

The nephrology crystal ball: the medium-term future

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*The authors were Members of the ERA-EDTA Council in January 2019, the time when the survey was proposed and designed.

ABSTRACT

In January 2019, the ERA-EDTA surveyed nephrologists with questions on kidney care and kidney research designed to explore comprehension of the impact of alterations to organization of renal care and of advancements in technology and knowledge of kidney disease. Eight hundred and twenty-five ERA-EDTA members, ~13% of the whole ERA-EDTA membership, replied to an ad hoc questionnaire. More than half of the respondents argued that kidney centres will be increasingly owned by large dialysis providers, nearly a quarter of respondents felt that many medical aspects of dialysis will be increasingly overseen by non-nephrologists and a quarter (24%) also believed that the care and long-term follow-up of kidney transplant patients will be increasingly under the responsibility of transplant physicians caring for patients with any organ transplant. Nearly half of the participants (45%, $n = 367$) use fully electronic clinical files integrating the clinical ward, the outpatient clinics, the haemodialysis and peritoneal dialysis units, as well as transplantation. Smartphone-based self-management programmes for the care of chronic kidney disease (CKD) patients are scarcely applied (only 11% of surveyed nephrologists), but a substantial proportion of respondents (74%) are eager to know more about the potential usefulness of these apps. Finally, European nephrologists expressed a cautious optimism about the application of omic sciences to nephrology and on wearable and implantable kidneys, but their expectations for the medium term are limited.

Keywords: future, nephrology, omic, private dialysis, transplantation

Nephrology is a complex medical specialty, encompassing aspects of endocrinology, cardiology, immunology, oncology and neurology. Patients with kidney disease have the highest number of comorbidities among all medical specialties, highlighting the many facets to their care [1]. Changes in the ownership of kidney care and dialysis centres (public versus private), advancements in technology and computing, diagnosis and therapy generate new challenges but also new opportunities for nephrologists and researchers to optimize care of this heterogeneous patient group. How these adjustments are perceived by involved professionals is crucial for the continued evolution of nephrology.

Thus, in January 2019, the ERA-EDTA surveyed nephrologists with questions on kidney care and kidney research designed to explore comprehension of the impact of alterations to the organization of renal care and of advancements in technology, and knowledge of kidney disease.

Eight hundred and twenty-five ERA-EDTA members, ~13% of the whole ERA-EDTA membership, replied to an ad hoc questionnaire, and this sample was approximately representative of the whole ERA-EDTA membership as for age (participants to the survey: <30 years: 4%; 30–44 years: 34%; 45–54 years: 23%; 55–64 years: 24%; >65 years: 15%; ERA-EDTA members: <30 years: 3%; 30–44 years: 30%; 45–54 years: 23%;

55–64 years: 25%; >65 years: 19%) and gender (participants to the survey: males 64%; ERA-EDTA members: males 63%).

THE ORGANIZATION OF NEPHROLOGY

Worldwide, there are 40 000 dialysis centres that are either private or public. In 2016, 44% of European centres were private and the number of private dialysis centres is increasing in most European countries [2]. Some nephrologists in Europe consider the expansion of corporate dialysis to be a concern because dialysis therapy is often separated from other aspects of clinical nephrology, and the inevitable need for profit may reduce the quality of treatment, negatively impacting upon clinical outcomes [3, 4]. On the contrary, the composition and the tasks of the nephrology workforce are being re-engineered, and activities traditionally under the responsibility of nephrologists are now undertaken by non-nephrologists. Furthermore, renal transplantation is increasingly performed in transplant centres performing multiple types of organ transplant, from pancreas to heart and lung transplantation.

To explore the perceived impact of the reorganization of care within kidney centres over the next 10–20 years, we posed questions related to dialysis centres' ownership, the management of medical aspects of dialysis and the organization of renal transplantation. Figure 1 shows that more than half of respondents argued that kidney centres will be increasingly owned by large dialysis providers, and that the majority of nephrologists providing care to patients will be employees of these companies. Nearly a quarter of respondents felt that many medical aspects of dialysis will be increasingly overseen by non-nephrologists and that nephrologists will not necessarily be involved in the management of dialysis patients. The reasons behind this may be multiple and different among countries in Europe, but shortage of nephrologists in the future may be one component. Furthermore, a quarter (24%) also believed that the care and long-term follow-up of kidney transplant patients will be increasingly under the responsibility of transplant physicians caring for patients with any organ transplant. Within such centres, surgeons often take over the tasks from nephrologists and often have different views on the many cardiovascular risk factors patients express in the long-term. In addition, the majority of respondents expect an increasing role of private companies in the delivery of dialysis treatment, and ~20% believe that medical aspects of care will be transferred to other specialists and/or to other professionals. If acute and chronic care of patients after kidney transplantation and a number of medical aspects in dialysis facilities are separated from the original management provided by nephrologists, then the concept of integrated long-term care may vanish.

Education, knowledge and activities of nephrologists cover a broad range of kidney-related diseases and clinical conditions from acute kidney injury (AKI) to all forms of renal replacement therapy. Intensive care units independently manage short-term AKI patients and with increasing frequency, they also care for prolonged periods for patients with repeated AKI episodes. Sometimes patients are discharged with advanced CKD, demanding periodical consultation of nephrologists. At least in some regions and countries, nephrologists are not

universally involved in the acute care of these patients and the transition into follow-up is not maintained. The care is mainly or exclusively done by internists or by general practitioners. The in-hospital and follow-up outcomes of these patients without special care are worse [5]. Moreover, non-nephrologists are also increasingly involved in dialysis treatments, the management of severe hypertension, rare diseases affecting the kidney and the urinary tract, as well as the work-up after kidney transplantation. Figure 2 outlines the questions about organizational changes related to the expansion of other specialties into areas typically inherent to nephrology, which requires education, specialist training and knowledge. The majority of respondents expect that for all the activities listed above the involvement of nephrologists will increase, from the care of Stages G4 and G5 CKD patients (72%, $n = 592$) to the care of patients with resistant hypertension (40%, $n = 492$). However, a not insignificant proportion of respondents expects a reduction in the care of haemodialysis (21%, $n = 171$) and peritoneal dialysis (24%, $n = 199$) patients. Similarly, 17% ($n = 137$) expect reduced involvement of nephrologists in AKI and 24% ($n = 197$) a reduced participation both in acute care teams and in the management of resistant hypertension. Overall, nephrology is perceived as an expanding specialty, but around a quarter of respondents believe that some activities that are key to nephrology will be primarily managed outside this specialty.

THE IMPACT OF INFORMATICS ON CLINICAL PRACTICE

Electronic medical records (EMRs) increase the efficiency and the quality of the clinical practice by making clinical data available to whichever physician is involved in patient care [6]. Dedicated websites to engage patients with diabetes and congestive heart failure have been successfully established [7]. In the UK, renal patients are more engaged than patients of any other specialty in a website (Patient View [8]) where the individual patient test results, medicines, medical alerts, diagnostic information and personal records can be accessed from anywhere. Furthermore, various applications for mobile devices or personal computers or tablets are applied to facilitate communication with patients with other complex conditions like heart failure [9]. Websites like Patient View [8] are not widely available throughout Europe and even when available not all patients elect to engage. EMR is a significant technological advancement, but its use is still not universally applied or is applied in restricted contexts. Handwritten comments and progress transcripts are still common. Figure 3 details this aspect of the survey focusing on the use of EMR, the use of applications (apps) and the exchange of e-mails with patients. Surprisingly, nearly half of the participants (45%, $n = 367$) use fully electronic clinical files integrating the clinical ward, the outpatient clinics, the haemodialysis and peritoneal dialysis units, as well as transplantation. An additional 20% used an integrated EMR system excluding renal transplantation. Furthermore, a minor proportion of nephrologists use EMR restricted to outpatient clinics and dialysis treatments (12%, $n = 103$) or to dialysis treatments only (13%, $n = 109$). By considering options for extending and improving communication with patients, only a

Organization of dialysis and transplantation

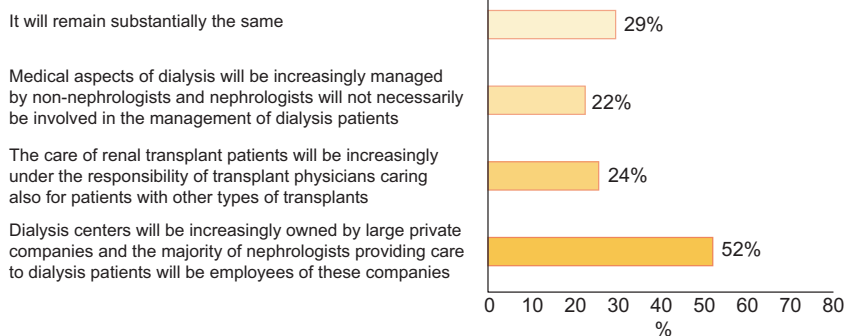


FIGURE 1: Questions related to the organization of dialysis and transplantation. The first option excludes the other three. Options two and three are non-mutually exclusive.

Nephrologist involvement

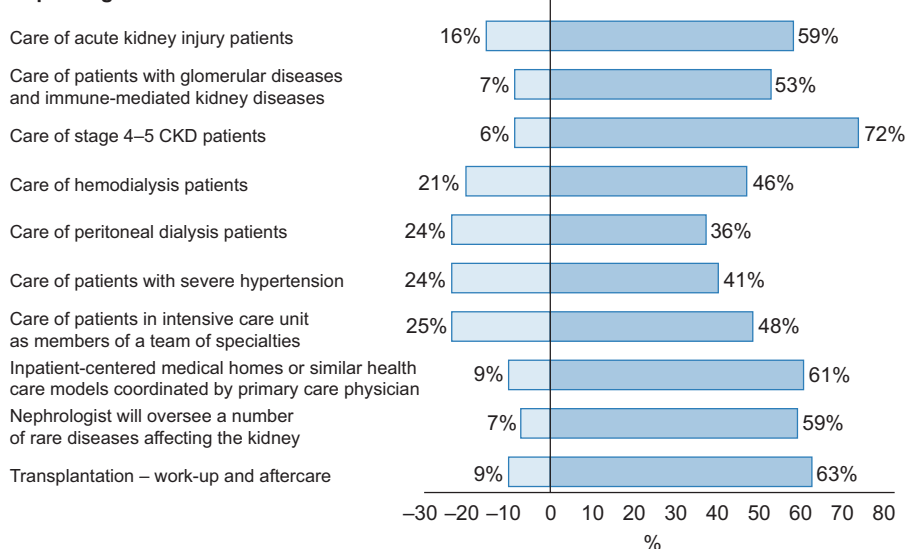


FIGURE 2: Nephrologists involvement in various areas of renal care. The proportion of responders that replied that they expect no change is the complement to 100% of the sum of those who said that the involvement of nephrologists will increase and of those who said that it will decrease.

fifth of nephrologists use EMR platforms including dedicated e-mail software for contact with patients, but nearly a third maintain informal e-mail contact with patients.

Smartphone-based self-management programmes for the care of CKD patients are scarcely applied (only 11% of surveyed nephrologists; Figure 4), but a substantial proportion of respondents (74%) are eager to know more about the potential usefulness of these apps.

OMIC SCIENCES, WEARABLE AND IMPLANTABLE AND CLONED KIDNEYS IN THE MEDIUM-TERM FUTURE

The omic sciences (genomics, transcriptomics, proteomics and metabolomics) and research on imaging techniques have progressed considerably over the last two decades. It is forecasted that the omic sciences will eventually result in the transition to a highly personalized form of medicine, i.e. ‘precision medicine’, the National Institutes of Health’s definition of this novel approach to patient care [10]. Diseases are described at

molecular level, and treatments are expected to target the key molecular alterations responsible for the same diseases [11]. While there are many perceived difficulties to overcome for the omic sciences to effectively inform the diagnosis and treatment of diseases and prevention strategies [12], it is without doubt that the ongoing research, for example into the creation of wearable and implantable kidneys, has significantly advanced our understanding and we are closer to these devices becoming a viable option for patients with end-stage kidney disease [13]. Cloned kidneys and kidney regeneration by organ scaffold recellularization are other fascinating areas in the early phases of study [14].

We explored the medium-term (10–20 years) expectation of nephrologists for these revolutionary innovations. Interestingly, the majority did not place a high value on precision medicine (Figure 5) or on new devices or cloned/transgenic kidneys. Overall, European nephrologists express a cautious optimism about the application of omic sciences to nephrology and on wearable and implantable kidneys, but their expectations for the medium term are limited. This is not surprising, since about

Use of electronic medical records

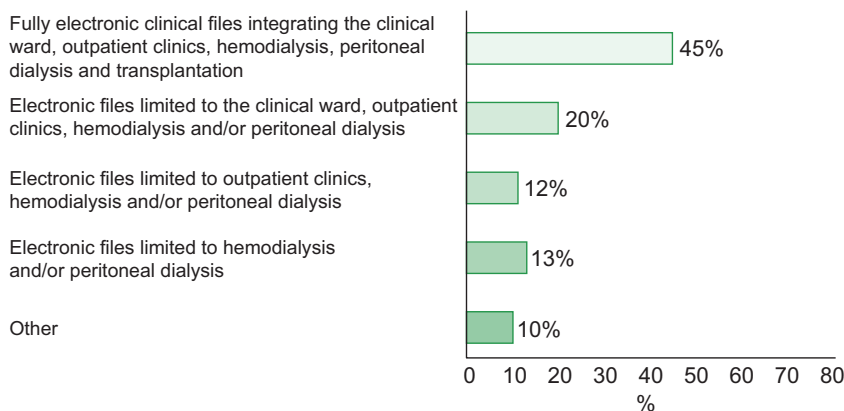
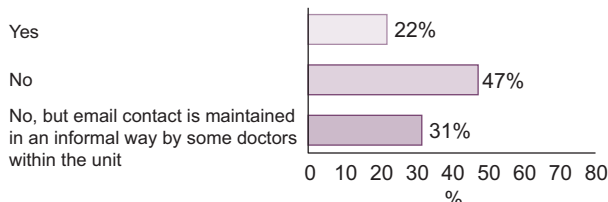


FIGURE 3: EMRs use among nephrologists.

Dedicated email contact with patients



Smartphone-based self-management programs for the care of CKD patients

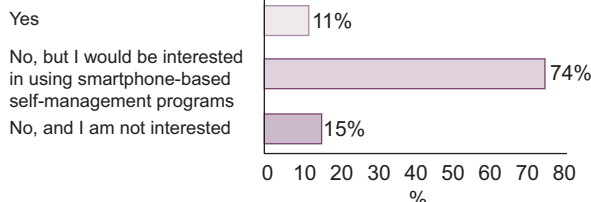
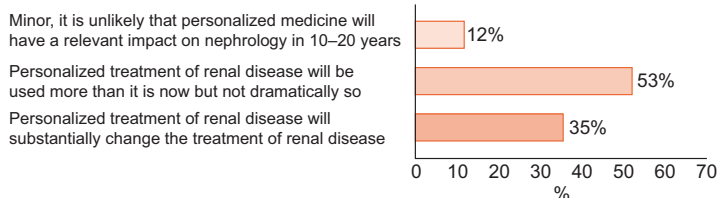


FIGURE 4: Dedicated e-mail contact with patients and smartphone-based self-management programmes for the care of CKD patients.

In 10–20 years which impact do you expect from personalized medicine to nephrology?



In 10–20 years bio-artificial kidneys and/or cloned or transgenic kidneys for transplantation

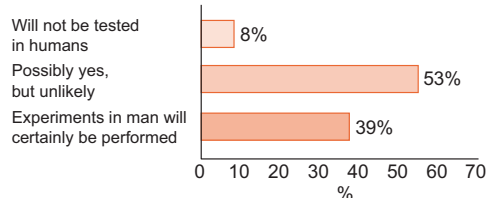


FIGURE 5: Impact of personalized medicine, bioartificial and transgenic/cloned kidneys in the medium term.

two-thirds of the respondents were beyond the mean age of their occupational lives, with considerable experience in the specialty. Too many approaches have been proposed during recent years, with minimal transfer into the clinic.

IMPLICATIONS

This survey has several implications for the ERA-EDTA. First, organization models of dialysis care should be openly discussed within our Association and should stimulate research, i.e. new clinical studies, which can be conducted within the European Community. Public and private centres have different strengths and weaknesses, and comparisons aimed at highlighting the impact of organizational differences on clinical outcomes may be useful for improving clinical care. Sparse analyses have been undertaken at national level [15]. Europe has unique opportunities to undertake studies involving several countries or making

comparisons among countries. This type of clinical study and comparison has the advantage to better understand whether findings in the USA [3, 4] apply also to Europe. Secondly, most kidney centres in Europe managed clinical data electronically. This is another opportunity to set up cohort studies and pragmatic clinical trials embedded in clinical practice [16], so-called ‘Real World Studies’. Few successful examples of electronic healthcare systems informing clinical research [17] and of trials embedded in clinical practice in dialysis centres [18] already exist. Multinational efforts for creating health informatics networks in Europe would rapidly return the investment, because the expanding field of dialysis takes away large shares from limited healthcare expenditure. This step forward will also advance research about the aetiology of kidney diseases, the development of personalized treatments and the monitoring of health risks and drug safety issues. Thirdly, spreading knowledge among nephrologists on apps that may improve patients’ care

can be fruitful (Figure 4). Research testing of apps—the usefulness, the effectiveness and the applicability in the setting of clinical trials— is a prerequisite. In this respect, the Scientific Program Committee of the 2020 ERA-EDTA congress decided to focus on the potential of apps in kidney care, and developers of apps will be invited to take part in this debate. The entire community of nephrologists is called to action in order to actively participate in shaping the future of their medical specialty.

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CONFLICT OF INTEREST STATEMENT

None declared.

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