



Nephrology Worldwide: the Vision, the Project, and the Mission

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Introduction

Nephrology as a specialty was established in the early decades of the twentieth century, after centuries of scattered scientific and clinical observations. Its true expansion, however, only occurred in the years following the Second World War due to the application of hemodialysis, peritoneal dialysis, and kidney transplantation, as well as the utilization of renal biopsy to identify different forms of nephropathies. The important contributions from the pharmaceutical and dialysis industries spurred new interest in innovative technology and novel therapies, allowing dissemination of information through international conferences and publications in scientific journals.

Nephrology was then recognized as an independent specialty by various universities and medical schools, with the creation of a specific core curriculum for physicians who wanted to focus their careers on the area of kidney disease. In the final decades of the last century, nephrologists concentrated their attention on the technological advances in dialysis and the new approach to diagnosis of clinical syndromes through histopathological techniques of electron microscopy and immunofluorescence. In the meantime, new drugs and protocols were developed for the treatment of specific kidney diseases, both primitive and secondary to systemic disease. Further developments have occurred in the area of kidney transplant, where studies on genetics together with clinical trials on new immunosuppressive drugs have allowed for the expansion of transplant programs while concurrently reducing the rate of organ rejection.

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When compared to the establishment of Nephrology as an organized specialty, kidney diseases have had a longer history, transcending the medical discipline. Furthermore, it also poses a global public health concern, affecting more than 750 million people in the world [1–3]. Currently, more than three million patients are estimated to be on renal replacement therapy worldwide.

The burden of kidney diseases varies significantly among countries. Socioeconomic, cultural, and political factors influence both the prevalence of kidney diseases and the provision of health care, leading to significant inequality in the disease burden, even in developed countries [4–6]. These disparities exist across the spectrum of kidney disease – ranging from preventive efforts to access to subspecialty health care and treatment of kidney failure with renal replacement therapy [1].

More than a medical discipline, field of study, and public health problem, nephrology (especially renal replacement therapy) is also an organized sector, or industry, directly and indirectly responsible for creating jobs for millions of people worldwide, often called stakeholders. With all this in mind, we designed the book “Nephrology Worldwide”. This introductory chapter goes beyond concepts and data and addresses the initiative behind the book, in all its spheres: the vision, the project, and the mission. In addition, we also curated a selection of nephrology highlights in the countries from local nephrologists’ view. Finally, we summarize our vision on education and future perspectives for nephrology.

Nephrology Worldwide

The Vision

The central idea that guided our vision for this book is quite simple: to answer the first question colleagues usually ask us when we meet at international conferences – “What is Nephrology like in your country?”. Prior to this project, we were already aware of the vast differences in

Nephrology among regions and countries in many aspects, such as the prevalence and incidence of kidney diseases, access to renal care, local guidelines, clinical management of kidney patients, nephrology practice, reimbursement, patients' and professionals' preferences, availability of renal replacement therapy, workforce in the nephrology setting, etc.

The response to this book's central question requires not only objective numbers and cold data, but also a critical analysis of the scenario and future perspectives for nephrology in the country. By the end of each chapter, readers should have a clear and general idea of the field in the country. We expect this book will help integrate nephrologists and stakeholders around the world and eliminate the still-standing frontiers of nephrology; this is our vision.

The Project

To fulfill our ultimate goal for "Nephrology Worldwide", we had to design a project, in all its stages, capable of providing the answers and information we were seeking. We also had to

conceive this book in such a way that it would have credibility among our peers and stakeholders. Therefore, our first challenge was selecting the leading authors, also called corresponding authors, and the countries to be included in this first edition.

One of the premises of the "Nephrology Worldwide" project was to include countries from all regions and continents, so the book would be legitimately international. Although 62 countries had initially agreed to participate, some authors were not able to deliver their chapters by the final deadline and thus were not included in the first edition. Ultimately, 51 countries are represented in this book, encompassing around 5.7 billion people (Fig. 1.1). In addition to our concern with geographic representation, the final selection included, among others, the most populated countries, as well as countries with the highest Growth Domestic Products (GDP) and Human Development Index (HDI).

The 10 most populated countries
22 of the 25 highest GDP
8 of the 10 highest HDI

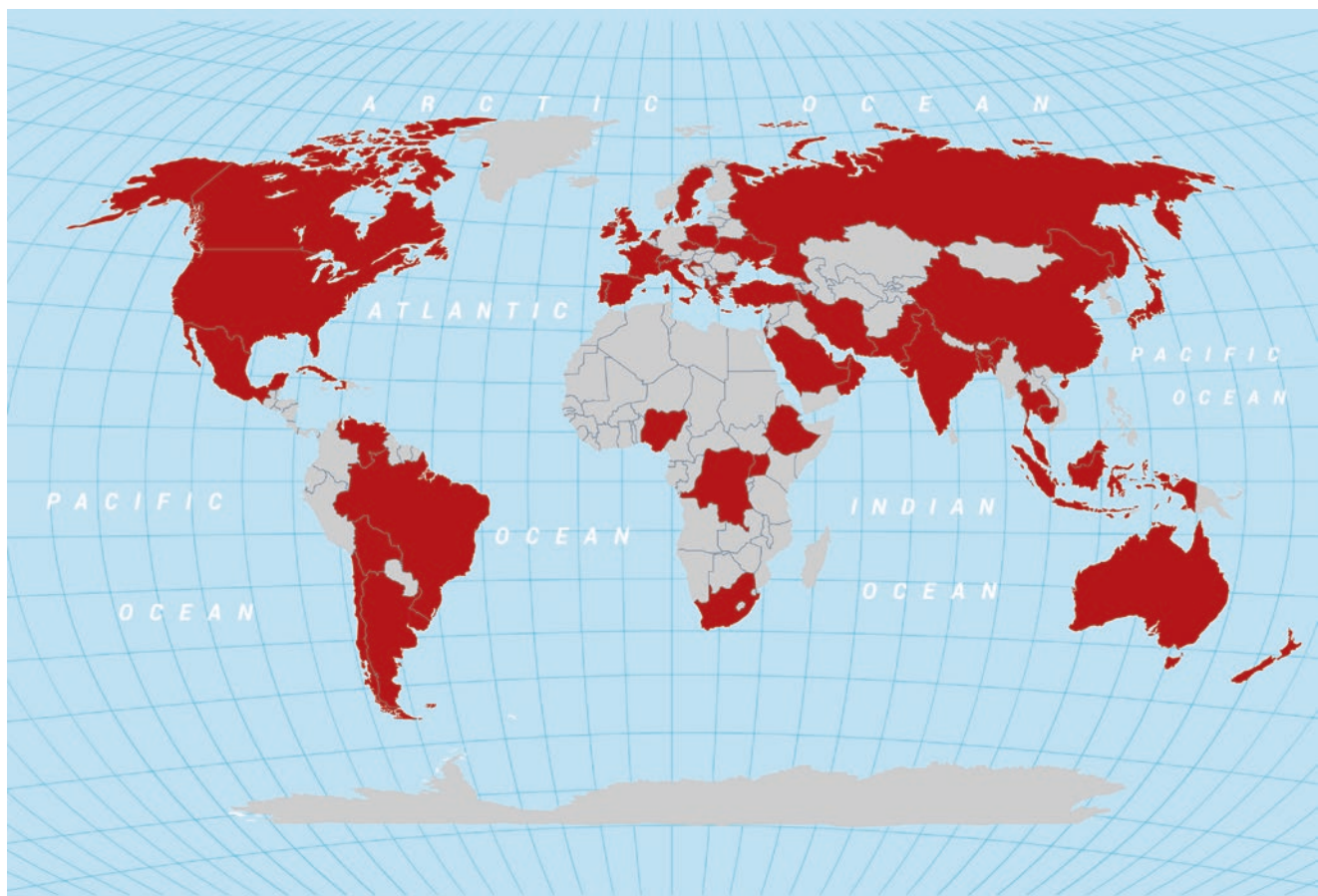


Fig. 1.1 Map highlighting the 51 countries included in "Nephrology Worldwide". About 5.7 billion people are represented, covering all continents and regions of the world

We carefully chose each leading author based on their background, nephrology practice, and leadership in the national nephrology society. To do so, we searched on the Internet and contacted colleagues around the world in order to hear their opinions. The leading authors were responsible for putting together a diverse team of co-authors, with different professional experiences, able to fully describe the field in their country. More than 300 authors, from 51 different nationalities, contributed to this book, which makes “Nephrology Worldwide” probably the most international book in nephrology.

Our second challenge in this project was to provide a chapter template and adequate guidelines to the selected authors. We did so in order to avoid missing key information and to create a didactic pattern throughout the book, with the goal of making the life of readers easier, since they would become familiar with the layout of chapters after reading just one. In these guidelines and template, we requested authors to provide a full overview of nephrology in the country, in their diverse fields and areas, such as kidney transplantation, maintenance hemodialysis, peritoneal dialysis, pediatric nephrology, acute kidney injury, and critical care nephrology. We stressed the importance of using the most up-to-date information and to consider including unpublished data, if relevant. We also asked the authors to address the history of nephrology in the country, reimbursement, nephrology practice, and job market, not only for physicians but also for nurses and the multidisciplinary team, when applicable. To make the book friendly and easier for readers, we deliver a kind reminder to the authors at the end of the guidelines: “be aware you will be presenting your country to a foreign audience, unfamiliar with the specificities of nephrology practices and healthcare in your country”.

The third phase of the project was the review of the manuscripts. In this stage, we meticulously reviewed the chapters and sent the authors a checklist asking to provide missing information and also anticipating questions that readers might have. Each chapter was first reviewed by two editors and the revised version was carefully looked over once more by one of the three editors. Our goal was to complete the revision in a timely fashion in order to avoid information and data becoming outdated. After concluding this stage, the manuscript was finally submitted to Springer Nature to finalize the editing process.

The Mission

Kidney diseases are indeed a global public health problem that we, as a nephrology community, must prioritize in the coming decades. Its prevalence will probably steadily rise in the next years due to the population aging and an increas-

ing prevalence of diseases such as hypertension and diabetes [7, 8]. To make an already concerning scenario worse, estimates have suggested that 2.3–7.1 million patients die per year due to an inability to access dialysis or sustain the treatment, which is called “the renal replacement therapy gap” [9–11]. We are now, more than ever, convinced that this a major issue, and the global nephrology community should shift its focus to this gap and the inequalities that contributed to it.

Editing this book was a transformative process for the editors in many ways, we hope readers will have a similar experience. It changed our view and perspective on the (Nephrology) World and it raised several important questions, not only medical, but also socioeconomic and political, that surround the field. Questions of a nature quite different than the one the book initially posed, now asking “Why?” in the place of “What?”. While we feel our original query has been responded, we finished this first edition with more questions than answers. More than that: although we feel we have finished the project, a book, we have only just started the “Nephrology Worldwide” mission.

Nephrology Worldwide Highlights

When this book was planned, it was agreed that each chapter would have a section entitled Highlights, in which authors could write about any special feature, story, history, project, or program specific to their country and considered worthy of sharing with the Nephrology community worldwide. Here, we address some of these highlights, most of them excerpts taken directly from the chapters. Please be aware you will find spoilers from the book in the following paragraphs.

History

The history of the local nephrology societies gives us a true perspective of how nephrology has developed around the world. It is not uncommon for local doctors to be sent abroad for nephrology training, often to faraway places for long periods of time, in order to come back home and propagate what was learned abroad. Each history includes many stories of real colleagues and events that contributed to the development of Nephrology in each one of the 51 countries represented in this first edition of this book. Schumlansky, Yu Voronoy, Richard Bright, Nils Alwall, Peter Kolff, Murray, Van Rood, Fred Boen, Belding Scribner, John Merrill, Jean Hamburger, Cimino-Brescia, Iversen & Claus Brunn, Giordano & Giovannetti, Moncrief & Popovich, Dimitris Oreopoulos, Priscila Kincaid-

Smith, Gianantonio, and many others – names that have contributed to the position where Nephrology stands today.

Diseases and the Kidney

This book will also provide an insight on different diseases and conditions, unknown to many, that pose a potential burden to acute kidney injury (AKI) and/or chronic kidney disease (CKD) and nephrologists around the world may face: Plasmodium malaria, dengue, HIV, traditional medicines – for example, *Callilepis laureola* (locally referred to as “impila”), potassium dichromate, Cape Aloe, high altitude-polycythemia, star fruit, snake bites, scorpion stings, fish gallbladder toxicity, cutaneous leishmaniasis, Nipah virus, leptospirosis, scrub typhus, melioidosis, use of poisonous substances (PPD, methanol, organo phosphorous compounds, paraquat, copper sulfate, rat killer), nephrotoxic drug exposure, etc.

In Bolivia, for example, more than four million people (38% of total population) currently live at high altitude (2500 meters above sea level); 8–10% of this population develops high altitude polycythemia. In a study, 40% of total screening polycythemia healthy subjects had some degree of proteinuria, so we estimate that roughly more than three hundred thousand peoples are at risk for kidney disease.

Another interesting story worth reading relates to Balkan endemic nephropathy, originally described in 1956. This is a unique familial form of interstitial nephritis, encountered with a high prevalence rate in Bulgaria, Serbia, Romania, Croatia, and Bosnia-Herzegovina, that leads to kidney failure.

Chronic Kidney Disease

CKD is a significant cause of morbidity and mortality globally, but in certain regions and countries communicable diseases impose an extra burden in the prevalence of CKD. Unfortunately, the reasons for this increased burden are most likely due to factors such as poverty, health care relegated as non-priority, and poor governance. For many of us, it may be a surprise to learn that serum creatinine test is not provided for hospitalized patients in many corners of the world. This book cites several concrete examples of the effect of socioeconomic disparities on the epidemiology of kidney diseases. CKD is mainly a disease of the young population in many developing countries, especially on the African continent; however, this is in sharp contrast with the older age groups seen in the developed world. Moreover, in most countries there are a great number of CKD patients diagnosed in later stages; over half of patients with CKD in

India seek medical attention only after they have developed advanced kidney failure, often requiring dialysis.

Also of note, the Chronic RENal Disease In Turkey – CREDIT Study – described a higher CKD prevalence than found in many industrialized western countries. Associations between CKD and several cardiovascular risk factors emphasize that CKD is a major public health problem and a major predictor of overall morbidity and mortality.

Nephrologists Worldwide

Shortages of nephrologists and renal nurses are not uncommon in several countries. Uganda, for example, has only ten nephrologists for a population of 45 million people, resulting in a ratio of one nephrologist per approximately 4.5 million people. Since the needs of these professionals are not met, emigration of nephrologists and nurses to other countries where they are better paid and which fully provide the working resources required is a common occurrence. This phenomenon is called “brain drain” and there may be countries where the number of emigrated nephrologists is higher than the number practicing in the country. Additionally, there is low availability or lack of local training in several African countries for aspiring professionals in the field. On the other hand, there are countries, like South Africa, contributing to the training of nephrologists from other countries on the continent through different Fellowship programs. This phenomenon is also observed on other continents, for example, some Cambodian nephrologists have been trained in France, Australia, Japan, and Thailand.

In Oman, most nephrologists are non-Omani and mostly from Egypt and Indian Subcontinent countries. Nephrology training for Omani clinicians was done entirely abroad in North America, Europe, and Australia. However, recently the Oman Medical Specialty Board approved the Nephrology fellowship program of at least 2 years following 4 years of Internal Medicine training. The Renal Dialysis Nurse Specialty program, launched in 1997, is one of the major accomplished nursing education programs in Oman with 344 nephrology nurses graduating from this program.

The vast majority of the 50 Irish Consultants accredited in Nephrology will have had some of their Nephrology Training outside of Ireland; some will have held Consultant, Attending, or other Faculty positions in other countries. These countries are typically, but not exclusively, English-speaking, such as England & Wales, Scotland, Canada, Australia, New Zealand, or the USA.

An important issue faced by many countries is the lack of appeal of the nephrology discipline, which ultimately may result in a shortage of nephrologists. A positive and different example from the global trend that needs to be highlighted comes from France, where Nephrology has become quite an

attractive discipline for trainees and interns. It has been ranked among the first medical specialties selected from interns over the last few years for its attractiveness. Diversity of activities (clinical nephrology, dialysis, transplantation, laboratory) is one of its positive aspects. The image of the discipline has been changed due to the University College of Nephrology Teachers (CUEN), dynamism of university nephrology departments and scientific societies and development, and creation of various clubs and platforms where trainees and young nephrologists can meet and exchange ideas. In addition to its attractiveness, recent changes in intern fellowship program rules also permitted a significant increase in the number of nephrology fellows in France. The outcomes from all of this are becoming clear and, due to the potential of this new, younger working force, it appears that nephrology needs will be covered adequately in the foreseeable future in France.

Dialysis

There are important gaps in CKD policies and renal replacement therapy availability among countries and regions. Renal replacement therapy is available to a very small number of end-stage renal disease (ESRD) patients in only a few urban centers in several countries, with rates inferior to 10 dialysis patients per million population (pmp) whereas countries like the USA and Japan have an overall prevalence of renal replacement therapy over 2000 pmp. Many other contrasts are expressed in the chapters, such as the fact that in Uganda there are only 52 HD machines in the entire country, 21 of which belong to the public sector, providing both acute and chronic HD.

In countries in development, such as the Democratic Republic of the Congo, the lack of financial resources forces patients either to reduce dialysis frequency, withdraw from dialysis, or use alternative treatment which results in higher mortality with a median survival of 17 months or 78 per 1000 patient-years. In contrast, the survival rate of dialysis patients in Japan has been excellent; the annual crude death rate was 10% in 2018, and it has hovered between 9% and 10% since 1983. Although the reasons for this have not been fully clarified, it is believed that could be related to the unique dialysis system and to the concept of chronic dialysis in Japan. Another curious fact regarding Japanese dialysis, which is also seen in other Asian countries, is the low dialysis blood flow rate (200–220 ml/min) – very different than that observed in many western countries (300–450 ml/min).

Besides blood flow rate, other dialysis practices such as dialysis frequency and average time per session are also addressed. In addition, regulatory issues are also discussed in “Nephrology Worldwide”; we would like to highlight dialyzer reuse, which may still be a matter of debate in some

Table 1.1 Countries where dialyzer reuse is performed and not performed (2019)

Reuse allowed	No reuse
Argentina	Albania
Bangladesh	Australia
Bolivia	Czech Republic
Brazil	Denmark
Cambodia	France
Canada (rare)	Greece
Chile	Iran
China (rare)	Israel
Cuba	Italy
India	Japan
Malaysia	Netherlands
Mexico	New Zealand
Nigeria	Poland
Oman	Portugal
Pakistan	Saudi Arabia
Russia (rare)	Singapore
South Africa (rare)	Spain
Switzerland (rare)	Sweden
Thailand	Turkey
USA (rare)	Ukraine
Uruguay	United Arab Emirates
	Venezuela

countries. While reuse is forbidden by law in several countries, it is widely used in others. There is yet another group of countries where reuse is permitted, but is rarely used, such as Canada, Switzerland, Russia, China, South Africa, and USA. In the latter, for example, reuse of dialyzers was once popular – in 1997, 82% of dialysis facilities participated in a reuse program – but currently it is rarely, if ever, used. Table 1.1 shows examples found in this book of countries where reuse is performed and countries where it is not performed as of 2019.

As a global trend, the number of patients on dialysis is steadily rising. In keeping with the increase in the incidence and prevalence of ESRD around the world, the burden of ESRD is on the rise in the Chinese Mainland. The number of ESRD patients receiving dialysis treatment has drastically increased from 261,877 in 2011 to 610,811 by the end of 2017.

This book also explores the differences between private and public healthcare for nephrology patients. In Portugal, considering the 2018 prevalent HD population, 91% were being treated in an outpatient dialysis unit run by the private sector, while 9% were dialyzed in public hospitals. In stark contrast to this scenario, in Cuba all of the HD centers are state-owned and operated.

Several different models of dialysis reimbursement exist globally and were discussed in the chapters. While in Brazil there is a huge difference in reimbursement for one HD session depending on the source of payment (the government or private health insurance), in Greece the reimbursement price

per HD session is almost equivalent for the public and the private sector, and the increasing number of private HD units does not increase the state expenses and health budget.

The medical workforce present in HD centers is also very different among countries. In Turkey, for example, most HD centers have general practitioners or internists who are continuously taking care of patients. These HD practitioners receive a special certificate following 3–6 months of education for HD practice. HD certificate education is given by the nephrology training centers in Turkey.

While peritoneal dialysis (PD) is not practiced in some countries due to the lack of financial resources, other countries have a PD-first program policy. For countries with an underrepresentation of PD in chronic renal replacement therapy provision, new models of renal services are being implemented. In some countries, PD patients are only followed in PD units integrated into nephrology departments in public hospitals.

When mentioning successful PD-first programs, Mexico is the first country that comes to mind. A contributing and decisive factor for its success was the 1985 earthquake in Mexico City, during which a large number of public HD facilities were damaged, thus requiring the use of PD on a larger scale. Following in Mexico's steps, other countries successfully applied the PD-first program. In 1985, PD-first policy was adopted by the Hospital Authority of Hong Kong, in which PD was reimbursed by the government as a first-line dialysis modality for patients with ESRD; Thailand and Indonesia were the latest to adopt it.

Finally, the last dialysis highlight comes from the Japanese PD program: the combination therapy, or hybrid therapy, with in-center HD. Out of 9445 PD patients in Japan, 1863 (19.7%) patients were under the combination therapy in 2018, with 1505 (16.6%) being treated with at least one HD session per week.

Renal Transplantation

The transplant project in many countries is faced with several challenges, the most important of which are very limited resources on budgeting and provision of health care facilities, the precarious continuity of supplies, and the underdeveloped infrastructure. The successful transplant project in Ethiopia, which was a result of a collaborative effort between a local Medical College and an American university, is an exemplary model that can be replicated in other developing countries.

Two well-established transplantation programs also deserve mention. Brazil has the largest publicly funded transplantation program in the world, with a fair organ allocation system and no social or cultural privileges. The numbers are expressive, but still far below the grow-

ing demands of the country. Spain is the country that should perhaps be looked to as the role model for renal transplantation. It is considered the renal replacement therapy of choice in Spain since it generally provides better quality of life and survival at a lower cost. Therefore, a large public policy effort is aimed at increasing renal transplantation rates and acceptance of donation by the population.

Nephrology Worldwide will also offer readers the possibility to understand the obstacles and opportunities faced when creating and/or improving the necessary legislation for development or enhancement of organ transplantation. The example of Croatia shows that development of surgical transplant techniques, long-term transplant tradition, and the existence of a national transplant organization are not, neither together nor individually, a guarantee for a successful transplant system if they are not accompanied by a set of appropriate legal, financial, and primarily organizational measures. It is interesting to note that kidney health and nephrology are of particular interest to the governments of some countries, such as in the United Arab Emirates, since the founder and first president of the country, Sheikh Zayed Al Nahyan, received a kidney transplant in 2000.

Home Dialysis

Regarding home dialysis, we would like to highlight three examples: New Zealand, Denmark, and Canada. New Zealand has one of the highest rates worldwide of home dialysis, with 1291 (47%) of the 2768 individuals on dialysis therapy. Of the patients on home dialysis, 34% are on home HD and the rest of them are on PD. In Denmark, there is also a high prevalence of home dialysis therapies (28% of dialysis patients), with 21% on PD and 7% on HD.

The proportion of Canadian patients treated with home dialysis modalities remains relatively high by international standards. However, it is much lower than it was in the 1980s and early 1990s when CAPD was being used in over 35% of prevalent patients. There has recently been an increase in home dialysis prevalence back up toward 25%, in part related to efforts by provincial renal agencies. This places Canada in the top 12 countries in the world for home dialysis use. About 20% of home dialysis in Canada is accounted for by home HD, less than is the case for Australia, New Zealand, and Denmark, but much more than in the USA and most of Europe.

Of note, the chapter on Australia, a country in which about 10% of the HD patients are under HD at home, provides a brief yet comprehensive description of their home HD program, addressing the history, epidemiology, selection of patients and training, equipment, barriers, and outcomes of home HD.

Health Care Services, Registries, and Programs

Examples of health care services and nephrology care are also reported in each chapter. For instance, Cuba has a unique health system that ensures universal and free coverage, with 56 nephrology centers distributed throughout the country offering specialized nephrology care and renal replacement therapy coverage. Similarly, in Uruguay, Nephrology has gradually developed, and yet has allowed for providing full, universal nephrology care to all inhabitants, both children and adults, across the nation.

National Registries are of utmost importance when targeting improvement in the different areas of activities and assuring a continuous quality control of the nephrology care in each country. Renal biopsy, glomerular diseases, CKD, renal transplantation, and dialysis registries (pediatric and adult), both national and regional, are also part of Nephrology Worldwide. Malaysia is one of many excellent examples. The Dialysis and Transplant Register was started in 1992, the first report of the Malaysian Dialysis and Transplant Registry was published in 1993, and it is still reporting today. The Malaysian Registry of Renal Biopsy started reporting in 2005 and the deceased donor kidney transplant waiting list linked to the Malaysian Organ Sharing System started in 1999. Data on renal replacement therapy are shared with the USRDS, and with the Global Observatory on Donation and Transplantation.

Exciting programs are being launched in several developing countries. Thailand, an endemic area of several tropical illnesses, has been gradually overshadowed by non-communicable diseases. The prevalence of pre-dialysis CKD in Thailand was greater than the global prevalence and this became a concerning issue. This could be linked to the upward trend of dialysis patients and centers, which resulted in catastrophic national health expenditure. In an attempt to overcome this burden, the Thai government released several campaigns and issued policies to slow down CKD progression. The model in CKD clinics is a multidisciplinary approach, implemented in all levels of public hospitals in order to improve health promotion and increase access of health care even in remote areas. The introduction of the Universal Health Coverage Scheme and the PD-First policy are laudable initiatives to narrow the gap between the wealthy and the poor in relation to access to health services. In order to avoid financial burden, any project aiming to decelerate CKD progression or providing economical renal replacement therapy with comparable outcomes to international standards is deemed a priority.

The Indonesian Society of Nephrology has developed short- and long-term programs in conjunction with the Ministry of Health including: unleashing the PD preferred program for the endorsement of CAPD; early detection and preventive program for CKD in the community and primary health care; and development of kidney transplantation in some tertiary hospitals.

Some of the success stories described in the book are summarized here. Nephrology in Albania has achieved great improvement in the twenty-first century. The possibility of treating every ESRD patient with renal replacement therapy became a reality in the last decade, and this is considered their greatest success. Academic nephrologists on the Chinese Mainland also play an increasingly important role in conducting global clinical trials that impact the development of global clinical practice guidelines.

In the 1980s, Poland had limited access to the modern methods of treatment of AKI and CKD, and only a limited number of patients with ESRD had access to renal replacement therapy. For many of our Polish colleagues, a trip to the western countries at that time was, in their own words, “like a journey to a different planet”. Thirty years later, however, the situation in Poland has changed dramatically and, nowadays, nephrology in Poland has developed almost to the level of many western European countries and the access to all types of renal replacement therapy is unlimited for those who need them.

On the concerning side, we must pay special attention to the Venezuelan chapter and the current sociopolitical landscape, which contrasts with its beautiful history and role in Latin American Nephrology. They finalize their chapter: *“Actions to retake a path towards stabilization or growth of the attention to kidney disease in all expressions have to be rethought within policies to rebuild the national health system; no simple or individual remedies seem possible at this time. But we are also certain that the country will at some point start retaking the route towards political stability, economic growth, and social development.”* The Nephrology Worldwide community should be ready to assist them however possible when this becomes a reality.

Acute Kidney Injury

There has been a reborn interest in acute renal failure, recently renamed acute kidney injury (AKI). The UK has a long history of recognizing and furthering the clinical management of AKI, dating back to the first descriptions of crush injury during the bombing of London in the Second World War. It was during the bombing of London in World War II that Eric Bywaters at the Hammersmith Hospital became interested in the histopathology of the AKI caused by crush injury. Due to military conflicts, nephrologists in Israel have also gained expertise in management of casualties with crush injuries and subsequent devastating AKI, hemodynamic, and electrolyte disturbances.

Since the Second World War and the first description of acute renal failure and Hemolytic Uremic Syndrome in 1962, extensive developments in renal replacement therapy as a means of treating AKI have occurred. However, the disparity in the access to basic prevention measures and these techni-

cal developments, when comparing developed and underdeveloped countries, is an important warning sign and rescue alert to the nephrology community worldwide. The predominant causes of AKI in many countries are still acute gastroenteritis (related to sub-optimal sanitation and water quality), inadvertent use of drugs, tropical infections, sepsis, poor obstetric care, and insufficient monitoring after major surgeries. In Bangladesh, for example, the incidence of AKI increases by 18–24% during monsoon season, secondary to an increase in new cases of acute gastroenteritis, dengue, leptospirosis, and bacillary dysentery.

Final Remarks on Nephrology Worldwide Highlights

Nephrology Worldwide will provide unique information on topics from kidney disease/renal replacement therapy and natural disasters – such as earthquakes (Chile, Iran, Turkey, Italy), monsoons – to the dialyzer crisis in Croatia. It will also discuss exciting projects like “Kidney in Health and Disease”, Green Nephrology, the Swiss Transplantation Cohort, the Swiss Kidney Stone Cohort, as well as interesting themes like “Fasting during the month of Ramadan and kidney disease”. Furthermore, the reader will learn about the Chernobyl tragedy and its impact on children born in the compromised zone after 1995, consanguinity rates in different countries, and genetic kidney diseases and congenital anomalies of the kidney and urinary tract.

It is our humble belief and firm objective that Nephrology Worldwide will fill a void within the nephrology community by allowing each and every country represented in this book to tell their history, stories, actions, and accomplishments, both past and present, hopefully reserving the future for new editions of this project with even more countries represented. Here all countries are equal and have the opportunity to tell everyone involved in Nephrology their realities, strengths, weaknesses, priorities, goals, and dreams.

Nephrology Education and the “Open Nephrology” Culture

Nephrology, like other disciplines, has been mostly separated from other specialties and disciplines for several reasons. The focus of postgraduate medical training has not typically been multidisciplinary or problem-oriented, but rather specialty-oriented, often leading to the development of an adversarial “them and us” mentality. Thus, specialists

were consulted for specialty-related problems or for the performance of procedures and tests with which they were familiar with and had the particular required skills. Such an approach was often deleterious to patient care because it led to fragmentation and conflicts. In addition, while some nephrologists endeavored to take a global view of the patient’s condition, their familiarity with intensive care technology, current management, and pathophysiology was often limited. As a consequence, the global perception of the patient was often out of touch with reality. This limited understanding of critical care medicine or, in several cases, the limited interest in considering the critically ill patient a target for innovation and special interest in nephrology then resulted in inadequate training and capacity to share decision-making and therapeutic strategies with the critical care colleagues. Such action, in turn, fueled the fire of antagonism rather than cooperation. The same process has occurred with cardiology in the area of hypertension and heart failure, urology in the area of kidney stones, rheumatology in the area of systemic diseases affecting the kidney and finally diabetology and science of nutrition. The clash of these “cultures” significantly impeded the development of a combined strategy in the management of patients with specific kidney problems, but at the same time combined syndromes where other organs and functions were involved. Other obstacles, such as financial incentives, competition in research, political strategies, and control of patient care, have further impeded the development of an “open nephrology” culture.

The vision of illuminated scientists and physicians belonging to the new generation allowed for the opening of nephrology as a specialty to other disciplines, favoring the development of a multidisciplinary culture. In this direction, scientific societies have tried to merge knowledge and information and, at the same time, scientific journals have started new policies to accept interdisciplinary papers. With this new wave, the era of cardionephrology began with a shared definition and classification of the cardiorenal syndromes. Critical care nephrology has become a new subspecialty with an enormous amount of publications. Currently, acute kidney injury represents one of the most interesting areas of common research from the pathophysiological mechanisms to the extracorporeal organ therapies and the world of regenerative medicine. Immunology and genetics are involved in the advanced research for immune-tolerance to permit safe and effective kidney transplantation. New drugs have been utilized or are under evaluation for onconeurology, hemolytic uremic syndromes, and glomerulonephritis.

Future Perspectives for Nephrology Worldwide

Overall, we can say that the future of nephrology will impact the future of the whole medical discipline. We think the future is *GREEN*. This is an acronym that describes the initials of the sciences that are likely to characterize the future of nephrology. *G for genetics*: patient genotyping will allow for the expansion of the application of precision medicine solutions in different kidney disorders in the future. *R for robotics*: the mechanical actuation of operations normally carried out by a caregiver will permit taking maximum advantage of bidirectional interactions between the patient and the dialysis equipment. *E for E-health and information communication technology*: remote monitoring as well as enhanced human intelligence by computers will provide the basis for specific diagnostic algorithms or research programs on big data that can be further improved by artificial intelligence networks. This will provide support in the decision-making process and will even provide the basis for automated feedback operations. *E for eco-compatibility*: water sparing technologies and home therapies with remote monitoring will contribute to save natural resources and will provide environment-friendly solutions. *N for nanosciences*: this interesting area of research will offer a new spectrum of biomaterials and will enable possible uses of nanofluids and therapeutic nanoparticles, drugs, and vaccines.

The GREEN approach to nephrology will provide new directions for investigators and physicians to achieve an equal distribution of care among individuals of various areas of the planet, cost reduction with possibility to expand the interventions to vast populations that today may be undertreated or segregated, early detection and resolution of problems, as in the case of virus dissemination and pandemics, improved treatment compliance and automatic feedback on results, reduction of patient's access to hospital center for technical and clinical complications, increased confidence of patients treated at home, with higher incidence and prevalence of home therapies, and consequent improvement in patient's quality of life.

We must work together to achieve a common pace of progress and advancement of science in different areas of the planet, concomitantly dealing with the global inequalities

and disparities in access to kidney health care worldwide. We are all part of a big family in this small world that must collectively strive to fulfill the “Nephrology Worldwide” mission.

Note: More information on the Nephrology Worldwide initiative can be found at <http://www.nephrologyworldwide.com>. Readers will find a friendly platform where they can send feedback, suggestions and also ‘apply’ to contribute as author or reviewer in future *Nephrology Worldwide* editions.

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