Nephrology in Ireland

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Liam Plant

Area[1]	70,273 Km[2]
Population[2]	4,921,500 (2019)
Capital	Dublin
Three most populated Cities & Suburbs [3] Functional Urban Areas (FUA)[4]	Dublin 1,173,179 (FUA 1,830,000) Cork 208,669 (FUA 410,000) Limerick 94,192 (FUA 160,000)
Official languages	English, Irish (Gaelic)
Gross Domestic Product (GDP)[1]	382.49 billion current USD (2018)
GDP per capita [1]	78,750 current USD (2018)
Human Development Index (HDI)[5]	0.938 (4th position) (2017)
Official currency	Euro (€)
Total number of nephrologists[6]	50 Consultant practitioners (2019) ≈30 whole time equivalents to Nephrology
National society of nephrology	Irish Nephrology Society www.nephrology.ie
Incidence of End-Stage Renal Disease (ESRD)[7]	2013–88 pmp
Prevalence of End-Stage Renal Disease (ESRD)[7]	2018–957 pmp
Number of ESRD patients on dialysis (all modalities)[7]	2018–2124 *of whom* 16 are paediatric patients
Number of ESRD patients on Centre/Satellite-based haemodialysis/ haemodiafiltration[7]	2018–1873 *of whom* 10 are paediatric patients
Number of ESRD patients on Home-based haemodialysis or peritoneal dialysis (APD/CAPD) [7]	2018–251 *of whom* 6 are paediatric patients *of whom* 55 are on Home Haemodialysis
Number of ESRD patients with a functioning kidney transplant [7]	2018–2528 *of whom* 64 are paediatric patients
Number of renal transplants performed 2009–2018 [7,8]	1708 (167 in 2018) *of which* 338 were from Living Donors

[1]The World Bank Group. Accessed in October 2019. Available from: https://databank.worldbank.org/views/reports/reportwidget.aspx?Report_Name=CountryProfile&Id=b450fd57&tbar=y&dd=y&inf=n&zm=n&country=IRL

[2]Central Statistics Office. Accessed in October 2019. Available from: https://www.cso.ie/en/releasesandpublications/er/pme/populationandmigrationestimatesapril2019/

[3]Central Statistics Office. Accessed in October 2019. Available from: https://www.cso.ie/en/media/csoie/newsevents/documents/census-2016summaryresultspart1/Census2016SummaryPart1.pdf

[4]OECD Functional urban areas. Version: January 2019. Accessed in October 2019. Available from: http://www.oecd.org/cfe/regional-policy/Ireland.pdf

[5]United Nations Development Programme. Human Development Reports. Accessed in October 2019. Available from: http://hdr.undp.org/sites/default/files/2018_human_development_statistical_update.pdf

[6]Irish Nephrology Society (INS) Membership data. Personal communication from President of INS. October 2019.

[7]Health Service Executive National Renal Office. Programme Documents and Resources. Accessed in October 2019. Available from: https://www.hse.ie/eng/about/who/cspd/ncps/renal/resources/

[8]Organ Donation Transplant Ireland Annual Report 2018. Accessed in October 2019. Available from: https://www.hse.ie/eng/about/who/acute-hospitals-division/organ-donation-transplant-ireland/publications/organ-donation-and-transplant-annual-report-2018.pdf

Introduction to Health and Healthcare in Ireland

The Republic of Ireland is situated in northwestern Europe, occupying five-sixths of the island of Ireland. It shares a 490 km land border with Northern Ireland, which is one of the constituent nations of the United Kingdom of Great Britain and Northern Ireland. Ireland is a unitary parliamentary republic with a written constitution and is a member of the European Union (EU), the Council of Europe, the

The author declares that he has no conflict of interest.

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Organisation for Economic Cooperation and Development (OECD) and the United Nations (UN). The table summarises the main information of Ireland [1–8]. It is a small but prosperous state, ranking amongst the top 10 countries of the world for such indices as gross domestic product (GDP)/gross national income (GNI) per capita [1], human development index (HDI) [5] and human capital index (HCI) [9].

The overall responsibility for the creation and assessment of healthcare policy lies with the government, exercised through the Department of Health [10]. Healthcare reforms in 2005 led to the establishment of a single body – the Health Service Executive (HSE) – that is responsible for providing healthcare and social services to all of Ireland [10].

Following the presentation of the Sláintecare Report [11] by the Oireachtas Committee on the Future of Healthcare, and its acceptance by Government in May 2017, there began a process to implement the vision thereof. The Sláintecare vision is to achieve a universal single-tier health and social care system where everyone has equal access to services based on need, and not ability to pay. Over time, everyone will be entitled to a comprehensive range of primary, acute, and social care services. Sláintecare's aims are to improve patient and service user experience; improve clinician experience; lower costs; and achieve better outcomes.

Almost two thirds of the population (63.4%) reside in urban areas [12]. The median age of the population was 37.1 years in 2017 [12]. One in five (20.8%) was aged <15 years, and 13.9% were aged >64 years [12]. More than 10% (11.6%) (535,475) of the population were non-Irish nationals born in some 200 different countries [2]. Of these, two groups – those born in Poland and in the United Kingdom – accounted for over 225,000 persons [2].

In 2017, Ireland experienced a birth rate of 12.9/1000 population; a death rate of 9.6/1000 population; and a net migration rate of 4.0/1000 population [12]. Life expectancy at birth was 79.9 years for men and 83.6 years for women [12].

In 2017, health expenditure in Ireland amounted to €21.1 billion [13]. This equates to 7.2% of GDP or 11.7% of GNI [13]. Health expenditure had risen by 12.8% since 2012 [13]. The majority of health expenditure (73.3%) came from direct government funding; 14.4% was funded by health insurance and other private sources; 12.3% came from household out-of-pocket expenditure [13].

The largest proportion (37.2%) of expenditure occurred within hospitals, 18% in long-term residential facilities, and 20% was directed to ambulatory healthcare providers, predominantly general practitioners [13]. Curative and rehabilitative care services provided by hospitals amounted to over one-third of all spending, of which 63% was on in-patient services [13]. Expenditure on pharmaceuticals and other medical non-durables amounted to 13% of the total [13].

At 2.9 per thousand population, Ireland had a low number of practising doctors compared with an EU average of 3.6 in 2015 [14]. By contrast, there were 11.9 nurses per thousand population, compared with an EU average of 8.4 [14]. The number of hospital beds was half that of the EU average at 2.6 per 1000 population [14].

Entitlement to health services is primarily based on residency and means, rather than on payment of tax or pay-related social insurance [15]. Any person, regardless of nationality, who is accepted by the HSE as ordinarily resident in Ireland has eligibility to health services [15]. There are two types of eligibility: full eligibility for those qualified to hold a medical card and limited eligibility for those not qualified. Eligibility for a medical card is established on the basis of age and economic means. Those eligible have charge-free access to general practitioner (GP) services; prescribed drugs and medicines (subject to a modest prescribing charge); public hospital services; dental, optic and aural services; maternity and infant care services; and community and social services [15]. In 2017 [12], 33% of the population held a medical card. A further 10.2% held a doctor visit card allowing charge-free GP visits, but not charge-free prescription medications or exemption from hospital charges [12].

For those not so eligible, GP services incur out-of-pocket charges (which may qualify for taxation relief); prescription medications must be purchased (but charges are capped at €124 per month with a drugs payment scheme, of which 26.3% of the population avails [11]); public hospital outpatient consultations are charge-free, but inpatient care attracts a fee of €80 per day, subject to a maximum of €800 per year; self-referral to an emergency department may also incur a fee [12].

Less than half (42.8%) of the population hold some form of private health insurance, largely to cover inpatient charges, inpatient private consultant charges and some diagnostic test charges, in private hospitals or as private patients in public hospitals [12].

Some 5.5% of the population qualify for a long-term illness card, which allows charge-free access to medications appropriate to designated illnesses, such as diabetes mellitus [12]. Notably, renal diseases are not designated illnesses for this scheme.

Brief History of Nephrology in Ireland

The beginnings of nephrology as a separate clinical discipline in Ireland may be traced back to the late 1950s [16]. In keeping with new thinking and new technologies then cur-

rent in Europe with regard to the treatment of renal failure, a multidisciplinary team of doctors established the first Artificial Kidney – Renal Unit in the Charitable Infirmary, Jervis Street, Dublin. Those involved were Dr. Arthur P. Barry (Consultant Obstetrician and Gynaecologist), Dr. Gerard Doyle (Consultant Pathologist), Dr. William F. O'Dwyer (Senior Consultant Physician), Mr. Anthony Walsh (Consultant Urologist) and Dr. Joseph A. Woodcock (Consultant Anaesthetist), who became the first Medical Director of the Unit [16].

A Kolff twin-coil dialyzing unit [17] – the first of its kind in Ireland – was purchased. Staff visited the Artificial Kidney Unit at Leeds General Infirmary, where Dr. Frank Parsons had performed his first dialysis treatment on 30 September 1956. The first haemodialysis treatment (for AKI) in Dublin was performed in May 1958. There followed treatments for many patients, initially all with AKI adjudged to have a reasonable prospect of recovery and many with obstetric AKI [18, 19].

It was not until November 1964 that a programme for regular haemodialysis treatment for end-stage renal disease (ESRD) was established – lack of a sufficient number of machines to be allocated to long-term treatments (the unit possessed only two machines) and difficulty with maintaining long-term vascular access being notable barriers to this [16, 20]. The creation of native vessel arteriovenous fistulae from December 1966 represented a significant improvement in dialysis delivery [21].

In 1963, the first kidney transplant was performed in Ireland [22]. Subsequently a multidisciplinary team was established in the Charitable Infirmary, Jervis Street, to develop a renal transplantation programme [16]. The team was led by Mr. Anthony Walsh (who subsequently became President of EDTA in 1968) and Prof. W.A.L. Gowan, Consultant Vascular Surgeon at St. Laurence's Hospital. The first deceased donor renal transplant performed by this team was on 31 January 1964 [16]. Outcomes with the initial series of transplant patients were not encouraging [16], and relatively few transplants were done until 1967 when the programme recommenced. The first living donor renal transplant was performed in 1972 [16].

In 1970, a Home Haemodialysis (HHD) Programme was established [16]. An additional Nephrology Unit was established at St. Mary's Hospital Dublin in 1971 [16]. In the following year, new renal units were established in Cork and Galway, with another renal unit opening in the Meath Hospital in Dublin [16]. Continuous Ambulatory Peritoneal Dialysis (CAPD) commenced in Ireland in 1980 [44].

By 1988, there were 342 ESRD patients in Ireland treated by dialysis. Two hundred and fifty-seven patients were treated by centre-based haemodialysis (HD) in 1 of 8 renal units, 5 were treated by HHD, and 80 were treated by CAPD (by 4 of the renal units). Further expansion progressively developed over time until the current complement of 12 renal units within 7 hospital groups throughout the country was completed.

In 2002, the Minister for Health commissioned a Strategic Review of Renal Services. This multi-stakeholder review, chaired by Dr. Liam Plant, presented its report in 2006. This report has significantly influenced the subsequent strategic development of renal services. On World Kidney Day 2009, the HSE established a National Renal Office (NRO), embedded within the Clinical Strategy and Programmes Division, with responsibility for planning, coordinating and managing the strategic development of renal services across the country [23]. A key development has been the deployment of the Kidney Disease Clinical Patient Management System (KDCPMS), an electronic patient record system with a common platform, in all renal units in Ireland [24]. This system provides a framework for performance monitoring in renal care provision, comparative clinical audit, enhanced delivery and quality of care, strategic planning and effective resource utilization. It will form the base platform for an intended National Renal Registry.

Professional and Advocacy Organisations

The Irish Nephrology Society (INS) https://www.nephrology.ie – established in 1969 – is comprised of doctors and scientists working in the care of patients with kidney disease, either at a clinical or research level. Membership extends to all parts of the island, incorporating the Republic of Ireland and Northern Ireland. Its mission is to ensure high-quality care for patients with kidney disease by promoting the highest standard of medical practice. It has an integral role in the education and training of medical practitioners and advises the government, the public and the profession on healthcare issues relating to kidney disease. The INS hosts two National Scientific Meetings each year as well as funding Young Nephrologists' research projects and recognising excellence in research by the award of specific prizes and medals.

The Irish Nephrology Nurses Association (INNA) https://www.inna-ireland.com – established in 1999 – has a mission to promote a high standard of quality care for renal patients and their families through education and research. Since its formation the association is committed to being a voice for nephrology nurses nationally and actively engaging in strategic developments in the area of renal care. The Renal Interest Group of the Irish Nutrition and Dietetic Institute (RIG/INDI) http://www.irishkidneydiet.ie/about-us/ acts as a professional organisation and forum for those practising as renal dieticians.

The primary role of the Irish Kidney Association https://ika.ie – a charitable voluntary organisation established in 1978 – is to support patients and their families who are affected by end-stage kidney disease and are being treated either by dialysis or with a functioning kidney transplant. As the only organisation representing the views of Irish kidney patients, the IKA constantly lobbies on their behalf. The priority of the association is to ensure that the unmet needs of the renal patient and family are addressed by the statutory health and education system either directly from the mainstream or via an association like itself.

Renal Disease in Ireland

The population of Ireland in 2015 had a lower (13%) – but rapidly expanding – proportion of its population aged >64 years than the total EU population (18.9%) [14]. The vast majority of the population (92.4%) has a White ethnic background [2]. A higher proportion of the population was obese than the EU total – 18% on self-reported data and 23% based on actual measures of height and weight [14]. Between 1998 and 2015 the national prevalence of doctor-diagnosed diabetes mellitus increased from 2.8% to 5.2% [25]. This background profile has a significant influence on the incidence and prevalence of renal diseases in Ireland.

Chronic Kidney Disease and End-Stage Renal Disease

Ireland does not have a national CKD (non-RRT) registry [26]. Incidence and prevalence studies are limited [26].

A randomly selected population based cross-sectional study of 1098 adults aged 45 years and older was conducted using data from the 2007 Survey of Lifestyle, Attitudes and Nutrition (SLÁN) [27]. Estimated Glomerular Filtration Rate (eGFR) was calculated from a single IDMS aligned serum creatinine using the CKD-EPI and the MDRD equations, and albumin to creatinine ratio was based on a single random urine sample [27]. The estimated weighted prevalence [27] of CKD-EPI eGFR<60 mL/min/1.73m^2 was 11.6% (95% CI 9.0–14.2%), being 12.0% (9.0–14.2%) of men and 11.2% (7.3–15.2%) of women. Ten percent (10.1%) of all subjects had albuminuria and an eGFR≥60 mL/min/1.73 m^2. Thus, in Irish adults aged over 45 years, the overall weighted estimated prevalence of the National Kidney Foundation (NKF)-defined CKD was 21.3% (18.0–24.6%) [27]. Twelve percent (12.4%) of subjects aged 60 to 69 years had stage 3 CKD, as had 36.2% of those aged over 70 years [27].

Another study [28] identified 207,336 adult patients, aged 18 years and over, with serum creatinine measurements recorded from a provincial database between 2005 and 2011 in the Northwest of Ireland. eGFR rates were determined using the CKD-EPI equation from standardised creatinine measurements, and the presence of CKD was defined as eGFR <60 ml/min per 1.73 m^2. The prevalence of CKD was 11.8% (95% CI 11.3–12.1%): 10.9% in men (10.7–11.1%) and 12.6% in women (12.4–12.8%) [28]. This corresponded to a detection rate of 4.5% (5.1% in women and 3.9% in men) [28].

The systematic review and meta-analysis of Hill and colleagues [29] suggested a global mean (95% CI) CKD prevalence of five stages to be 13·4% (11·7–15·1%) and of stages 3–5 to be 10·6% (9·2–12·2%). CKD prevalence in Ireland seems to fall within this range.

Although a formal ESRD Registry is not in place, the National Renal Office [23] has been collecting annual incidence and prevalence data for more than a decade, more recently utilising the KDCPMS platform [24]. On 31 December 2018, some 4572 adults and 80 children were living with ESRD in Ireland [7]. This equates to a prevalence of 941 pmp for adults and 16 pmp for children [7]. Over half of adults (53%) had a functioning renal transplant, as had 80% of children [7]. In 2013 [7], the incidence of ESRD in adults was 405 cases, equating to 88 pmp. Incomplete reporting since then indicates an ESRD incident rate of 85–95 pmp.

In the 2013 USRDS Report on geographic variation in the incidence of treated ESRD pmp by country, Ireland (88 pmp) fell into the lowest of four incidence groupings at <120 pmp, falling within 10 pmp of such countries as Iceland, Finland, Switzerland and Scotland [30]. An ESRD prevalence then of 862 pmp fell within the lower mid-range of countries, falling within 50 pmp of such countries as Romania, Finland, Serbia, Argentina, Scotland, Turkey, Denmark, Norway and England and Wales [30].

There is a lack of systematic data as to the causes of CKD in Ireland mostly relating to methodological variation in disease allocation and data recording. In a recent study [31] utilising the KDCPMS platform, the authors felt that for 1196 haemodialysis patients, the underlying cause of ESRD was either unknown or missing in 28% of cases. Glomerulonephritis accounted for 19.2% of cases, diabetic nephropathy for 18.6% and cystic kidney disease for 6.4%. A single-centre study [32] of all 692 incident ESRD patients between 1 January 2002 and 13 December 2015 reported that 21% of cases were due to diabetic nephropathy, 17% to glomerulonephritis, 9% to polycystic kidney disease, 7% to pyelonephritis and 5% to vascular disease. 19% of cases were attributed to a miscellaneous group of diagnoses, and 19% were of unknown or unspecified causes.

Acute Kidney Injury

Ireland does not have a national acute kidney injury (AKI) registry. Incidence and outcome studies are limited.

A retrospective cohort study (2005–2014) used data from two regional laboratory information systems to determine incidence and severity rates of AKI [33]. The Kidney Disease: Improving Global Outcomes (KDIGO) criteria were used to identify all AKI events and subclassify each by severity grade. Incidence rates for men increased from 6.1% (95% CI 5.8–6.3%) per 100 patient-years to 13.2% (12.7–13.8%) during this period and from 5.0% (4.8–5.2%) to 10.1% (9.8–10.5%) for women [33]. Incidence rates for AKI increased in all locations of clinical supervision but much more for inpatient and emergency room settings compared with general practice [33].

At present, acute hospitals in Ireland are organised into six hospital groups covering specific geographic areas and a paediatric hospital group [34]. Within each hospital group is at least one renal unit, which acts as the regional resource for advice or direct management (sometimes following patient transfer) of cases of AKI. Not all hospitals have a renal unit on campus; some ICU units in specific hospitals have the capacity to deliver continuous renal replacement therapies; the largest (Model 4) hospitals typically have the capacity to deliver acute renal replacement therapies, either as acute haemodialysis or as continuous venovenous haemo(dia)filtration.

Glomerulopathies

Ireland does not have a national glomerulonephritis (GN) registry. Incidence and outcome studies are limited. Ireland did not participate in the International Kidney Biopsy Survey [35]. A single-centre retrospective study has been reported [36]; 1372 native renal biopsies were performed between 2004 and 2008. Of these, 236 (17%) were performed in patients aged >64 years. The commonest indications for biopsy in those aged >64 years were AKI (32%) and nephrotic syndrome (25%). Obviously, a mix of histological features was encountered, depending on presentation. The commonest glomerular conditions reported in this series in total were pauci-immune GN (17.4%); membranous GN (8.9%); IgA GN (7.6%); minimal change disease (4.2%); and post-infectious GN (3.4%) [36]. It is probable that a different spread would be detected in younger patients and depending on presentation.

Renal Disease in the Paediatric Population in Ireland

The Irish Paediatric Nephrology Services have evolved over the last 30 years. Specialist Paediatric Nephrology Services are provided on two campuses in Dublin, with a complement of six consultant paediatric nephrologists. The service will shortly move to the National Children's Hospital site when it is commissioned. At present 750 new patients are seen per annum, with 2500 review appointments also provided [37]. Each year 8 children develop ESRD; 15–25 are waiting for a kidney transplant; 25 develop significant haemolytic uraemic syndrome; and 200 have nephrotic syndrome [37]. Every year 1000 Irish children are born with some kind of congenital abnormality of the kidney or urinary tract [37].

About 60 children are under follow-up with a functioning kidney transplant [7, 37]. Structured adolescent to adult transition clinics are available in Dublin and Cork. In 2018 an outreach paediatric nephrology clinic was established in Cork. The future development of Paediatric Nephrology Services is incorporated into the HSE National Clinical Programme for Paediatrics and Neonatology Model of Care [37].

There has been considerable clinical and research interest in hereditary renal diseases in Ireland [38–40].

Renal Replacement Therapy for ESRD in Ireland

All modalities of renal replacement therapies (RRT) are available in Ireland. Although some patients may elect to have private outpatient/inpatient consultations with a nephrologist, the bulk of costs, particularly the direct costs of dialysis modalities, is borne by the State. All adult ESRD patients are under the clinical governance of 1 of the 11 HSE adult renal units. All paediatric ESRD patients are under the clinical governance of the paediatric renal unit.

A formal ESRD Registry is not yet in place, but the National Renal Office [23] has been collecting annual incidence and prevalence data for more than a decade, more recently utilising the KDCPMS platform [24]. On 31 December 2018, some 4572 adults and 80 children were living with ESRD in Ireland [7]. This equates to a prevalence of 941 pmp for adults and 16 pmp for children [7]. 54% of adults had a functioning renal transplant, as had 80% of children [7].

If one focuses on RRT modalities in adults, it has been the case that, at least for the last 15 years, the majority of patients alive with ESRD each year have had a functioning transplant [7]. Between 2007 and 2017 there has been a 41% (n = 1300) increase in the number of adults with ESRD [7]. In that interval, the increase in those treated by dialysis has been 35% (n = 535) and by transplantation 47% (n = 765).

Data on patient survival from entry into ESRD is available from a single centre [32]. Six hundred and ninety-two patients entered ESRD between 1 January 2002 and 31 December 2015. If surviving for 90 days, 95% of those aged <65 years survived for 1 year and 77% for 5 years; 89% of

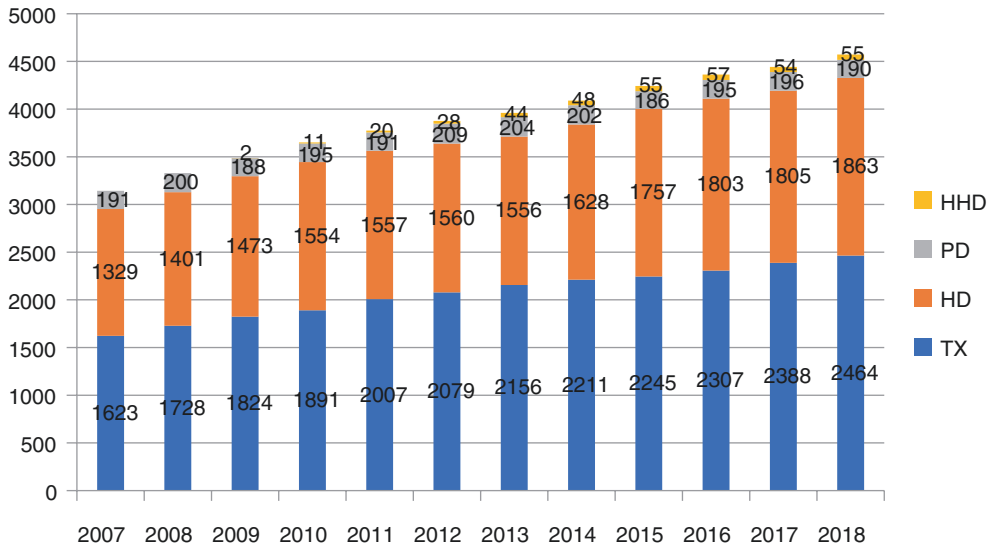

Fig. 42.1 Increase in number of adults with ESRD 2007–2018, by modality. (HHD home haemodialysis, PD peritoneal dialysis, HD centre-based haemodialysis, TX renal transplant)

those aged >64 years survived for 1 year and 47% for 5 years [32]. As would be expected, there was a considerable survival advantage to the 30% of these who received a renal transplant [32].

As illustrated in Fig. 42.1, 54% of adults with ESRD have a functioning transplant, 41% are treated by centre-based HD and 5% by a home-based modality, either home haemodialysis (HHD) or peritoneal dialysis (PD). This percent distribution in types of RRT modalities used is very similar to that in Scotland, England and Wales [41]. The National Renal Office has set a target that 60% of ESRD patients should ideally be treated with a functioning transplant and that of those treated by dialysis, at least 20% should be treated in the home setting, either by HHD or PD. These targets are occasionally attained in individual renal units but have not yet done so consistently on a national basis [7]. As in other jurisdictions, there are increasing attributable economic and social costs between home-based, satellite centre-based and hospital centre-based therapies.

Ireland does not yet have a model to commission RRT treatments, nor an activity-based funding stream for specific therapies. Each hospital group bears the expenditure cost of RRT within its core budget; additional funding from central HSE resources is allocated based on ongoing evaluation of total activity by the NRO [7]. For a minority of patients, health insurance reimburses consultant fees for private consultations in supervising dialysis patients, but not for consumables, equipment or training – the costs of which are reimbursed from public funds. The costs per treatment of HD treatments within contracted commercial units are reimbursed by the hospital group under whose clinical governance the patient falls [7].

Centre-Based and Satellite Centre-Based Haemodialysis (HD)

Centre-based HD (or, for a significant proportion, haemodiafiltration –HDF) is the commonest modality of dialysis delivered [7]. Not all units utilise haemodiafiltration, and the proportion varies within those that do, largely based upon the clinical judgement of the staff within the units. There is one national paediatric HD centre at the Children's University Hospital, Temple Street, Dublin. The 11 adult renal units within the 6 hospital groups supervise 22 separate HD centres. Eleven of these are directly provided on major hospital campuses; three are directly provided satellite HD centres on smaller hospital campuses; and eight are contracted satellite HD centres, staffed and provided by commercial dialysis providers (but with the parent HSE renal unit retaining clinical governance) [7]. Contracts for dialysis equipment and consumables are awarded by competitive tender within hospital groups; the provision of contracted HD centres is also awarded by competitive tender. All HD centres now host/interact with the KDCPMS [24]. Strategic development of HD services as a national integrated network is coordinated by the NRO [7].

HD centres vary in size from 10 patients or less (the paediatric HD centre) to 150–160 patients (Cork University Hospital and Beaumont Hospital Dublin) [7]. Three other HD centres treat >100 patients, but the typical HD centre caters for 60–90 patients [7]. The location of new HD centres will be decided based on the need to reduce patient travel time and avoid overcrowding in existing HD centres. In 2012, 50% of patients lived >29 km from the HD centre where they were treated [7]. Patient transport to/from HD centres is widely provided but with differences in organisation and eligibility from region to region [7].

In 2017, 29% of patients treated by centre-based HD were treated in contracted satellite HD centres (amounting to 25% of all dialysis patients and 12% of all ESRD patients) [7]. HD treatments for AKI are not delivered in these centres, and patients who are unwell will typically have the location of their treatment transferred to the parent renal unit.

Both centre-based HD units and contracted satellite HD units are predominantly staffed by registered general nurses, with smaller numbers of healthcare assistants. Dialysis technicians are not a feature in Ireland, as opposed to dialysis biotechnicians who work to introduce and maintain dialysis and other equipment. Typically the ratio of dialysis nurses to patients will vary from 1:3 to 1:4 during treatment delivery, with additional shift leaders, clinical nurse managers and other educational/administrative staff. Renal dieticians are attached to all renal units, but with a low dietician to patient ratio. Dedicated renal psychologists, renal pharmacists and renal social workers are very uncommon in Irish HD units – such services are accessed from generic resources by patients.

The vast majority of patients are treated thrice weekly. Dialysers are not reused in Ireland. Difficulties in establishing native AV access [31], and mitigating the infective risk of tunnelled HD access [42], remain an ongoing challenge. There is considerable variation (27–57%) in the proportion of those using native AV access across centres [31]. Most HD centres operate at or close to capacity, and this has implications if there are regional surges in new patients; it has also restricted easy access to holiday HD sessions both for Irish and for international patients [7].

The prevalence of blood-borne virus infections (HBV, HCV, HIV) is very low in Irish HD units (<3% of patients), but facilities for isolation are found in all units, and a standardised national policy to minimise the risk of transmission is in practice [7]. Patients infected with hepatitis C are eligible for antiviral therapies with a view to its eradication.

Home Haemodialysis (HHD)

In Ireland, HHD and peritoneal dialysis (PD) are viewed as complementary renal home therapies. Equipment, training and protocols have a uniform structure throughout the country. There is a national competitive contract for equipment and consumables, and the six renal units providing training in HHD are linked via a National Renal Home Therapies Programme by the NRO [7].

HHD was initially provided in Ireland in 1970. Having initially been a very significant modality, it declined with the development of a wider network of regional HD centres and CAPD. A national programme was reinstituted in 2009 [43]. Analysis of the first 100 patients trained indicated that, during the period of follow-up, 29% were transplanted, 9% died and only 7% reverted to centre-based HD [43]. Twenty percent (20%) of patients were treated by nocturnal HHD (NHHD). This pattern has continued, with transplantation being the principle reason for modality change. In 2018, six renal units supervised a total of 55 HHD patients [7]. The two largest renal units in Dublin and Cork accounted for 64% of this total.

Peritoneal Dialysis (PD)

CAPD was first delivered in Ireland in 1980 [44]. Training in both CAPD and automated PD (APD) is provided by the paediatric renal unit and eight of the adult renal units [7]. The proportion treated by APD varies, depending on patient choice and clinical considerations – typically about two thirds of all patients utilise APD. The proportion of new ESRD patients whose first modality of dialysis was PD between 2008 and 2013 was 14% [7]. In 2017, 10% of all prevalent ESRD dialysis patients were treated by PD [7], although the proportion varied considerably between hospital groups. As a proportion, this has remained relatively constant over the last decade [7], renal transplantation being amongst the commonest reasons for modality switch.

Reported outcomes [45] are similar to those reported from comparable health systems. Peritonitis rates are low. Both percutaneous and laparoscopic surgical catheter placement techniques are in use [46].

Renal Transplantation

Renal transplantation has been performed in Ireland since the early 1960s [16, 22, 47, 48]. In that period over 4500 renal transplant procedures have been performed, and the National Renal Transplant Programme is now located in Beaumont Hospital, Dublin [47, 49]. Since 2003, the majority of paediatric kidney transplants have been performed in the Children's University Hospital, Temple Street, Dublin [47]. Having been in abeyance for some years, the National Living Donor Renal Transplant Programme was re-established in 2005 [47].

In the 5 years between 2014 and 2018, 632 kidney transplants from deceased donors were performed (including 15 simultaneous pancreas-kidney transplants), as were 240 (27.5% of the total) from living donors – 26 of these were organs transplanted within the context of a Paired Kidney Exchange Programme with the United Kingdom or desensitised in the UK [8]. Thus, there has been an average of 174 kidney transplants per annum in that interval [8]. This is illustrated in Fig. 42.2.

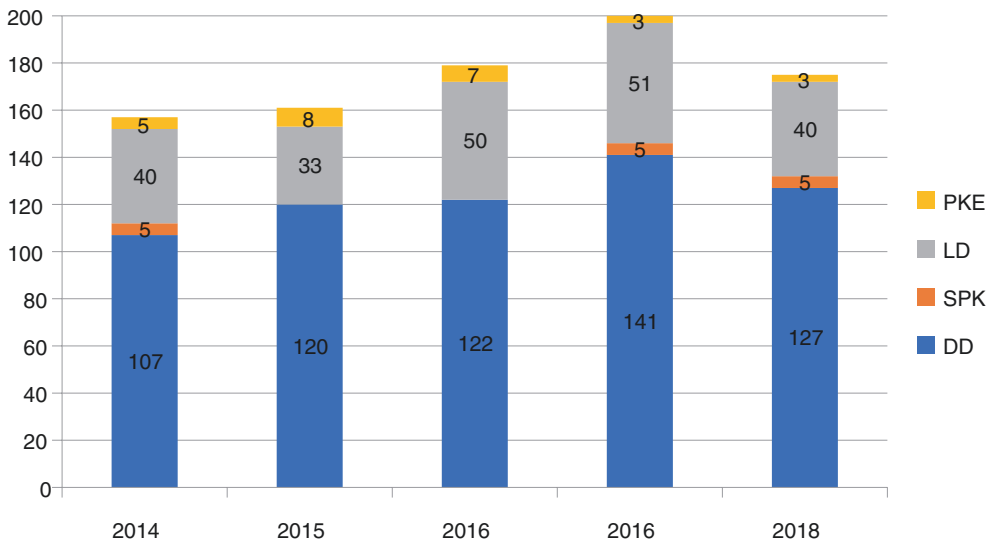

Fig. 42.2 Renal transplants by type 2014–2018. (PKE Paired Kidney Exchange/ Desensitised in the United Kingdom, LD living donor, SPKT simultaneous pancreas-kidney transplant, DD deceased donor)

The Pancreas-Kidney Transplant Programme, previously co-located with the National Kidney Transplant Programme in Beaumont Hospital, has, since 2017, co-located with the National Liver Transplant Programme on another campus in Dublin.

Organ Donation and Transplant Ireland (ODTI) has been delegated the regulator functions assigned to the HSE in the Statutory Instrument (SI) 325 (2012), European Union (Quality and Safety of Human Organs Intended for Transplantation) Regulations 2012 [50]. Since March 2019, the Department of Health has introduced a new policy on the reimbursement of the expenses incurred by living kidney donors [51].

Currently there is no legislation relating to organ donation in Ireland [8]. It has historically functioned on the basis of voluntarism and clinical interest in organ donation [8]. A new Human Tissue Bill is anticipated, which will address, amongst other issues, the establishment of a "soft" opt-out system for deceased donor kidney procedures [8].

In the period 2014–2018, deceased organ donation came from an average of 84.5 persons per annum [8]. It is hoped that with more widespread acceptance of organs from older donors or from those with cardiac death, and with the infrastructural changes introduced by ODTI and the proposed legislative changes in the Human Tissue Bill, the numbers of deceased donors will pass above 20 pmp to a target of 26 pmp [8].

More than half (54%) of adults with ESRD in Ireland have a functioning renal transplant, a rate of just over 500 pmp [7]. This relatively high proportion reflects a relatively high organ donation rate, with a relatively low prevalence of ESRD, and good long-term transplant survival [7, 8, 48]. Between 2012 and 2016, 1-year allograft survival was 97% for deceased donor recipients and 94% for living donor recipients [8]. Ninety-eight percent (98%) of deceased donor recipients and 100% of living donor recipients were alive at 1 year [8]. Five-year allograft survival was 86% for deceased donor recipients and 89% for living donor recipients, with patient survival rates of 88% and 97%, respectively [8]. A retrospective study of 3260 transplant recipients from 1971 to 2015 indicated that 15-year allograft survival had improved from 10% for those transplanted in 1971–1975 to 45% for those transplanted between 1996 and 2000 [48].

All adult kidney transplant procedures are performed in the National Kidney Transplant Service at Beaumont Hospital, Dublin [49]; all paediatric kidney transplant procedures are performed at the Children's University Hospital, Temple Street, Dublin; all pancreas-kidney transplants are performed in St. Vincent's University Hospital, Dublin; a small number of procedures are performed in the United Kingdom as part of the Paired Kidney Exchange Programme [8]. Once stabilised, long-term follow-up for the majority (66%) of recipients is delivered by the referring renal unit [7].

In 2018, the median waiting time for a first kidney transplant was 22 months and 11 months for those who received a living donor transplant [8]. At the end of 2018, some 429 patients were on the waiting list; 167 transplants were performed during the year, and 178 new patients activated on the list [8]. This compares with a waiting list of 551 patients at the end of 2016 [8]. 156 potential living donors (for 103 potential recipients) initiated assessment, with 85 progressing to the 1-day assessment phase, and 40 living transplant procedures were performed during the year [8]. The immunosuppression protocols for patients with standard immunological risk incorporate induction with IL2ra agents, followed by long-term tacrolimus and mycophenolate mofetil maintenance therapy. Steroid withdrawal is practised in fewer than half of patients.

As in other countries, research into, and surveillance of, complications of transplantation is ongoing. In a study of 3346 Irish solid organ transplant recipients (71.2% renal transplants), the commonest cancers were squamous cell skin cancer with SIR (95% CI) 20.05 (17.97–22.31), basal cell skin cancer 7.16 (6.43–7.96), non-Hodgkin lymphoma 6.23 (4.26–8.59) and renal cell carcinoma 3.36 (1.96–5.38) [52]. New-onset diabetes after transplant (NODAT) was observed in 10.5% of patients within the first 5 years post-engraftment [53].

The survival of patients successfully transplanted (annual death rate 1.2 per 100 patient years at risk) is considerably improved (after a survival equilibrium time of 1-year post-engraftment) compared with waiting-list patients (2.4) and non-listed patients on dialysis (16.5) [54].

Critical Care Nephrology

The nephrology services in Ireland work closely with colleagues in critical care. Many of the intensive care units (ICUs) are equipped, staffed and trained to deliver renal replacement therapy for patients with AKI and multi-organ failure. The Model of Care for Adult Critical Care of the National Clinical Programme for Critical Care identifies the need for access to continuous venovenous haemofiltration (CVVH) for level 3 ICUs and Model 4 regional and supra-regional hospitals [55].

In a 3-year retrospective single-centre study of 450 patients treated by CVVH in a Model 4 hospital, mortality in ICU was 38%, in hospital was 47%, and at 1-year was 54%. Three hundred and ninety patients had AKI, whilst 60 (13%) had pre-existing ESRD [56]. 6% of those with AKI aged <75 years who survived to discharge were RRT-dependent, as were 8.6% of those aged >74 years [56].

Nephrology Practice in Ireland

Non-ESRD CKD care is predominantly supervised by general practitioners (GPs). In patients with identified glomerular diseases, with heavy proteinuria, with rapidly declining GFR, with hereditary nephropathies or with low clearance CKD, there is shared management with renal unit outpatient services. As complexity increases, or when patients transition to ESRD, the renal unit staff have a progressively increasing role in the long-term care pathway delivery. Other disciplines commonly participating will be, amongst others, diabetologists, cardiologists, vascular surgeons and urologists. Typically, the supervising renal unit will have a significant input into the care pathway for any other medical condition which such patients may develop (especially for those with an ESKD need) in partnership with appropriate other specialties.

Guidelines for GPs are available from the Irish College of General Practitioners [57]. Guidelines for patients are available from the HSE [58] and from the Irish Kidney Association (IKA) [59].

Management of AKI is predominantly by the in-patient medical/surgical team supervising the patient. As complexity and/or severity of AKI increases, nephrologists and/or intensive care staff will play an increasing role. Although not formally endorsed, there is widespread adherence to the recommendations of the KDIGO Clinical Practice Guideline for Acute Kidney Injury [60].

There are about 50 consultants in Ireland accredited in nephrology and appointed to clinical and/or academic posts in which at least some of their practice is in nephrology [6]. Twenty one (42%) are female [6]. The overwhelming majority are employed in the public sector, albeit with varying entitlement to private practice [6]. Many also contribute to undifferentiated general internal medicine activities; many have substantial research, teaching, administrative or leadership appointments; as a consequence of which, there are probably no more than 30 whole time equivalent (WTE) consultant sessions devoted to nephrology in Ireland – much lower than in many other countries [6, 26].

The vast majority of these consultants 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 and Wales, Scotland, Canada, Australia, New Zealand or the United States [6].

Since 1999, Ireland has had a Higher Specialist Training in Nephrology Scheme, under the governance of the Irish Committee on Higher Medical Training [61]. Many of the alumni of this scheme have progressed to whole-time consultant appointments in Ireland, and it remains a highly desired training scheme with a very high calibre of applicant. The tradition of spending at least some time training abroad remains.

Entry to this scheme requires completion of general professional training and successful completion of the examinations needed to allow membership of the Royal College of Physicians of Ireland [61]. The duration of training is for a minimum of 5 years – 2 spent in nephrology/GIM clinical posts; 1 spent in a high-intensity GIM clinical post; 1 in a high-intensity nephrology post; and at least 1 year spent in research activities or other out-of-programme experience. On completion of this cycle, trainees are awarded a Certificate of Completion of Specialist Training and join the Specialist Register in Nephrology [61]. However, new opportunities to take up consultant posts in Ireland remain limited.

Renal nursing careers can have a focus in a variety of roles – inpatient care, delivery of haemodialysis care, outpa-

tient care, etc. There are a number of clinical nurse specialists and advanced nurse practitioners specialising in low clearance/pre-dialysis care, in post-transplant care, in renal home therapies and in vascular access, to mention but a few. Postgraduate NFQ Level 9 (Postgraduate Diploma/MSc) courses are provided by a variety of universities and institutes of technology [62].

Renal dietitians, although few in number, are attached to renal units around the country and work together via the Renal Interest Group of the Irish Nutrition and Dietetic Institute to bring a national consistency to practice and to promote a healthy renal diet [63].

Pay scales in nephrology are the same as for other clinicians of comparable grade working in the public system. Annual salaries for consultants vary from €165,000 to €273,000, depending upon when they were appointed, where in the country they work and what proportion of their activity is exclusively devoted to public work. There is a wide variation in the amount of additional income generated by activities focussing on the care of private patients. Annual salaries for renal nurses range from €29,800 to €64,500, depending on seniority or whether they work as clinical nurse specialists, advanced nurse practitioners or clinical nurse managers. Annual salaries for renal dieticians range from €36,000 to €76,500, depending on seniority and role [64].

Irish renal units are involved in much collaborative and integrated research activities. Examples would include the Rare Kidney Disease Registry and Biobank [65]; the Vasculitis Ireland Network (VINE) [66]; the Irish Kidney Gene Project [67]; studies on the health-related quality of life of ESRD patients on dialysis [68]; and within the GEnetics of Nephropathy: An International Effort (GENIE) Consortium [69].

Future Perspectives of Nephrology in Ireland

In Ireland, patients with kidney disease have access to a very highly trained workforce of multidisciplinary clinicians; to the most modern diagnostic equipment and medications; to the support of an active advocacy organisation (the IKA) [70]; and to a reasonably well-integrated national service with a high degree of internal concordance and collaboration. The principal challenge going forward relates to a lack of capacity within the service.

Within each of the renal units, the available HD centres continuously operate at or close to full capacity [7]. This can cause considerable problems within HD centres if there is a surge in new patient presentations or in a need to transfer patients from satellite centres to parent centres. It also restricts access to Holiday HD slots. Despite a programme of commissioning new HD centres over the last decade, demand still outstrips supply. Until this balance is restored, this item in particular introduces an unnecessary stress to care pathways.

Also reflecting capacity issues (access to vascular surgeons; access to operating theatres) is the poor proportion (27–57%) of HD patients with a functioning AV fistula. Despite an integrated national system to promote the different modalities of home-based dialysis, the national target – that at least 20% of dialysis patients should have the opportunity to avail of this – has not yet been reached. Similarly, there remains a need to maximise access to deceased donor kidneys and to those from living donors.

The KDCPMS platform needs to form the basis of a real-time Renal Registry as well as enhancing the collection of activity metrics and outcome measures.

Most deficient, however, remains the low number of clinicians. The number of consultant nephrologist WTEs varies, from 0.5 to 0.7 per 100 ESRD patients and from 3.0 to 7.0 pmp catchment population, between hospital groups. This is an unusually low proportion by international standards [26]. Expansion is needed to provide the critical mass to deliver optimum national clinical, teaching and research outputs. The same applies for renal clinical nurse specialists/advanced nurse practitioners and renal dieticians. Continued vigilance to ensure that equipment and consumable procurement obtains best value is necessary.

Easily accessible guidelines for GPs, non-renal hospital doctors and patients need to continue to be developed.

Conclusion

Ireland has the appropriate organisation, structures, equipment and personnel to deliver top quality renal care. The principal challenges are insufficient capacity within the RRT centres and insufficient clinicians.

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