiary care including haemodialysis and peritoneal dialysis, 10 of which also provide renal transplantation. Ten of these units are in England with one each in Scotland, Wales and Northern Ireland each covering a regional population between approximately 2–12 million total populations. There are 70 consultant paediatric nephrologists in the UK.

In addition a growing number of Paediatricians with a Special Interest in Nephrology (SPINs) who have undergone nephrology modules in their training, who are based in the district hospitals and who work with the specialist teams to provide care for children as close to home as possible through developing regional networks[2]. Each of the tertiary centres is staffed with specialist nurses, dieticians, psychologists, social workers, play specialists, pharmacists and many others who are all integral to providing care for children with renal disease. The BAPN has also developed significantly. There are now sub-committees for clinical services, research, training, standards & guidelines and registry & audit. The BAPN has always had a strong association with the adult nephrology community in the UK and in 2010 the BAPN became a Division of the UK Renal Association[3]. The President of the BAPN is one of the Trustees of the Renal Association and we have representation on the Renal Association committees. This has strengthened the infrastructure of the BAPN and helps with all aspects of our work. The British Kidney Patient Association[4] has also had an important role in the development of many Paediatric Nephrology centres in the UK through their charitable fundraising activities which have supported both clinical services and the families directly.

Paediatric Nephrology Training in UK

Paediatric trainees enter sub-speciality training in Paediatric Nephrology through a National recruitment programme (NTN GRID) following completion of Level 2 training in Paediatrics. Trainees can also enter NTN GRID through an academic route if they are eligible to undertake an Academic Clinical Lectureship programme. Successful candidates complete a minimum of 2 years within paediatric nephrology NTN GRID posts and are then eligible to enter the General Medical Council Specialist Register with a Certificate of Completion of Training (CCT) in paediatrics and paediatric nephrology. The College Specialist Advisory Committee (CSAC) for Paediatric Nephrology, appointed by the Royal College of Paediatrics and Child Health, is responsible for and oversees paediatric nephrology training in the UK. The number of training posts available is linked to work-force planning and there are currently 11 trainees in NTN GRID posts across 9 available training centres, with 4 further trainees due to commence in September 2015. The curriculum is topic based and trainees are able to link work based assessments (eg directly observed practical procedures, case-based discussions, multi-source peer feedback) with the curriculum using an eportfolio. Trainees meet twice each year for a 2 day training meeting and are formally appraised yearly at this meeting by the CSAC Chair and Training Advisors. Trainee meetings are vibrant and well attended. They often cover a specific topic, such as transplantation or dialysis, drawing on local expertise of the host centre. They also allow trainees to compare training, share interesting cases and present research. In their penultimate year of training, trainees complete START (Speciality Trainee Assessment of Readiness for Tenure). START is an 'OSCE styled' formative assessment based upon

12 unseen scenarios which cover the domains of the GMC's good clinical practice. Paediatric Nephrology in the UK continues to have a strong and growing academic basis. Trainees have the opportunity to undertake formal research training fellowships and all trainees are encouraged to participate in officially recognised and supported studies.

The UK Renal Registry

The UKRR6, established in 1995, is part of the UK Renal Association, and has the chief aim of facilitating improvements in the care of patients with kidney disease by audit against national standards, benchmarking, and supporting research, innovation and quality improvement.
It is funded by NHS Renal Service Commissioners, through an annual capitation fee paid by each of the UK renal centres, paediatric and adult, submitting data. In the latest annual report of the UKRR in 2013, a total of 891 children and young people less than 18 years of age with established renal failure (ERF) were receiving treatment in the UK. At the census date, 80.2 % had a functioning transplant, 11.7 % were receiving haemodialysis and 8.1 % were receiving peritoneal dialysis. In patients aged <16 years, the prevalence and incidence of ERF was 58.2 and 9.3 per million age related population, respectively. All data was collected electronically by digital transfer from the 13 Paediatric centres to UKRR.

Research

All 13 paediatric nephrology centres within the UK participate in research and contribute to a clinical studies group which meets 3 times a year. There are academic interests within each centre including renal development and genetics, podocyte biology and function, nephrotic syndrome, transplant immunosuppression, chronic kidney disease, hypertension and haemolytic uraemic syndrome.
The hallmark of research in the UK has been collaboration between centres. This is exemplified by the work done to set up a rare disease registry entitled RaDaR. To date there are 18 rare disease groups (RDG) consisting of clinicians, scientists and patient representatives. The remit of these groups is to collect patient data through the registry, provide dependable patient information, and develop and deliver research studies. It is through collaborative work such as this that the clinical studies group hopes to achieve its stated aim of ensuring every patient is offered the opportunity to participate in research.

Figure 1: Map of the UK Paediatric Nephrology centres.

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Pediatric Nephrology in Turkey

Turkey is situated on an area where Europe meets Asia, creating a link between the two continents. Because of its geographical location, Anatolia has been very important throughout history, and is the birthplace of many great civilizations. Turkey has also been prominent as a center of commerce because of its connections to the three continents and sea surrounding it on three sides.

Rezan Topaloglu
Sevcan Bakkaloglu
Aysun Karabay Bayazıt

2020

Modern Turkey was established by Mustafa Kemal Atatürk after the proclamation of The Republic of Turkey in 1923. The area of Turkey is 783,562 km² and total population is 83.154.997 (2019), 25.543.939 of total population (32 %) is under the age of 18. There are 35.559 (1.534 inpatient) medical institutions and 164.594 physicians in Turkey (2019). Social security fully covers every children under the age of 18.

The foundation of "Pediatric Nephrology" in Turkey is parallel to the organizations in Europe. The European Society for Pediatric Nephrology (ESPN) was founded in 1967. Turkey was one of the founder countries, represented by Prof. Dr. İhsan Doğramacı who paid much attention to pediatric nephrology, thus initiating the process of implementing pediatric nephrology in Turkey and in Europe. In 1983, Pediatric Nephrology achieved the status

Pediatric Nephrology Centers in Turkey.

of a subspecialty in Pediatrics in Turkey. Today, Pediatric Nephrology subspecialty training has been given by 31 centers throughout Turkey. We have more than 60 pediatric nephrology centers (most of them are university centers) including almost 50 pediatric hemodialysis units, 60 pediatric peritoneal dialysis units and 30 pediatric transplantation centers.

Turkish Society of Pediatric Nephrology (TSPN) was founded in 1990 provided the basis for standardization and institutionalization of training in pediatric nephrology; and it also accelerated the development of clinical and experimental research studies. The construction of well-equipped modern hospitals as well as the financial support by both universities and pharmaceutical industry but most importantly great enthusiasm of Turkish Pediatric Nephrologists played important roles in achieving high quality of health-care and in the rapid increase in scientific activities.

First National Congress of TSPN was held in 1996 and thereafter repeated every two years. World experts from Europe and North America have been invited to our national meetings and a number of Turkish nephrologists had given many talks during international meetings, which promotes the exchange of knowledge and provides a mutual benefit to the societies.

The Pediatric Nephrology Fellowship Program is a three-year program after four-year pediatric residency program in Turkey. After completing this program, fellows must pass the pediatric nephrology certifying examination to get the subspecialty diploma. TSPN- Accreditation Council for Pediatric Nephrology Training was established in 2005. Many Turkish nephrologists were also received Board Certificate of TSPN after passing a well-structured two-step (written and OSCE) clinical exam.

In 2020, 205 well-trained pediatric nephrologists and 55 fellows are the basis for a high standard of clinical care and academic activities, thus putting Turkey into the leading position in the world. Turkey takes a very active part in international collaborative studies with the highest contribution to the registries

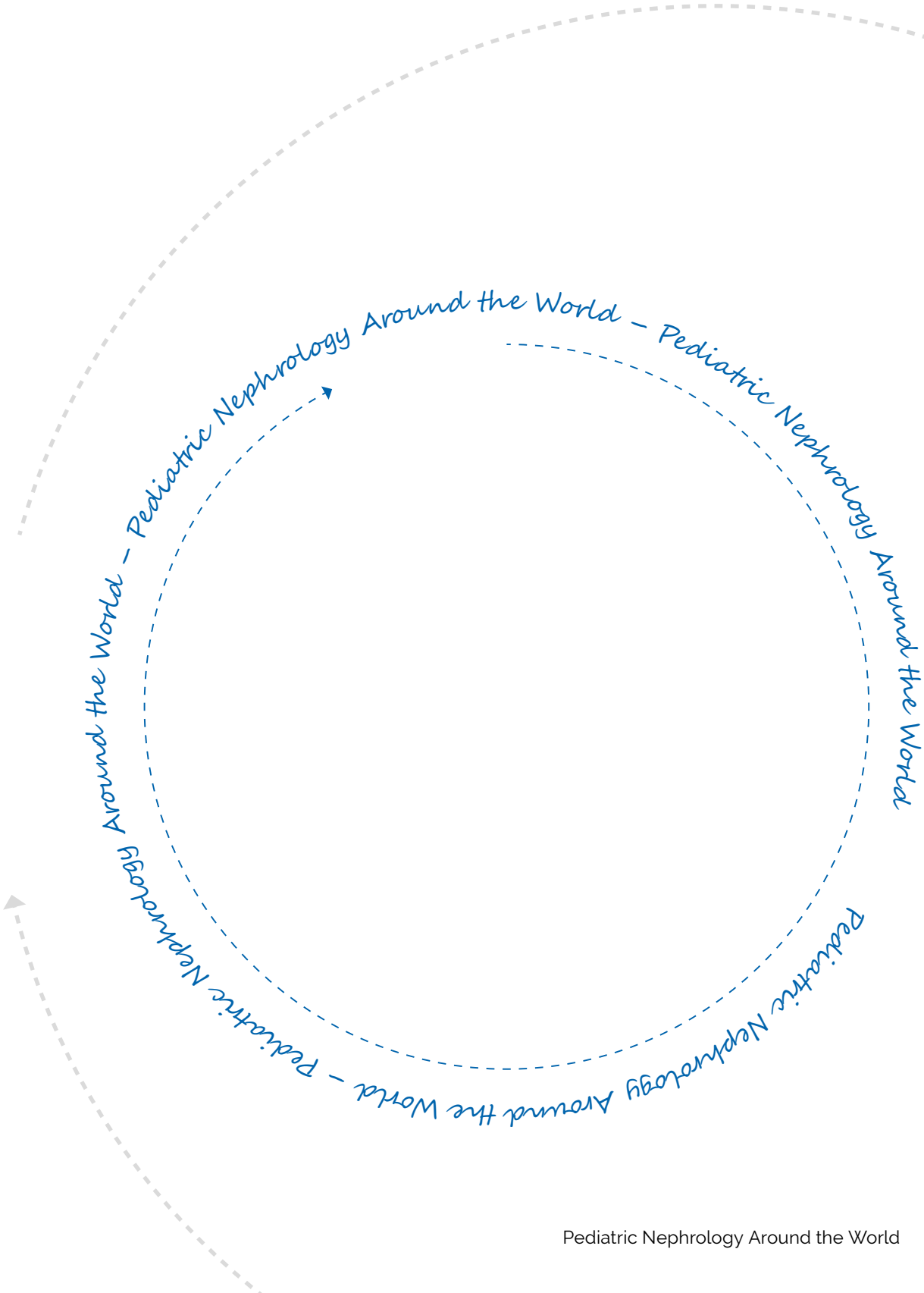
From the 9th Congress of Turkish Society of Pediatric Nephrology.

and prospective studies. Many Turkish nephrologists are working as board member or regular member of ESPN Working Groups. Turkey is well represented by our colleagues in IPNA and ESPN councils since early 2000s. In 2019, Prof. Dr. Rezan Topaloğlu was elected as the president of ESPN.

In addition to the great participation to international congresses and international studies, Turkey is very successful in organizing international meetings. The first organization of the ESPN Congress in Turkey was held in Istanbul in 2005 under the presidency of Prof. Dr. Ayşın Bakkaloğlu. This was followed by other successful international congress organizations which were ESPN Congress in Antalya in 2018, IPTA Congress in Istanbul in 2009, and Mediterranean Kidney Society Meeting in Cappadocia in 2015. There were also three ERA-EDTA Meetings in Istanbul in 1978, 2008 and 2015 and one ISPD meeting in 2008 with a significant contribution of Turkish pediatric nephrologists.

Turkey had an active role in the establishment of Southeastern European Pediatric Nephrology Working Group and organized its first and third congresses in 2001 and 2008 in Turkey. Turkey is an active participant of European Pediatric Dialysis Working Group and ESCAPE Network group and Cooperative European Pediatric Renal Transplant Initiative (CERTAIN)

The new generation of Turkish pediatric nephrologists is well prepared to take over the mission they have learned from the pioneers, will aim at improving the accuracy of diagnosis, and providing the availability and accessibility of renal care for children in order to guarantee equity and efficacy of health care for all.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America

An Overview of Pediatric Nephrology in Canada

Allison A. Eddy
Canada

By land mass, Canada is the second largest country in the world, yet its population is relatively small at 35.5 million (22 % are less than 20 years of age; 4.3 % are aboriginal peoples). Politically the country is divided into ten provinces and three northern territories. Ninety percent of the population lives within 160 miles of the border with the United States, where 15/17 of the Canadian medical schools are also located.

2015

CA

Canada has a publically funded healthcare system that is financed through taxation (federal and provincial). Two of the provinces (British Columbia and Ontario) also charge individual health premiums to supplement healthcare funding, while some individuals may have supplemental coverage available through employer and private health insurance programs. The principles of healthcare delivery are mandated by the federal Health Care Act (1984); however the provinces and territories are responsible for the actual administration and delivery which means that there is some regional variation in access and comprehensiveness of services. Each province has its own College of Physicians and Surgeons that grants medical licenses to practice medicine based on specific qualifications. In 1964, Dr. Keith Drummond became the first Pediatric Nephrologist in Canada, after subspecialty training in Minneapolis, Minnesota. Today there are an estimated 68 actively practicing pediatric nephrologists

(data provided by the Canadian Association of Pediatric Nephrologists) who work full-time in one of 14 academic Pediatric Departments, each affiliated with a medical school (Figure 1). Most pediatric nephrologists are salaried and have variable amounts of protected time for research, teaching and administration. The clinical programs are based in Children's Hospitals that may be physically free-standing (n=3; only two are governed by their own Board of Directors), maternal and child stand-alone facilities (n=4), or a pediatric "hospital within a hospital", located within large multi-departmental medical campuses (n=7). Most Pediatric Nephrology programs also provide clinical care to patients who live in smaller and rural communities through travelling outreach clinics. Recent advances in video-telecommunication technologies have created new opportunities to develop teleheath clinics, but more work remains before these are optimized. A smaller number of qualified pediatric nephrologists (perhaps 8) work in communities with blended nephrology-general pediatric practices. The Pediatrics Chairs group, representing all 17 Canadian Departments of Pediatrics conducts an annual workforce survey of pediatric academic programs. The most recent data indicate an aging pediatric nephrology workforce with a significant gap (~14) between the number of pediatric nephrology trainees and the anticipated number of retirements/new positions over the next five years. These data are corroborated by a workforce study completed by the Canadian Association of Paediatric Nephrologists in 2013. The Royal College of Physicians and Surgeons of Canada (RCPSC) oversees medical specialist training in Canada, setting national standards for competency-based medical education and continuing professional development for 80 medical specialties. To become a pediatric nephrologist in Canada, a MD graduate must first complete a 4-year pediatric residency (the fourth year can be used to begin Nephrology subspecialty training, but many complete a fourth year in general pediatrics first) in a RCPSC-accredited program and pass the Royal College examination in Pediatrics to become a Fellow of the RCPSC. Quebec is the only province that requires additional certification (in French) through the Collège des Médecins du Québec. Nine Canadian Pediatric Nephrology programs have been accredited by the RCPSC to provide a two-year subspecialty training program in Pediatric Nephrology (program review and re-accreditation is required every 6 years). Interested and qualified trainees are matched to available subspecialty residency positions annually through an electronic Canadian Resident Matching Service (CaRMS). Since the early 1990s, the RCPSC has also provided Pediatric Nephrology subspecialty certification by examination, after satisfactory completion of the two-year program. Maintenance of RCPSC certification as a pediatric nephrologist requires ongoing professional development via participation in accredited educational activities (400 credit hours over a 5-year period; a process that is regulated by the RCPSC). Individuals interested in working as a clinical-scientist must pursue additional training in research (funded through a variety of mechanisms) before beginning a faculty position. Many Canadian programs also offer clinical fellowships for international medical graduates (IMGs), who typically return home after training is competed as this training pathway. As of 2013, IMGs who complete training in an accredited program may be eligible to take the RCPSC examination in Pediatric Nephrology to become an Affiliate of the Royal College of Physicians and Surgeons of Canada, but they an not eligible to Practice in Canada based on this credential alone. As the clinical practice of pediatric nephrology is continuously evolving, I took this opportunity to survey some of the current

trends in Canada. Two thirds of the programs travel periodically to smaller communities for outreach clinics. Two of the larger programs without outreach sites are affiliated with part-time pediatric nephrologists who work in the community. Patients are typically transferred to adult programs at the age of 18 years, with flexibility in some programs to delay transition until 19–21 years for certain complex established patients. There is a growing trend to have kidney biopsies performed by interventional radiologists (50 %), with accommodation to involve nephrology trainees. For acute kidney injury most programs identified a preference for continuous renal replacement therapy (CRRT) or/and hemodialysis, while peritoneal dialysis was the preference in two programs. In approximately half of the programs, CRRT is managed jointly by Nephrology and the Critical Care physicians. For the other programs, Critical Care is slightly more likely than Nephrology to be the most responsible CRRT service. Just over 60 % of the patients requiring chronic dialysis are managed by in- centre hemodialysis; the remainder by home peritoneal dialysis. Since 2003, Canada has performed 49–73 kidney transplants annually for recipients less than 18 years of age; approximately 46 % are living donors. A small number of the

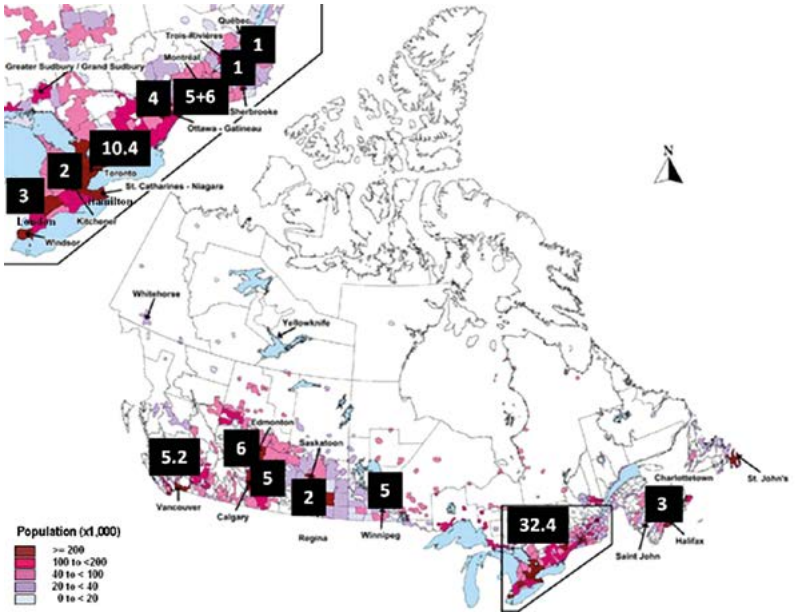


Figure 1: The distribution of the Canadian Pediatric Nephrologists (expressed as full-time equivalents) who are working in university-affiliated academic medical centres is shown on a map of Canada. The population density (2011) is indicated by the color coding (lower left). The densely populated southern regions of the provinces of Ontario and Quebec are shown in higher magnification in the upper left insert. The data were obtained by surveying the Canadian Pediatric Nephrology division heads. The map was obtained from Statistics Canada, Demography Division and is reproduced with permission under an Open License Agreement.

Canadian pediatric nephrologists are clinician-scientists with more than 50 % of their time protected for research. The Canadian Institutes of Health Research and the Kidney Foundation of Canada are the primary sources of extramural grant support for kidney-related research. Some of the Children's Hospital Foundations and Research Institutes are an additional funding source, on a competitive basis. Areas of current research activity include developmental nephrology, renal complications of prematurity, glomerular disease (genetics, nephrotic syndrome, hemolytic uremic syndrome), acute kidney injury and its sequelae, renal transport (kidney stones, renal tubular acidosis), hypertension and cardiovascular disease, chronic

kidney disease (vascular injury, improving outcomes), kidney transplantation (medication compliance, rejection biomarkers), eHealth, and evidence-based clinical care pathways. Canadians are actively involved in the global mission of nephrology education and improving clinical care for pediatric nephrology patients around the world through active participation in the activities of IPNA and the International Society of Nephrology (ISN). There is always one elected Canadian Pediatric Nephrologist on the IPNA Council (currently Dr. Julian Midgley). McGill University was partnered with Bangalore, India as a Sister Renal Centre funded by the ISN. This Centre has recently "graduated" and been approved to form a "Trio Program" with the addition of Ethiopia. As a member of the ISN Council and Fellowship Committee, and an ex officio member of IPNA Council, I am excited that we will soon see the launch of a new IPNA-ISN Sister Renal Centre program. A similar partnership currently exists to support Pediatric Nephrology fellowship training.

Acknowledgements

I would like to thank Dr. Maury Pinsk, Canadian Association of Pediatric Nephrology President and the Canadian Nephrology Pediatric Division Heads for providing some of the data that was cited.

Pediatric Nephrology in Argentina

Argentina is a country with 40.117.096 million of inhabitants its current administrative division establishes twenty-three provinces and a federal district – the Autonomous City of Buenos Aires. There are 12.333.747 children under 18 years of age (30, 74 %).

Andrea Exeni

2019

AR

We are approximately 120 pediatric nephrologists (78 % females). 58 % live in Buenos Aires and surroundings.
In 4 of the 23 provinces there are no permanent pediatric nephrologist. Usually once a month a Pediatric Nephrologist travels from another province.

To become a Pediatric Nephrologist a complete training in clinical pediatrics is required. followed by a fellowship in Pediatric Nephrology.

The University of Buenos Aires also offers a fellowship program. The specialist title is either awarded by the local Association of Medical Doctors in each district, the Argentinian Society of Pediatrics or the University of Buenos Aires. Within the public system the trainee receives a monthly remuneration during the complete fellowship.
Regarding scientific societies there is a Nephrology Committee in the Argentinean Society of Pediatrics .It renovates its authorities every three years .It has an educational

purpose and works in elaborating consensus and multicentric studies There are meetings for all pediatric nephrologists every 4 months that take place in Buenos Aires and through web way can be transmitted to all the country This is very important to continue our education.

The Argentinean Congress of Pediatric Nephrology takes place every 3 years and besides international meetings. We participate actively in the Latin American Society of Pediatric Nephrology (ALANEPE) Congress also every 3 years. The ALANEPE Journal, "Archivos Latioamericanos de Nefrología Pediátrica", was founded in our country in 2001 and strongly contributes to education of Pediatric Nephrologists all over Latin America. In the last few years there has been an increasing production in basic research mainly in the National Academy of Medicine, the University of Buenos Aires and University of Mendoza achieving important knowledge.

Pediatric Nephrologists have also participated as professors in the IPNA teaching program throughout Latin America.

The health system in Argentina is either public, with health insurance or private. It is very important to understand that even though we are a developing country our public system offers patients with no resources medical attention of high quality in all areas of the medical system. Acute dialysis techniques (peritoneal and hemodialysis) are widely available in Hospitals. Specialized centers offer CRRT in neonatal Intensive Care patients. Nevertheless there is still an heterogeneous distribution of resources.

Dialysis and transplantation in patients with no economic resources is provided by the Government with no cost for the patient. Despite the fact that many centers offer peritoneal dialysis and hemodialysis as mentioned before there is heterogeneity in our health system throughout the country. In terms of area, Argentina is the second largest country of South America after Brazil, and the 8th largest country in the world. Its total area is approximately 2.7 million km^2. Despite the fact that there are many Pediatric Nephrologists in our country still very young patients need to travel large distances to other cities either to enroll in Pediatric dialysis programs because of lack of resources.

We have a Central Unique National Institute of Ablation and Implant Coordinator (INCUCAI) which is the body that promotes, regulates, coordinates and supervises the activities of donation and transplantation of organs, tissues and cells in our country. Acts in the Argentine provinces with 24 jurisdictions of ablation and implant. The mission of INCUCAI is to promote, regulate and coordinate the activities related to the procurement and transplantation of organs, tissues and cells at the national level, guaranteeing transparency, equity and quality. It also provides a vigorous control in follow up and in keeping the registry of all these patients to date. To the date there are 356 patients under 18 years in chronic dialysis; 166 in peritoneal dialysis, 185 patients in hemodialysis and 13 in hemodiafiltration. 89 (25 %) of these children are in waiting list for renal transplantation-, other 19 patients are in waiting list for preemptive renal transplant.

The first renal pediatric transplant in Argentina was performed in 1961, since then the programs have been growing. There are 11 pediatric units that perform renal transplantation. Even though renal transplants are mainly concentrated in Buenos Aires other 4 provinces perform transplants as well. Patients that travel from all over the country to receive the renal transplant then have to travel periodically for follow up.

In Argentina renal transplantation is mainly performed with cadaver donor. In 2017 148 pediatric patients under 18 years were

transplanted (105 cadaver donor) and in 2018 141 to the date (113 cadaver donor).

Follow up of all pediatric patients is very close during the pediatric period but we are still working in difficulties in the Transition programs. This is a very important issue and the Pediatric Nephrology community is working hard to design the correct strategy to guarantee adequate follow up of the patients.

In conclusion

Argentina has an active and devoted Pediatric Nephrology community that provides high quality medicine and care to patients with renal disease. Patients have direct access to the specialist There is a network of nephrologists and coordinated work is achieved mainly though scientific societies. Our public health provides patients with no economic resources with all treatments needed.

Pediatric Nephrology in Jamaica 1984–2020

Jamaica is an island in the Western Caribbean with a population of almost 3 million people. Adult nephrology had been in existence in Jamaica since the 1970's and in that decade, Jamaica was the first English speaking Caribbean country to perform renal transplants.

Maolynne Miller

2020

JM

However, Paediatric nephrology was first introduced to the island in December 1984 when Jamaica's first paediatric nephrologist returned from Canada and started the paediatric nephrology centre at the University Hospital of the West Indies (UHWI) in Kingston. Prior to her arrival, there was a cohort of urological patients with unmanaged chronic kidney disease and severe rickets. Adult nephrologists managed severe cases of AKI, acute dialysis was rare. There was no protocol for the investigation of urinary tract infections and many cases of obstructive uropathy presented

already in end stage renal failure. All children with end stage kidney disease (ESRF) died.

The focus in the early years (1985–2000) was education and prevention of disease. To this end, with the help of the Paediatric Association of Jamaica, outreach visits were made to hospitals across Jamaica to inform physicians of best practice procedures and when to request paediatric nephrology consultation.
A paediatric nephrology clinic was started at UHWI and paediatric nephrology was included in the curriculum for Paediatric residents and medical students. The new paediatricians would take this knowledge to the rural hospitals to which they were posted as well as to their Caribbean island of origin. The first paediatric nephrology manual was written in 1988 as a guide for paediatric residents and paediatricians, and revised regularly. Renal biopsies were performed for all cases of atypical glomerular disease and acute peritoneal dialysis for acute kidney failure.

In 1999, Jamaica's second paediatric nephrologist returned from training in Britain and started the island's second paediatric nephrology centre at the Bustamante Hospital for Children (BHC) also in Kingston. Chronic dialysis was however not available for children under age 12 years until the advent of a new Adult Nephrologist to UHWI in the mid 1990's.
He was willing to allow paediatric nephrology to co-manage children of "small adult" size in the Adult Dialysis programme. Between 2007 and 2010 at UHWI, three year olds started chronic PD managed by the paediatric nephrology service.

During this period efforts were made to interest residents in the DM programme in pursuing paediatric nephrology as a subspecialty and identify training centres. In 2012 Jamaica's third paediatric nephrologist (second generation) returned from training at the Hospital for Sick Children (Toronto) and officially launched at UHWI the first paediatric chronic dialysis programme. Seven children were dialysed that year.

Outcomes (Figures 1, 2)

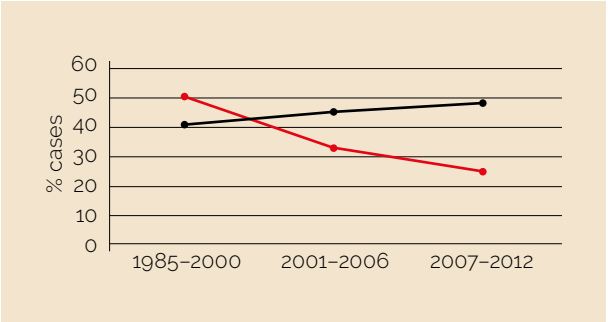


Figure 1: Relative changes in **glomerular** vs. urological causes of chronic renal failure with time.

Figure 2: Chronic Renal Failure Incidence per million children under age 12 years.

1985–2000 The cumulative annual incidence of CKD in children < age 12 years was 3.2/million age related population (34 children). Glomerular disease was the most common cause of CKD and was post infectious in 26.5 % (11.8 % post Streptococcal). Urological causes – primarily obstructive uropathy, accounted for 41 % of cases. 50 % of children were in ESRF at first presentation and the mortality from CKD was 65 %. Access to dialysis locally was only 0.8 %.

2001–2012 showed a gradual shift from glomerular to urological causes of CKD and greater access to dialysis such that between 2007–2012 all eligible children were dialysed and mortality from ESRD was only 7 %. Serial data showed steady increase in the incidence of CKD – most likely due to increased awareness of practitioners of symptoms and signs. However, for children under the age of 12 years, chronic dialysis was only available at UHWI – a fee paying hospital, and the costs were burdensome to the parents and hospital. Shortages of supplies were common.

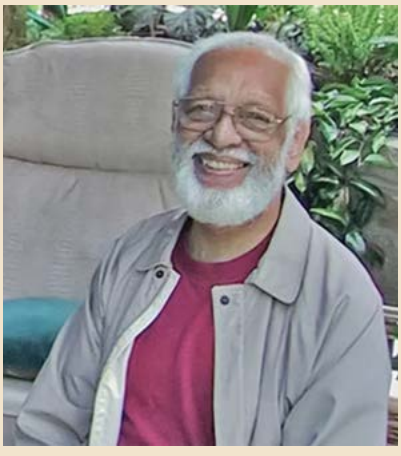
In 2012 Jamaica Kidney Kids Foundation (JKKF) was created to improve the care of children with CKD. Since 2013 JKKF has provided dialysis consumables to the UHWI and the parents do not have to pay for the treatment. Additionally JKKF and its partners pays for services (eg blood tests, X Rays, renal biopsies) that patients cannot afford. In 2013 JKKF and Friends, and a paediatric nephrologist giving voluntary service, made it possible for monthly rural paediatric nephrology clinics to be conducted in Western (CRH) and Central Jamaica (Mandeville Regional Hospital). These rural clinics brought renal care to children who could not afford travel to the centres in Kingston.

In 2013 JKKF with the Issa Trust and IPNA sponsored a 2 day re-treat for paediatricians across the island to train in the diagnosis and management of CKD and establish a platform for early referral and local monitoring. The retreat was followed by outreaches to several parishes to inform rural hospital medical staff on the same topics. This practice of annual or biennial Conferences, Workshops and outreach programs has continued to the present time with IPNA support and the JKKF.

In 2014 /2015, three children began home peritoneal dialysis with cyclers and fluid donated by JKKF. This offered extended life to children from 2 rural parishes

Notable Jamaican Doctors

Dr. Maolynne Miller as a Paediatric Surgery Intern with the infant who inspired her to do Paediatric Nephrology (ca. January 1979).



Professor Reginal Carpenter: Dr. Miller's Mentor, and Jamaica's first Paediatric Surgeon, whose patients provided the first CKD cohort on Dr. Miller's return to Jamaica in 1984.

who had no access to dialysis in Kingston.

Unfortunately both rural children died from sudden acute illnesses. The toddler survived for about 6 months on home PD and the child about 4 years. The program has not resumed as the remaining patients do not have suitable home environments.

Relationships forged with IPNA Paediatric nephrologists Drs. Bitzan and Bonilla Felix and Dr. Rulan Parekh at local IPNA and JKKF sponsored training workshops and conferences, created the platform from which paediatric nephrology fellowships for Jamaica paediatricians were obtained. With the assistance of IPNA, ISN, JKKF and concessions by the host institutions Montreal Children's Hospital and the Hospital for Sick Children, our third generation of paediatric nephrologists emerged – returning to Jamaica in 2016, 2017 and 2019. The first generation paediatric nephrologists (1984, 1999) have handed the baton for the continuation of hospital based paediatric nephrology in Kingston to two of them. In 2019 the newest addition to our nephrology family established Western Jamaica's first paediatric nephrology service at the CRH.

In March 2020, the first child from our 2012 dialysis cohort received a successful renal transplant from his mother at the UHWI. This was a collaborative effort involving Transplant Links, UHWI Surgical and Adult Nephrology services as well as Paediatric Nephrologists in Kingston – a first for our paediatric team.

In summary, we have progressed from a single paediatric nephrologist in 1984 to six now, and there are currently three paediatric nephrology centres instead of one. As a group, our paediatric nephrology team formulates and revises management protocols specific for Jamaican children based on local data. Construction has begun for a Paediatric and Adolescent hospital for Western Jamaica, offering paediatric dialysis and renal transplantation. This will be spearheaded and managed by our CRH paediatric nephrologist.

Our ongoing challenges are financial and training related. Drugs and supplies are expensive and training is needed for nephrology support staff in the new paediatric renal centres. Charitable organizations such as JKKF help in this regard as Government financing is limited. Our partnerships with IPNA, ISN and paediatric nephrology colleagues worldwide have helped tremendously in the realization of the paediatric nephrology dreams I had when I returned in 1984. We are thankful and look forward to more progress in the future.

Dr. Maolynne Miller: Jamaica's First Paediatric Nephrologist, who returned in 1984 to the University Hospital of the West Indies – Kingston, Jamaica.
Priorities: Education of Medical Practitioners on Paediatric Nephrology and creation of management protocols, acute peritoneal dialysis, renal biopsies, general paediatric nephrology service.

Notable Jamaican Doctors

↑

Dr. Joy Williams:
Jamaica's Second Paediatric Nephrologist, who returned in 1999 to the Bustamante Hospital for Children – Kingston, Jamaica.
Priorities: Education of Medical Practitioners on Paediatric Nephrology, implementation of protocols, acute peritoneal dialysis, renal biopsies, general paediatric nephrology service.

↑

Dr. Rebecca Thomas-Chen: Jamaica's Fourth Paediatric Nephrologist, who returned in 2016 to the University Hospital of the West Indies – Kingston, Jamaica.
Priorities: continuing the paediatric dialysis programme, renal transplantation 2020 (collaborative).

Dr. Marsha Gooden:
Jamaica's Third Paediatric Nephrologist, who returned in 2012 to the University Hospital of the West Indies – Kingston, Jamaica.
Formally established Jamaica's first paediatric dialysis programme for children under age 12 years.

←

Dr. Sandrica Young Peart: Jamaica's Fifth Paediatric Nephrologist, who returned to the Bustamante Hospital for Children – Kingston, Jamaica. Priorities: Renal transplantation (2020) (collaborative), planning for establishment of chronic dialysis facilities for children under age 12 at Bustamante Hospital for Children (public hospital).

Dr. Nadia McLean: Jamaica's Sixth Paediatric Nephrologist, who returned to Cornwall Regional Hospital – Montego Bay, Jamaica. The First Paediatric Nephrologist in Western Jamaica. Priorities: Establishing Dialysis and Transplantation service for Western Jamaica.

Paediatric Nephrologists in Canada who Trained Our Newest Paediatric Nephrologists

Dr. Martin Bitzan: Montreal Children's Hospital – Montreal, Canada. Trained Dr. Rebecca Thomas-Chen and Dr. Sandrica Young Peart.

Dr. Rulan Parekh: Hospital for Sick Children – Toronto, Canada. Instrumental in the training of Dr. Marsha Gooden and Dr. Nadia McLean.

The Paediatric Nephrology Centres in Jamaica
University Hospital of the West Indies

Smallest Child on Haemodialysis: David, age 6 years (ca. 2012), with the Haemodialysis facilities shared with Adults.

Paediatric Peritoneal Dialysis: Nurse and patient in the Peritoneal Dialysis Unit, which is shared with Adults for in-patient peritoneal dialysis.

The Bustamante Hospital for Children

Cornwall Regional Hospital

Jamaica Kidney Kids Foundation

Dr. Maolynne Miller: Founder and Chairperson of the Jamaica Kidney Kids Foundation (JKKF). The JKKF was established in 2012.

Ms Erin Hayle (my daughter): JKKF Outreach Manager, Director and Public Educator in Chief.

Jamaica Kidney Kids Foundation Family Support Group

Dialysis patients and their families on at an outing (ca. 2017).

Dialysis kids and their parents.

Dialysis kid, David (ca. 2018).

Jamaica Kidney Kids Foundation – Rural Hospital Outreach

(L to R) Dr. Martin Bitzan, Dr. Maolynne Miller, Dr. Marcos Peres Brayfield, and Dr. Melvin Bonilla Felix at Black River Public General Hospital – St. Elizabeth, Jamaica (ca. 2016).

Jamaica Kidney Kids Foundation 2018 Conference on Paediatric Nephrology (with IPNA Support)

Professor Timothy Bunchman speaks at the Jamaica Kidney Kids Foundation 2018 Conference on Paediatric Nephrology.

Attendees listen keenly at the Jamaica Kidney Kids Foundation 2018 Conference on Paediatric Nephrology.

Jamaica Kidney Kids Foundation School Outreach

Children are taught the importance of their kidneys at JKKF School Outreaches.

Adults learn about their kidneys and how to maintain their health.

Blood pressure screening of students at school outreach.

Africa

Pediatric Nephrology in South Africa

South Africa is a very beautiful country with very diverse populations, financial resources and cultures. In 2018, the World Bank upgraded South Africa to status of an Upper Middle Income country, third only to Thailand and China. This is deceptive as living conditions are improving but still leave a lot to be desired.

Udai Kala
Paediatric Nephrology,
University of the Witwatersrand
and Chris Hani Baragwanath
Hospital, Johannesburg

2020

Basic amenities such as water and electricity are a major problem in rural areas, with load shedding of electricity (planned electricity outages to prevent unplanned blackouts) happening in the cities affecting dialysis facilities. This is complicated by the legacy of apartheid which kept races apart with unequal different health, education and social facilities. Slowly there has been integration, but should be evolving at a pace that is faster. In certain areas like the Western Cape, integration has been better.

There are eight medical schools in the country producing approximately 1500 new doctors every year. There are presently 1385 registered paediatricians in the country. Paediatric nephrology is only offered in 7 centres located in 4 cities. Two of these centres are the main transplant centres, located in Cape Town and Johannesburg. Presently there are approximately 30 registered

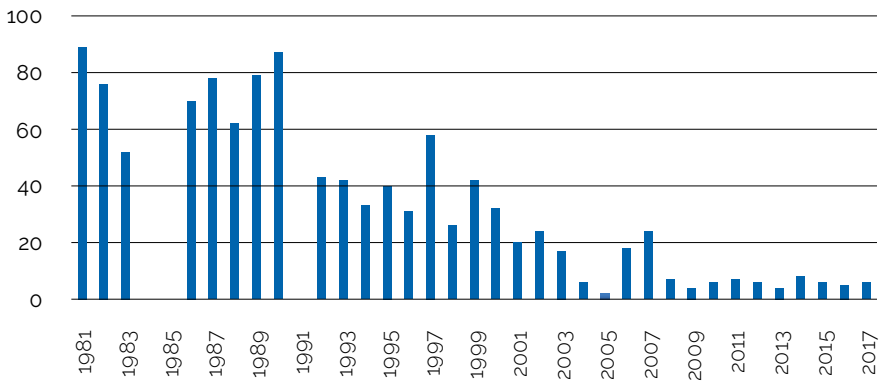
paediatric nephrologists in the country, suggesting a shortage of this specialised skill.

In the 2011 census, the population of South Africa was 51.7 million, of which 20.1 million (38.8 %) were less than 19 years of age. There is only 1 Adult Nephrologist per 1 million people in South Africa (Clin Kidney J. 2016 Feb; 9(1): 11–22). The paediatric nephrology coverage is probably only a 1 Pediatric Nephrologist per 4 million people. Unlike the adult services where many nephrologists are in private practise, most of the paediatric nephrologists (90 %) are in the public sector, caring for 80 % of the population.

Despite the shortage, due to better living conditions and primary health care, the prevalence of acute post streptococcal nephritis has dropped markedly (Figure 1). In areas where there are a lot of suboptimal housing (e.g. Cape Town and all the periurban areas) the condition is still seen, but with decreasing prevalence.

The prevalence of CAKUT is reasonably high. The most common lesions in the Black African child is obstructive uropathy due to posterior urethral valves (PUV), pelvi-ureteric junction (PUJ) obstruction, vesico–ureteric junction (VUJ) obstruction. These lesions are often diagnosed postnatally as sonar for foetal abnormalities are not done antenatally in majority of pregnancies in the public sector. Vesico-ureteric reflux (VUR) is uncommon in the Black African Children, but is common in the White and Asian populations. Mixed race populations may present with a combination of all the pathologies. Therefore, in some areas after a urinary tract infection (UTI), only sonar of the kidney and bladder is performed. A voiding cysto-urethrogram (VCUG) or nuclear imaging is only done after two properly documented UTI or if obstructive lesions of the lower tract are suspected. The trend is towards a MAG 3 scan after an ultrasound, but if there are no radionuclear imaging facilities available then a VCUG is done.

The prevalence of nephrotic syndrome is high in the Black African child, with a high prevalence of steroid resistance. The incidence of both minimal change and focal glomerulosclerosis is almost equal to at 30 %. In a recent genetic study done in Durban, Kwazulu-Natal, published in 2018, the Nephrin 2 gene was the most common genetic cause in Black Africans, compared to the Black Americans, where the APOL 1 gene has been more prevalent. Hepatitis B related nephropathy, which causes mainly secondary membranous nephropathy,



APSGN 1981 to 2017 CHBAH.

Figure 1: Number of cases of acute post streptococcal nephritis (APSGN) at the Chris Hani Baragwaneth Academic Hospital (CHBAH) over the last three decades.

formed almost 20 % of nephrotic syndrome in Southern African countries before being virtually eliminated with the introduction of Hepatitis B immunization in 1994. HIV associated nephropathy was making an impact, but with the introduction of highly active antiretroviral therapy, has remained with a prevalence of 5–7 % of nephrosis. AKI due to sepsis and gastroenteritis remains a prevalent clinical problem (Figure 2).

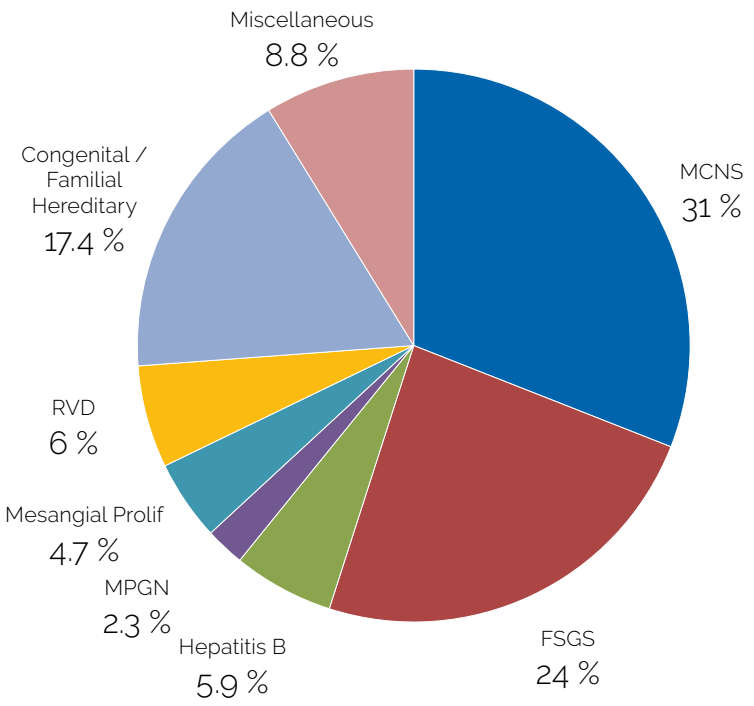


Figure 2: Causes of Nephrotic Syndrome in biopsied Black African Children at CHBAH 1982 2017.

Hypertension due to Takayasu's Aortitis with or without renal artery involvement is relatively common and often associated with a Grade 4 Mantoux response to Tuberculosis. Areas such as Cape Town, where TB is endemic, still has 1–2 new cases per year. They are treated with anti-tuberculosis drugs and steroids, cyclophosphamide and maintained on methotrexate and low dose steroids and anti-hypertensive agents. Often stenting of renal arteries and aorta are undertaken by our cardiology colleagues with a fair degree of success.

Renal replacement therapy in the form of peritoneal and haemodialysis has been freely available but is generally confined to the major academic centres. Both modalities are used, although a "PD first approach" is preferred. Presently, automated peritoneal dialysis is done unless there is no electricity available in the area. Acute dialysis is started whenever possible, until the cause of the renal failure is determined and suitability for chronic dialysis and transplant is determined via a multi-disciplinary team consisting of social workers, nursing staff, psychologist, palliative care team and the medical team. An approach for an affected child is outlined with the multi-disciplinary team for further escalation or withdrawal of therapy. We are trying to change the circumstances where we have influence. The problem is that we do not have sufficient social workers follow-up on missed appointments and compliance of therapy. Almost one third of patients are lost to follow up. This is due to a very mobile population, lack of funds for travel to health facilities, inadequate housing, and inadequate nutrition.

Renal transplantation is available to children in the four major centres, but due to social customs and

rituals, the pool for cadaver organs are very limited. There is a bigger push for living related donors.
The first paediatric renal transplant was done in 1967 by Prof. Chris Barnaard in Cape Town followed by paediatric renal transplants in Johannesburg and Cape Town both in 1968. A total of 249 paediatric transplants have been done in Cape Town, 418 in Johannesburg and approximately 10 in Durban. Pretoria is sending their transplants to Johannesburg. Renal replacement therapy including transplantation is available in private practise in Johannesburg.

The capacity for dialysis and transplantation training has increased with the opening of the Nelson Mandela Children's Hospital in Johannesburg, which has state of the art infrastructure and equipment.

With the assistance of both IPNA and ISN fellowships, there has been a tremendous amount of training done for fellows from Africa in Cape Town (almost 25 fellows) and to a lesser extent in Johannesburg, Pretoria and Durban. These fellows have virtually all returned home after completion of training, and have built paediatric renal units and programmes doing renal replacement therapy, including transplants in Kenya, Ghana, Nigeria, Zambia, Uganda and Tanzania.

In conclusion, renal replacement therapy is available to children of South Africa. However, due to poor living standards, distance to travel to and from health facilities, and poor compliance and follow up it becomes a more difficult task to insure these services are delivered to children in need.

The present financial constraints have affected the functioning of the health sector. However, prevention initiatives, including monitoring blood pressure and urine dipsticks in schools, can make a huge impact in detecting and diagnosing renal disease early, instituting appropriate management, and decreasing renal related diseases requiring renal replacement in the country.

I thank all of the paediatric nephrology and nursing colleagues for taking great care of these precious children under difficult circumstances and inadequate resources, as well as assisting me with data for this report.

Pediatric Nephrology in Gabon

Gabon, crossed by the equator, has an area of 267,667 square kilometers. Gabon has 85 % of its territory covered by rain forest and 800 kilometers of coast along the Atlantic Ocean.

Y Nzame Vierin
Pediatrician at Centre Hospitalier Universitaire d'Angondjé, Libreville, Gabon

2017

Located in Central Africa, it is surrounded to the North West by Equatorial Guinea, to the North by Cameroon, to the East and South by Congo and to the West by the Atlantic Ocean (Figure 1).

The total population was estimated at 1,811,079 in 2013 [1] while the population density at the national level was 6.8 inhabitants / km². This density reached record levels in some localities: 3,700 inhabitants per km2 in Libreville, the capital, and 2,480 inhabitants per km2 in Port-Gentil. The population is mainly urban (87 %). The annual growth rate is 2.9 %. Those under 15 represent 34.7 % of the total population.

In terms of care, there is no specialized service in Pediatric Nephrology.

There is a National Hemodialysis Center (NHC) which receives both adults and children. No pediatric department offers peritoneal dialysis. All cases of renal failure requiring extra-renal cleansing are

GA

Figure 1: Administrative map of Gabon.

referred to the NHC. The transfer of children is under the responsibility of the UAS. This center is open 24 hours a day.

Unfortunately, World Kidney Day is not celebrated and screening for kidney diseases does not happen…

Likewise, no MD in pediatric nephrology appears in the directory of the National Council of the Order of Doctors…

Unfortunately, malfunctions in the national health information system do not allow reliable data on the health status of children. According to hospital data, infectious diseases are the main causes of death. Between 2015 and 2016 in the pediatric ward of Angondjé University Hospital, twenty cases (1.18 %) of renal or renal disorders were recorded (Figure 2). The sex ratio boys / girls was 4, the average age of 7.1 years.

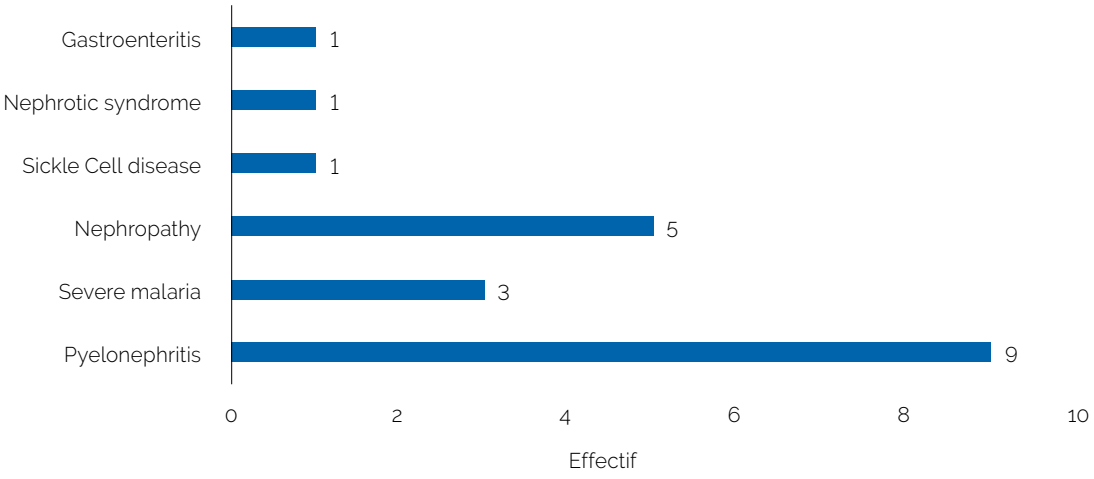


Figure 2: Renal or renal impairment disorders recorded.

Case	1	2	3	4	5
Sex	Male	Female	Female	Male	Male
Age	9 years	17 years	5 years	2 years	14 years
Diagnostic	Interstitial nephropathy	Non-labeled	Infectious origin	Nephropathy of undetermined origin	Nephrotic syndrome
Evolution	Favorable	Favorable	Death in an acute lung edema	Death in an array of severe sepsis	During dialysis

Table 1: Etiology of renal insufficiency.

Five children were transferred to the NHC for renal failure. The etiologies of renal failure are reported in Table I below.

Consequently, it is becoming urgent to train human resources in the field of pediatric nephrology. Postgraduate teaching activities focused on pediatric nephrology would undoubtedly improve the care of sick children and preserve the kidney of children. Similarly, World Kidney Day and screening sessions for kidney diseases could be conducted in schools as such campaign would raise the level of awareness and aim to sensitize the public authorities to the situation.

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Pediatric Nephrology in Madagascar

Madagascar is an island located in the Indian Ocean (Figure 1). It is part of the African continent. There are around 22 millions people for 596 790 km² . According to the estimation of the Institut National des Statistiques in Madagascar, its population was composed by 40 % of children less than 15 years of age in 2013.

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The public health system includes four levels of care: basic; health care centers; district hospitals including general medicine, maternity and surgery wards regional hospital including specialized medicine wards, surgery wards, maternity and a pediatric ward; university hospital with specialized wards such as pediatrics. Except one regional hospital, pediatricians work especially at the university hospital. There are 22 university hospitals in the six main towns in Madagascar. Most of those university hospitals are multidisciplinary ones. Only two are specific for pediatrics: the first one with 80 beds and the second with 40 beds. Pediatric surgery is located in another university hospital. Private sector includes 2 levels of care: private office or dispensary and private clinic hospital. Few specialist

doctors are available full time in those private clinic hospitals. Infections are the most frequent pediatric diseases in our hospitals. Regarding nephrology, acute pyelonephritis and the nephrotic syndrome are the most common concerns. Some cases of typical hemolytic uremic syndrome might occur after acute diarrhea. Taking the example of the Mother and Child University Hospital of Tsaralàlana (80 beds), there were 143 acute pyelonephritis, 30 nephrotic syndromes and 3 hemolytic uremic syndromes among 3781 admissions in 2014. Technical investigations are not always accessible for patients either because of geographic reasons or financial resources. Ultrasonography is quite available everywhere but there are only few radiologists trained to pediatric practice. CT-scan is available in the six main towns of Madagascar but isotopes and Intravenous pyelography are only available in Antananarivo (capital of Madagascar). MRI is only available in a private hospital. Biological examinations are limited. There are few hemodialysis centers for adults, especially in Antananarivo, but the number of patients who can pay hemodialysis is limited, and there is no access to hemodialysis for children. Peritoneal dialysis is the most adapted technique in our situation. Kidney transplantation can be performed abroad if the family has enough resources. Concerning drugs, antibiotics are the most used in nephrology and molecules for preserving renal function are available. About immunosuppressive agents, only corticosteroids are accessible for patients. The others must be imported from other countries. Based on such conditions, the management of children with renal diseases can only be achieved in a general pediatric ward. Therapeutics resources are often insufficient for the advanced forms of acute renal failure and also in nephrotic syndrome. Organizing an advanced specialization of some pediatricians, implementing of a pediatric nephrology ward, making an easier access to techniques and making some specific drugs available should optimize the quality of care of children with kidney diseases.

Figure 1: Localization map of Madagascar.


Pediatric Nephrology Around the World – Pediatric Nephrology Around the World – Pediatric Nephrology Around the World – Pediatric Nephrology Around the World –

Asia

Pediatric Nephrology in Singapore

Singapore is a small island state with a 5.5 million-strong population packed densely into 718 square kilometers of land, and is a regional hub for medical consultation and research. There are two major centers for Paediatric Nephrology in Singapore.

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The first is the Shaw-NKF-NUH Children's Kidney Centre of the KTP-National University Children's Medical Institute at the National University Hospital. This center is the tertiary referral center for the region for pediatric nephrology, and is the only end-stage care (dialysis and transplant) center in the country. The second is at the KK Women and Children's Hospital, which has general nephrology and critical care nephrology capabilities. Pediatric nephrology training in Singapore occurs after the 3-year general pediatrics residency program, and has been approved as a dually accredited program in both General Pediatrics and Pediatric Nephrology for a further 4 years. There are to date, 10 trained pediatric nephrologists in government institutions and 7 in the private sector in Singapore. The Singapore Renal Registry captures the data on end-stage renal care for all patients in Singapore, including pediatric patients. Paralleling the city state itself, which celebrates its 50th jubilee year of independence

this year, the Paediatric Nephrology program in Singapore has undergone a rapid evolution, transforming from "Third World to First". Before 1988, almost all children with end-stage kidney disease did not survive as there was no established dialysis facility for children. In the early days, the pioneering effort to start a chronic renal replacement program was helped by contributions from numerous well-wishers and donors. The fledgling team envisaged that home-based automated pediatric dialysis would be the modality of choice for school-going children with working parents. During the first 10 years of the program, dialysis was performed in the adult dialysis unit. The first specialist pediatric dialysis nurse was recruited in 1998. This resulted in a significant improvement in the outcomes of the dialysis program, in particular the infection-related outcomes [1].

The first pediatric renal transplant was started in Singapore in 1989 – this was a 2 year old with focal and segmental glomerulosclerosis, and this child is now 30 years old, with excellent graft function, and contributing back to the community as a healthcare professional.

Our long-term patient survival results have been excellent with a cumulative survival of 86 % at 15 years [2]. In 2002, through the generous donation from the Shaw Foundation and the National Kidney Foundation (NKF), the Shaw-NKF-NUH Children's Kidney Center (CKC) was set up as a comprehensive one-stop center for the treatment of children with kidney diseases, including acute dialysis for critically ill children. Today, the Center sees 2,000–3,000 children with kidney disease annually.

In the early days of the pediatric nephrology program, acute dialysis in the pediatric intensive care was exclusively peritoneal dialysis [3]. In 25 1995, the first infant was started on continuous arteriovenous hemofiltration, and subsequently the continuous venovenous hemofiltration (CVVHF) program was initiated, initially using innovations to the hemodialysis blood pumps, and subsequently with the commercially available CVVHF machines. Today, the Singapore Pediatric Renal Replacement Program has handled a total of 68 transplants and has managed 143 patients on peritoneal and hemodialysis. The predominant dialysis modality is automated peritoneal dialysis taking into consideration the educational needs of the children and the working parents. The key goal of the CKC remains to enable young patients to live normal lives, despite their illness. Hence, the Program has developed a strong psycho-social rehabilitation arm, which organizes support groups, workshops and a kidney camp that children have come to look forward to annually.

In fact, in 2015 we celebrated the 16th anniversary of the Kidney Camp. In 2007, the BELIEF program was launched to help CKC graduates obtain internships to help them in their career aspirations. South-East Asia still comprises many emerging economies, and healthcare technology similarly trails behind. The Singapore Pediatric Renal Replacement Program has sought to translate its experience in rapid evolution to similar progress for the region. Since 2001, it has welcomed at least 40 fellows and observers from 15 countries in the region. In 2003, the IPNA-Baxter Fellowship was launched as a partnership between IPNA and Baxter Healthcare (Asia) Pte Ltd to fund a doctor annually from Asia for training in pediatric nephrology in Singapore. More recently, another collaboration for fellowship training has been set up with Fresenius Medical Care in 2015, the IPNAFresenius Fellowship. A total of 32 fellows have been trained for at least one year at our center, 17 of whom have arrived under IPNA auspices, and 10 under the joint IPNA-Baxter protgramme. Many of them have gone home to be pioneers, founding pediatric dialysis or transplant programs in their home countries. This "trainand-export" strategy has thus proven

to be a great force-multiplier and leveller for the region. Since 2015, the Singapore program has also begun to reach out physically beyond its shores by participating in the International Society of Nephrology's (ISN) sister unit program. Yangon Children's Hospital in Myanmar is the first hospital which has partnered with Singapore to develop its pediatric dialysis unit and pediatric nephrology programme, helmed by several alumni of the IPNA fellowship program. Singapore has also established a regional education program targeted at pediatric nephrologists and pediatricians or adult physicians caring for children with kidney disease in Asia. This three-day intensive Primer Course in Pediatric Nephrology for Asia involves modules on major topics in pediatric nephrology, ranging from basic science to evidence-based reviews. The format of the course consists of lectures with an audience response system to facilitate interactions between the faculty and audience. The course is followed by a one-day hands-on dialysis workshop with 10 workstations involving challenging problems in the various modalities of dialysis. The Primer Course is conducted every 3 years, the first being in 2012, and the second in 2015, and is supported by IPNA, the Singapore Society of Nephrology and the National University of Singapore. With this active network of pediatric nephrologists trained around Asia, an Asian 26 collaborative study in the genetics of renal disease, the DRAGoN study (Deciphering diversities: Renal Asian Genetics Network) has been initiated in 2015, with a focus on primary focal segmental glomerulosclerosis, to determine the genetic and ethnic differences amongst the Asian population. In conclusion, the Singapore program hopes to continue its longstanding partnership with IPNA to develop pediatric nephrology not only in the country but also in the region.

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Pediatric Nephrology in Nepal

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Nepal is an underdeveloped landlocked nation located between China and India. The geography is itself a great challenge to deliver health facilities to people as most of the area, about 80%, is covered by hills and mountains. The estimated population of the country is 26.4 million and about 35% of the population is below 14 years of age. The pediatric subspecialties including nephrology is in its early phase of development and it has a long way to go.

At present there are five pediatricians who have obtained one year of pediatric nephrology fellowship (of which 2 are IPNA, 1 is ISN fellow) and are providing pediatric nephrology care. Among them, four work in the capital Kathmandu and one works in Dharan, a town in eastern Nepal. They practice both pediatrics and pediatric nephrology. None of the health institutes or hospitals has a dedicated pediatric nephrology unit. Similarly, pediatric renal biopsy service is available in only few centers. Because of lack of nephropathologists, the samples are sent to India for immunofluorescence and electron microscopy from peripheral centers. Immunosuppressive medicines like rituximab are rarely available and far beyond affordability of the common people; similarly there is scarcity of pediatric hemodialysis tubing, dialyzers, and both HD and

Renal disease	Percentage	Renal disease	Percentage
Glomerulonephritis (GN)	**46.5**	**Congenital Problems**	**7.8**
Acute post infectious GN	28.7	Posterior urethral valves	3.4
Hemolytic Uremic		Vesicouretral reflux	2.3
Syndrome (HUS)	10.1	Wilms tumor	0.6
Henoch-Schonlein nephritis	4	Prune belly syndrome	0.9
Lupus Nephritis	3.7	Polycystic kidney disease	0.6
Nephrotic syndrome	**34.1**	**Chronic renal failure (CRF)**	**4.2**
Minimal change	32	**AKI -III**	3.5
Mesangioproliferative	1.2		
Membrano proliferative	0.3	**UTI**	3.5
Focal segmental glomerulosclerosis	0.6		

PD catheters. Because of the lack of equipment, it is often difficult to provide renal replacement therapy or plasmapheresis to children in need. Additionally, pediatric HD services and chronic PD services are provided by limited centers across the country. At present, pediatric transplant services are not available in the country. In addition, nuclear imaging is available only at a single center, and fluoroscopy guided MCUG is performed by a very limited number of centers.

The exact data on the national prevalence of different renal problems in pediatric group is not available due to lack of a registry system. However, hospital level occurrences can be derived from studies conducted at specific sites. The annual hospital admission rate due to renal conditions accounts for 6–8 % of all admissions (Bhatta NK 2008, Yadav SP 2016). The table below provides the breakdown of different renal problems encountered at a single center (Bhatta NK, 2008).

With the improvement of expertise and diagnostic facilities, the number of reported patients with AKI has increased. From unpublished hospital-based data, it was found that AKI occurs in about 7 % of the total pediatric admissions, but 30 % of Pediatric ICU admissions. Similarly, the number of CKD cases seeking medical attention has increased. This heralded the need of adequate renal replacement therapy (RRT) throughout the country. Unfortunately, access to dialysis services remains inadequate, as only a very few centers provide pediatric dialysis services in the country.

Many families are unaware about the renal problems, and seek late consultation in the healthcare system. Very few families can afford to continue long-term therapy. There are very few training opportunities or workshops conducted at the national level focusing on pediatric renal health. As a result, there is a dearth of skilled clinicians to work in this field. Although government has committed to provide free dialysis services for

end stage renal disease patients, and some assistance in renal transplant, there are two hindering factors. Firstly, the lack of access to pediatric renal services, and the lack of experience in pediatric renal transplant. In addition, the legislation for cadaveric renal transplant still needs to be drafted.

Good quality research is also lagging in this field; most of the published articles are retrospective or prospective observational studies. Similarly, the need for a national registry of pediatric renal diseases is limited by the human resources and skillsets required to maintain the registry. This is not just an issue for pediatric nephrology, but also supporting departments. There is a need to provide quality clinical services and to conduct impactful research.

To conclude, pediatric nephrology in Nepal is currently in its infancy. More clinicians and para-medics should be trained to improve the level of service throughout the country. Similarly, both the government and international bodies should work together, identify the needs, create educational programs for both clinicians and patients, and uplift the status pediatric nephrology in Nepal. Similarly, collaboration with developed centers and organizations working for kidney health of children is needed to support the development of pediatric nephrology in Nepal. . Although current levels of service lag behind developed nations, there are windows of opportunity to improve the care of children in Nepal.

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Pediatric Nephrology in Myanmar

Myanmar is situated in South-East Asia and her neighboring countries are China, Thailand, India and Bangladesh. The total population is 55 million according to the 2014 census. There are around 18.5 million children under fourteen years of age, of which 4.5 million are under five years old.

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In Myanmar, there are 15 provinces, and each province has at-least one secondary level care hospital; some regions have two to three secondary level care hospitals depending on the size of the population. Every secondary level care hospital has one to two pediatricians. Tertiary care hospitals are in the capital city of Nay Pyi Taw, Yangon and Mandalay. However, there are only three paediatric nephrology and dialysis units and eleven trained paediatric nephrologists – that is one nephrologist per 1.4 million population under fourteen years of age. Most paediatric nephrologists are posted at Yangon and Mandalay Children Hospital and cover those three paediatric renal and dialysis units. All of them were IPNA fellows.

Pediatrics was established as a specialty in 1960, although Paediatric Nephrology as a sub-specialty was only established in 2006. Paediatric Nephrology services had been developed

to well-functioning nephrology units during the years from 2006 to 2020.

Capacity Building

In 2006, the first Pediatric Nephrologist in Myanmar served at Yangon Children Hospital. Subsequently, pediatricians were sent to Singapore for training as Nephrology Fellows to acquire the skills as Pediatric Nephrologists; all were supported by the IPNA and Baxter Fellowship Programs. Adult renal services in Myanmar was established more than 20 years earlier. Therefore, in the beginning, pediatric kidney and dialysis nurses were trained in adult nephrology units. After the Singapore-Myanmar Renal program was introduced, nurses received training from the Singapore Paediatric Kidney Center Team at the National University Hospital and had opportunity to have updated knowledge and technology regarding care of children with acute and chronic kidney disease, peritoneal dialysis, hemodialysis, and transplant.

Service Improvement

Pediatric Nephrology services initially started as outpatient follow-up clinics at Yangon Children Hospital in 2004. After the setup of the Nephrology unit in 2006, care expanded to inpatient care of children with kidney disease and care of children with chronic renal problem and acute emergency condition like acute peritoneal dialysis in children with AKI. Renal replacement therapy started as acute peritoneal dialysis in 2006, and later, acute hemodialysis in 2008. The Chronic Dialysis Unit for CKD patients was established in 2014. Mandalay Paediatric Nephrology was set up in 2014 at the 300-bed Mandalay Children Hospital situated in Mandalay, covering the northern part of Myanmar. A third paediatric renal and dialysis unit was developed in 2018 at the Children Hospital which was newly opened at Yangon in 2012.

In 2015, the Sister Renal Centre (SRC) Program, supported by IPNA, was started with the Children Kidney Center (CKC) National University Hospital, Singapore. Then SRC was upgraded from level C in (2015–2016) to level B (2017–2018) then to level A in 2019–2020. During this period the paediatric kidney transplant program became another remarkable milestone of our renal services in Myanmar. We received technical support from the paediatric transplant surgical team and nephrology team from NUH Singapore. Funding was jointly from the Myanmar Government, Ministry of Health, IPNA, as well as Myanmar volunteer donors.

Acute peritoneal dialysis training for sixty pediatricians and nurses who are working at district hospital of fifteen provinces was completed in 2019.

Common renal problems in Myanmar children

Common renal problems of Myanmar children are the same as other Asian countries. Nephrotic syndrome is the major cause of admissions to the pediatric nephrology ward. Other common renal diseases include acute post streptococcal glomerulonephritis, lupus nephritis, urinary tract infections, acute kidney injury (AKI) due to various etiologies, CKD and congenital anomalies of kidney and urinary tract (CAKUT). Here, acute post streptococcal glomerulonephritis is most common cause of acute glomerulonephritis in children. Of the children with idiopathic nephrotic syndrome, about 7–12 % are corticosteroid-resistant with histopathological findings of focal segmental glomerulosclerosis, mesangial proliferation, or membranoproliferative glomerulonephritis. A few children have IgA deposition.

Incidence of lupus nephritis is in increasing, and common biopsy findings are WHO stage II, III and IV. In a review of the kidney biopsy features of 66 pediatric patients with lupus nephritis,

the age range at onset of disease was 5–12 years in 2018 and 2019 at three pediatric nephrology units, >50 % had WHO class II and around 40 % had proliferative lupus nephritis (WHO class III & IV).

Based on total hospital admissions, AKI in children accounted for between 0.4 % to 5 % hospital admissions in three centers. The incidence of AKI in PICU was quite high at 9–50 %. Common etiologies of AKI are infection, sepsis, and viper snake bite. Mortality was higher in the group under five years of age, at >50 %, compared to 29 % in the age group of 5–12 years of age. Renal replacement therapy (peritoneal dialysis, hemodialysis, continuous venovenous hemodiafiltration (CVVHDF) and plasmapheresis) is available at each dialysis center. However, children with AKI often arrive at the hospital in severe kidney failure because of poor health knowledge, poverty, and difficult access to the tertiary hospital from remote areas. These factors negatively affect the survival, progression to CKD, and quality of life of these patients.

The chief causes of chronic kidney disease include chronic glomerulonephritis, focal segmental glomerulosclerosis, obstructive uropathy (e.g. posterior urethral valves), and renal hypoplasia or dysplasia. From 2016 to 2019, a total of 94 pediatric patients were with end stage renal disease. Currently both CAPD and intermittent HD are the main renal replacement therapies in Myanmar.

Paediatric kidney transplant was started in 2017, supported by IPNA, and technical support by NUH Singapore Paediatric Renal Teams. Currently ten live donor kidney transplants have been carried out.

Continuing Medical Education

The Pediatric Nephrology Group of Myanmar organizes national and international programs yearly, as well as a monthly CME program of seminars and workshops. With the support of ISN and IPNA, the Educational Ambassador Program was introduced once or twice each year in 2015 to 2018 for sharing of updated knowledge on paediatric nephrology for the pediatricians, nephrologists and postgraduate students. In addition, there are clinical case discussion with the Paediatric Nephrology Team from CKC National University Hospital Singapore every Friday morning.

There are not enough paediatric nephrologists to provide service in both district and outreach areas. Therefore, paediatric nephrology teams go to district hospitals every month to treat children with kidney disease, give CME for doctors and nurses, and talks to the public in outreach areas. Pediatricians at district hospitals can discuss renal cases with nephrology teams by telecommunication like Viber, Skype video call and telephone communication. There is a plan to start a training program for paediatric nephrologists at a paediatric renal center which is affiliated with the Medical University. In the meantime, fellows continue to be trained under the IPNA renal fellowship from Myanmar, NUH Singapore, and Paediatric Kidney Center AIMS New Delhi India.

Research

Attempts are being made to develop a research culture in paediatric nephrology. Pediatric nephrologists work under the main paediatric department and are affiliated with medical universities. Therefore, paediatric post graduate students have a chance to study pediatric kidney disease as their term paper/ dissertation joint with paediatric nephrology team. Good quality research is being produced. Currently the Myanmar Paediatric Nephrology Group has participated in the Study on Genetic Analysis in Children with Nephrotic Syndrome initiated by CKC NUH Singapore.

Challenges

Glomerulonephritis/ nephrotic syndrome, AKI due to infection and sepsis, lupus nephritis, and CAKUT remain the leading causes of morbidity and CKD. With the improvement of paediatric renal services, awareness of the community to utilize the health facilities has increased. However, lack of knowledge, missed opportunities to access health services, the unavailability of services, and other social factors make Myanmar lag other countries in developing world. The dialysis center is in the capital city which was far away from patients' hometown. The government provides funding and support, but it is insufficient to sustain the service. Much depends on the support of voluntary donors. Our Paediatric nephrologists and Senior pediatricians have set up "Yangon and Mandalay Children Hospital Kidney Foundation" in 2019 to support acute and chronic kidney disease and renal transplantation in Myanmar. The small number of trained paediatric nephrologists and dialysis/renal nurses with respect to children and adolescence population is one of the factors allowing good coverage. Moreover, the Myanmar Government has plans to provide dialysis facilities at each province, at the same time as training skilled nephrology teams in adult as well as paediatric services.

Conclusion

As a developing country, Myanmar paediatric renal services has been growing and developing since 2006. However, there are many areas of weakness and must improve in the long term. Firstly, capacity building should be as strong as other well-functioning centers in developed countries. Secondly, health awareness of community and social economic factors must be improved. Last, the Myanmar Paediatric Renal group should work together with other developed paediatric kidney centers in the region and internationally. The Myanmar Government and international organizations like ISN/IPNA should collaborate to improve the paediatric renal services in Myanmar.