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ORIGINAL ARTICLE

Dialysis nurse demand in Europe: an estimated prediction based on modelling

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ABSTRACT

Background. To estimate the projections of supply and demand for dialysis nurses (DNs) over 5 years in four European countries (France, Italy, Spain and the UK).
Methods. This study modelled the nursing labour workforce across each jurisdiction by estimating the current nursing labour force, number of nursing graduates and the attrition rate.
Results. France currently has the greatest demand for DNs (51 325 patients on dialysis), followed by Italy, the UK and Spain with 40 661, 30 301 and 28 007 patients on dialysis, respectively. The number of in-centre haemodialysis (HD) patients is expected to increase in the four countries, while the number of patients on home HD (HHD) or on peritoneal dialysis (PD) is expected to increase in the UK. Currently Italy has the greatest proportion of DNs (2.6%), followed by France (2.1%), Spain (1.7%) and the UK (1.5%). Estimation of the dialysis nursing staff growth rate over 5 years showed that the UK has the greatest estimated growth rate (6%), followed by Italy (2%), France (2%) and Spain (1%).
Conclusions. Dialysis demand will increase in the coming years, which may exacerbate the DN shortage. Additionally, competencies and training requirements of DNs should be precisely defined. Finally, implementing and facilitating PD and HHD strategies would be helpful for patients, healthcare professionals and healthcare systems and can even help ease the DN shortage.

Keywords: burden, dialysis, estimating model, nurse demand, nurse shortage

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KEY LEARNING POINTS

What was known:

- The aging population has created a greater need for healthcare, which has been associated with strains on healthcare providers.
- Although the relationship between nurse supply and demand in Europe has been cyclical, over the last several years many European health systems have faced an unprecedented nursing staff crisis.
- Despite the fact that nurse staffing levels influence the processes of care, there is no systematic framework for dialysis nurse (DN) registers in most European countries.

This study adds:

- The demand for DNs is expected to increase over the next 5 years in most European countries, as the number of patients requiring dialysis will increase.
- The proportion of incident end-stage renal disease patients on peritoneal dialysis varies in the four countries analysed, with figures ranging from 11% in France to 21% in the UK.

Potential impact:

- An accurate estimation of the demand and supply of DNs will aid the implementation of proactive policies and strategies that limit the impact of a DN shortage on patient care.
- It would be interesting to precisely define the competencies and training requirements of DNs, as well as the situations that require their intervention.

INTRODUCTION

In four European countries (France, Italy, Spain and the UK), an aging population, primarily attributed to the increase in life expectancy and a decrease in birth rates, has resulted in an increased demand for healthcare [1]. In addition, the prevalence of obesity and diabetes has risen to epidemic proportions and continues to be a major health problem worldwide [2, 3]. It is well known that both obesity and diabetes are risk factors for chronic kidney disease (CKD) and end-stage renal disease (ESRD) [4–6].

Historically, the relationship between nurse supply and demand in Europe has been cyclical, with periodic shortages of nurses where demand outstrips available supply [7]. However, over the last several years, many European health systems have faced an unprecedented nursing staffing crisis [8, 9]. This nurse shortage severely compromises the quality of healthcare services and negatively impacts the quality of life of patients [10, 11].

The nursing shortage significantly affects nephrology nurses, including those with dialysis expertise [12]. The relevance of this issue depends critically on the fact that CKD is a leading cause of illness worldwide and has become a major public health concern [13–15].

Detailed knowledge of patient characteristics, level of care and the time needed to provide the patient with the appropriate care are sine qua non to determine daily nurse staffing needs in the dialysis department [16].

Registered nurse staffing levels influence the processes of care, which subsequently impact on clinical outcomes [17]. However, as far as we know, there is no systematic framework for dialysis nurse (DN) registers in most European countries, which makes it extremely difficult to know the total volume of nurses who work in dialysis units.

Against the background of increasing demands, being able to estimate the necessary DN resources may be a promising approach, as we could act proactively to buffer the negative effects of nurse shortages [18].

Economic models can serve as useful tools for analysing and forecasting labour demand and supply trends across various sectors. In healthcare, labour supply models enable policymakers and health systems to make informed decisions regarding workforce planning, education and recruitment strategies. By quantitively assessing various factors that influence the nursing labour market, these models help in identifying potential shortages/surpluses, ensuring that health systems can maintain an optimal level of care and efficiency [19]. We have developed a DN demand and supply model based on the number of DNs required and the supply of nurses currently available. This report aimed to estimate by modelling the projections of supply and demand for DNs over 5 years.

MATERIALS AND METHODS

Design

This study adapted a previously published model [20] and examined the projected demand for nephrology nurses over a 5-year time horizon in four European countries.

Setting

The model estimated the number of nephrology nurses needed to manage patients on dialysis based on country-specific estimates of the following: current number of patients receiving dialysis therapy, incidence rate of patients requiring dialysis therapy, dialysis modality distribution, annual mortality, patient switching between home modality to in-centre therapy, annual transplant rate and ratio of nurses to patients required for each modality.

This study modelled the nursing labour workforce across each jurisdiction by estimating the current nursing labour force, number of nursing graduates and attrition rate [21]. In addition, we evaluated the relationship between the proportion of nurses required to manage patients on dialysis versus the total nurses available at the different time points. Details of input model assumptions and sources segmented by country are shown in Table 1 and Supplementary Table S1, respectively [22–38].

Table 1: An overview of the data and estimations used in the DN demand and supply models.

Model input	France	Italy	Spain	UK
Assumptions				
Population	68 043 000	58 870 762	47 615 034	67 620 000
Incidence growth rate, %	2.75	2.75	2.75	2.75
Dialysis incidence, *n*				
Baseline	9880	7327	6492	7992
Year 1	10 152	7529	6671	8212
Year 2	10 432	7736	6854	8438
Year 3	10 719	7949	7043	8671
Year 4	11 014	8168	7237	8909
Year 5	11 317	8393	7436	9155
Incidence modality distribution rates[a], %				
ICHD	85	84	80	73
PD	11	14	16	21
HHD	0.2	0.7	0.4	7
Annual dropout and transplant rates, %				
Mortality	13	13	13	13
PD dropout	20	20	20	20
Home HD dropout	14	14	14	14
Transplant per million	38	28	57	35
DN labour requirements by modality (per patient)				
ICDH	1/4	1/4	1/5	1/3
PD	1/10	1/10	1/15	1/17
Home HD	1/10	1/10	1/10	1/12
DN supply				
Total number of nurses				
Baseline	581 484	367 378	300 567	569 287
Year 1	533 727	361 692	296 438	569 744
Year 2	525 971	356 006	292 308	570 201
Year 3	498 214	350 320	288 179	570 658
Year 4	470 458	344 634	284 050	571 115
Year 5	442 701	338 948	279 920	571 572
Percentage of nephrology nurses				
Baseline	Unknown	Unknown	Unknown	Unknown
Nursing graduates, *n*				
Baseline	24 557	10 191	10 899	25 227
Percentage specializing in nephrology				
Baseline	Unknown	Unknown	Unknown	Unknown
Attrition, *n*				
Baseline	52 334	15 877	15 028	24 770

[a]Distribution of incident patients between different dialysis modalities.

Nursing supply analysis and projection

Three major components make up the supply of nurses, current number of nurses, future growth of registered nurses and attrition. To determine the current supply of nurses, national labour force statistics were used to identify the number of registered nurses within each jurisdiction. Future growth was based on analysing the number of new graduates entering the field, while the annual attrition rate was based on published literature examining nurses' intention to leave the profession (see Table 1). There is a lack of data on nurse attrition, and the reported estimate used in this study does not include factors such as emigration, age-related retirement or death.

The supply of nurses was projected using baseline data for calendar year 2023 and assumed the number of graduates and attrition rates held steady over the next 5 years.

Nephrology nursing demand analysis and projection

The demand for nurses with a dialysis specialty was based on an analysis of the number of total patients requiring dialysis by modality and estimating the nurses needed to support those patients based on the modality using published recommendations for nurse:patient ratios.

To determine the current number of patients on dialysis by modality, registry data were used to determine the current prevalence by modality. Future projections were based on the incidence rate by modality, dropout rate [peritoneal dialysis (PD), home haemodialysis (HHD)], mortality and transplant rate.

The results were summarized based on the percentage of total nursing supply needed to support patients on dialysis.

RESULTS

DN demand model

The DN demand model showed differences among the four countries studied. According to the data, France currently has the greatest demand for DNs, followed by Italy, the UK and Spain. The total number of patients on dialysis will increase over the

Table 2: DN demand model in France, Italy, Spain and the UK.

Country	Dialysis modality, *n*	2023	2024	2025	2026	2027	2028
France	ICHD	47 481	48 008	48 782	49 593	50 529	51 590
	PD	3079	2998	2978	2 998	3044	3108
	Home HD	765	537	410	318	251	202
	Total[a]	51 325	51 543	52 171	52 909	53 824	54 900
Italy	ICHD	36 166	37 051	37 860	38 663	39 500	40 393
	PD	4228	3713	3419	3265	3200	3192
	Home HD	267	235	222	213	206	201
	Total[a]	40 661	40 999	41 501	42 140	42 906	43 786
Spain	ICHD	24 685	24 920	25 169	25 486	25 892	26 394
	PD	3071	2795	2664	2619	2626	2664
	Home HD	251	181	154	135	121	111
	Total[a]	28 007	27 896	27 988	28 240	28 638	29 168
UK	ICHD	25 019	26 650	28 250	29 852	31 457	33 067
	PD	3892	3986	4105	4241	4386	4539
	Home HD	1390	1461	1622	1739	1823	1885
	Total[a]	30 301	32 097	33 977	35 831	37 667	39 490

[a]Total number of patients requiring dialysis.

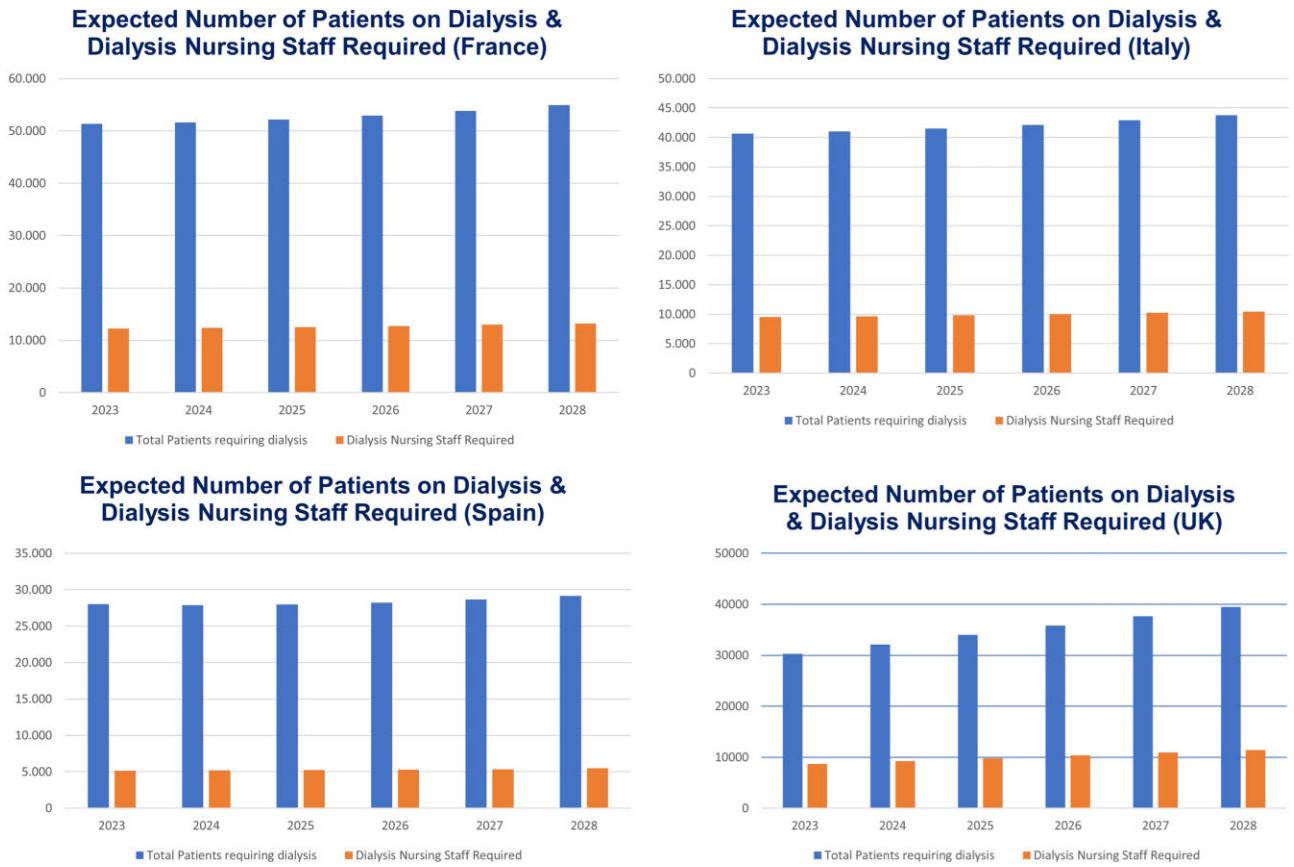

Figure 1: Expected number of patients on dialysis and dialysis nursing staff required in France, Italy, Spain and the UK.

5 years in these four countries (Table 2 and Fig. 1). The number of patients on in-centre haemodialysis (ICHD) is expected to increase over the 5 years in all the countries, with the UK having the greatest increase and Spain the lowest. However, the number of patients on PD over 5 years is expected to remain stable in France, decrease in Italy and Spain and increase in the UK. Interestingly, the number of HHD patients will decrease in France, Italy and Spain but will increase in the UK.

Table 3: DN supply model in France, Italy, Spain and the UK.

Country	Dialysis modality	2023	2024	2025	2026	2027	2028
France	Dialysis nursing staff required, *n*	12 255	12 375	12 534	12 730	12 962	13 229
	Dialysis nursing staff growth rate, %	NA	1	1	2	2	3
	Dialysis nursing as proportion of all nurses, %	2.1	2.2	2.4	2.6	2.8	3.0
Italy	Dialysis nursing staff required, *n*	9491	9658	9829	10 013	10 216	10 438
	Dialysis nursing staff growth rate, %	NA	2	2	2	2	2
	Dialysis nursing as proportion of all nurses, %	2.6	2.7	2.8	2.9	3.0	3.1
Spain	Dialysis nursing staff required, *n*	5167	5188	5227	5285	5365	5467
	Dialysis nursing staff growth rate, %	NA	0	1	1	2	2
	Dialysis nursing as proportion of all nurses, %	1.7	1.8	1.8	1.8	1.9	2.0
UK	Dialysis nursing staff required, *n*	8684	9240	9793	10 345	10 896	11 446
	Dialysis nursing staff growth rate, %	NA	6	6	6	5	5
	Dialysis nursing as proportion of all nurses, %	1.5	1.6	1.7	1.8	1.9	2.0

NA: not applicable.

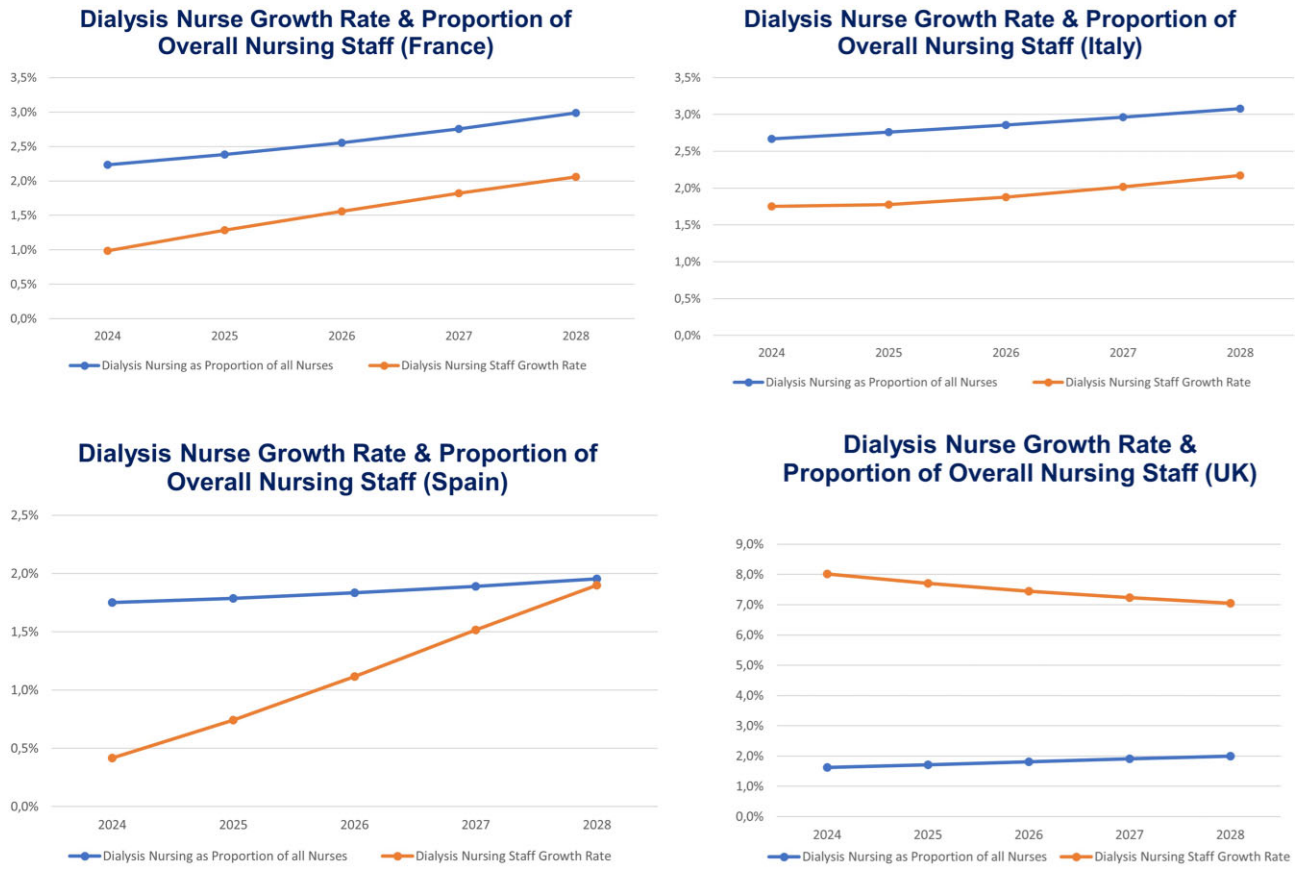

Figure 2: DN growth rate and the proportion of overall nursing staff in France, Italy, Spain and the UK.

DN supply model

Similar to the DN demand model, the DN supply model also showed differences among countries. Regarding the total number of nurses, it was estimated that Italy has the highest proportion of DNs (2.6%), followed by France (2.1%), Spain (1.7%) and the UK (1.5%). The estimation of the proportion of DNs as a proportion of all nurses over the 5 years showed an increase in the four countries (Table 3).

Estimation of dialysis nursing staff growth rate over 5 years showed that the UK has the greatest estimated growth rate {median 6% [interquartile range (IQR) 5–6]}, followed by Italy [median 2% (IQR 2–2)], France [median 2 (IQR 1–3)] and Spain [median 1% (IQR 0–2)] (Table 3 and Fig. 2).

DISCUSSION

Having enough qualified workers is essential for health systems to deliver high-quality care to all patients [39]. There is currently an estimated shortage of nearly 1 million healthcare workers in Europe. In addition, many doctors and nurses are moving to

countries with better working conditions and pay, leaving other countries with shortages [9, 39].

The nursing shortage in Europe, exacerbated by the severe acute respiratory syndrome coronavirus 2 pandemic, has become more severe [7–9]. Nursing turnover remains a significant challenge for healthcare organizations, with a growing number of nurses expressing an intent to leave their positions [40, 41]. A survey conducted during the pandemic showed that 22% of nurses were considering leaving their roles, a figure that has since increased to 31% in a more recent survey. Among inpatient registered nurses, the percentage is even higher, exceeding 40% [41].

A Health Affairs study from April 2022 revealed that the registered nurse workforce in the USA declined by ≈100 000 by the end of 2021, the largest drop seen in 4 decades [42]. Europe is similarly affected, with potentially severe shortages of nurses that could compromise healthcare delivery. In England, for instance, the National Health Service reported 34 709 nursing vacancies on 31 December 2023, representing >8.4% of its nursing workforce [43].

The issue of ESRD is of particular importance in Western Europe, where the median burden of kidney failure prevalence in Western European countries was 1038 patients per million population. The data from the four countries analysed in the current study showed small variations among France [1310 patients per million population (PMP)], Italy (1236 pmp) and Spain (1213 pmp), but the prevalence was lower in the UK (971 pmp) [44]. The lower prevalence of renal disease in the UK may be related to better management in primary care medicine (owing to public health policy favouring primary care for now a half century) of hypertension and type 2 diabetes mellitus, which are the two main contributors to ESKD.

To deal with this problem, it is crucial to have an adequate nephrology workforce to meet the growing worldwide burden of kidney disease and its risk factors, as well as the increasing demand of renal replacement therapy and kidney care [45].

According to the results of our model, the demand for DNs is expected to increase over the next 5 years, as the number of patients requiring dialysis will be greater. This increase in demand has been greatest in the UK, where an increase of 30.3% in patients who will require dialysis is expected in 5 years [24].

Over the next 5 years, the number of patients receiving ICHD is projected to increase across all countries, with the UK experiencing the most substantial increase and Spain the smallest (probably because Spain has a high rate of renal transplantation).

It is currently extremely complex to deal with the growing demand for DNs. Several factors, including population aging, retaining existing nurses and retirement (baby boomers are beginning to reach retirement age), significantly impact the number of DNs and therefore the supply of nurses to maintain adequate staff [9].

Additionally, the dialysis modality directly impacts the number of nurses necessary for its management. While DN labour requirements per patient on ICHD range from 1/3 to 1/5 (UK) and 1/5 (Spain), DN labour requirements per patient on PD are significantly lower, ranging from 1/10 (France and Italy) to 1/17 (UK) [28, 33, 35, 37]. Similarly, DN labour requirements per patient on HHD are significantly lower than that of HD, ranging from 1/10 (France, Italy and Spain) to 1/12 (UK) [28, 33, 35, 37].

The model predicted a decrease in the number of HHD patients in France, Italy and Spain but an increase in the UK. While the exact cause is uncertain, it may be attributed to recent technological advancements, particularly in daily HHD with low-flow dialysate and a proactive financial policy in the UK, while HHD is far less reimbursed than ICHD in France, Italy and Spain.

Since the DN labour requirements per patient are lower for PD and HHD than ICHD, it might be suggested that a greater proportion of patients on PD or HHD might be useful to reduce the impact of the nurse shortage.

According to our research data, the proportion of incident ESRD patients on PD varies in the four countries analysed, with figures ranging from 11% in France to 21% in the UK [24].

Another strategy to reduce the impact of the DN shortage on care quality is the implementation of remote patient monitoring devices [46]. Improvements in telemedicine and health monitoring tools will help support patients and their families at home, which might help to lighten the workload of DNs [46, 47].

The current study has certain limitations that must be considered when interpreting the results. The first is that its geographical scope was limited to four Western European countries, so its applicability to other European countries, mainly Eastern countries, where the availability of PD is reduced or absent and healthcare resources are reduced, may be limited. Another limitation is that we do not accurately know the number of DNs currently working in the different dialysis centres in Europe. Although an attempt has been made to define and protocolize the scope of practice, standards, competencies and situations that require intervention by DNs [48], there are centres that, in addition to DNs, have other types of healthcare workers involved in the care of patients with ESRD especially in Germany, France and the UK. Finally, the current DN demand model was built assuming that healthcare delivery in the future (projected over 5 years) will not change substantially from the way healthcare was delivered in the base year and that there will be stability in the current rates of ESRD. Furthermore, the DN supply model assumed that current graduation rates and workforce participation patterns will remain unchanged in the future. Therefore, any relevant changes in these factors may significantly impact both the supply and demand projections reported in the current study. It is extremely important to develop demand and supply scenarios to analyse the impact of such changes [49].

CONCLUSION

The results of this study suggest an increase of the total number of patients on ICHD in the four countries, which will entail an increase in DN demand. Regarding the DN supply, although differences are currently observed between the four countries, the model showed an increase in the proportion of DNs as a proportion of total nurses over 5 years in the four countries.

Additionally, implementing and facilitating home dialysis strategies is helpful for patients, healthcare professionals and healthcare systems and can even help ease the nursing shortage. Finally, an accurate estimation of the demand and supply of DNs will aid in the implementation of proactive policies and strategies that limit the impact of a DN shortage on patient care.

SUPPLEMENTARY DATA

Supplementary data are available at *Clinical Kidney Journal* online.

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AUTHORS' CONTRIBUTIONS

All authors met the International Committee of Medical Journal Editors authorship criteria. All authors contributed to the development and critical revision of the manuscript, commented on the various versions of the manuscript and read and approved the final manuscript for submission.

DATA AVAILABILITY STATEMENT

The data underlying this article will be shared upon reasonable request to the corresponding author.

CONFLICT OF INTEREST STATEMENT

All authors were remunerated for their contributions to the advisory board by Baxter Healthcare. K.P. is employed by Baxter.

REFERENCES

1. Cristea M, Noja GG, Stefea P *et al*. The impact of population aging and public health support on EU labor markets. *Int J Environ Res Public Health* 2020;**17**:1439. https://doi.org/10.3390/ijerph17041439
2. World Health Organization. World Obesity Day 2022–Accelerating action to stop obesity. Updated March 4, 2022. https://www.who.int/news/item/04-03-2022-world-obesity-day-2022-accelerating-action-to-stop-obesity [last accessed 14 December 2023].
3. Sun H, Saeedi P, Karuranga S *et al*. IDF Diabetes Atlas: global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract* 2022;**183**:109119. https://doi.org/10.1016/j.diabres.2021.109119
4. Maric-Bilkan C. Obesity and diabetic kidney disease. *Med Clin North Am* 2013;**97**:59–74. https://doi.org/10.1016/j.mcna.2012.10.010
5. Shelton BA, Reed RD, MacLennan PA *et al*. Increasing obesity prevalence in the United States end-stage renal disease population. *J Health Sci Educ* 2018;**2**:151.
6. Xie D, Ma T, Cui H *et al*. Global burden and influencing factors of chronic kidney disease due to type 2 diabetes in adults aged 20–59 years, 1990–2019. *Sci Rep* 2023;**13**:20234. https://doi.org/10.1038/s41598-023-47091-y
7. Eurostat Statistics Explained. Healthcare personnel statistics—nursing and caring professionals. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Healthcare_personnel_statistics_-_nursing_and_caring_professionals&oldid=355980#Healthcare_personnel_.E2.80.93_nurses [last accessed 14 December 2023].
8. Gaietto KJ, Brooks MV. The shortage of expert nephrology nurses in hemodialysis: a literature review. *Nephrol Nurs J* 2019;**46**:577–85.
9. Tamata AT, Mohammadnezhad M. A systematic review study on the factors affecting shortage of nursing workforce in the hospitals. *Nurs Open* 2023;**10**:1247–57. https://doi.org/10.1002/nop2.1434
10. Adams R, Ryan T, Wood E. Understanding the factors that affect retention within the mental health nursing workforce: a systematic review and thematic synthesis. *Int J Ment Health Nurs* 2021;**30**:1476–97. https://doi.org/10.1111/inm.12904
11. Al Yahyaei A, Hewison A, Efstathiou N *et al*. Nurses' intention to stay in the work environment in acute healthcare: a systematic review. *J Res Nurs* 2022;**27**:374–97.
12. Boyle SM, Washington R, McCann P *et al*. The nephrology nursing shortage: insights from a pandemic. *Am J Kidney Dis* 2022;**79**:113–6. https://doi.org/10.1053/j.ajkd.2021.07.007
13. Berger JR, Hedayati SS. Renal replacement therapy in the elderly population. *Clin J Am Soc Nephrol* 2012;**7**:1039–46. https://doi.org/10.2215/CJN.10411011
14. Kim JE, Park WY, Kim H. Renal replacement therapy for elderly patients with ESKD through shared decision-making. *Electrolyte Blood Press* 2023;**21**:1–7. https://doi.org/10.5049/EBP.2023.21.1.1
15. Weisman DS, Thavarajah S, Jaar BG. Prime time for chronic kidney disease. *BMC Nephrol* 2023;**24**:295. https://doi.org/10.1186/s12882-023-03340-w
16. de Kleijn HC. Establishing nurse to patient ratio in haemodialysis care: development of a validated classification tool for estimating nursing care time in haemodialysis centres. PhD thesis, Vrije Universiteit Amsterdam, 2023. https://doi.org/10.5463/thesis.56 [last accessed 14 December 2023].
17. Thomas-Hawkins C, Flynn L, Clarke SP. Relationships between registered nurse staffing, processes of nursing care, and nurse-reported patient outcomes in chronic hemodialysis units. *Nephrol Nurs J* 2008;**35**:123–30, 145; quiz 131.
18. Kersten M, Vincent-Höper S, Nienhaus A. Stress of dialysis nurses-analyzing the buffering role of influence at work and feedback. *Int J Environ Res Public Health* 2020;**17**:802. https://doi.org/10.3390/ijerph17030802
19. Doi S, Ide H, Takeuchi K *et al*. Estimation and evaluation of future demand and supply of healthcare services based on a patient access area model. *Int J Environ Res Public Health* 2017;**14**:1367. https://doi.org/10.3390/ijerph14111367
20. Oh PJ, Shin SR. [A study on the projected workforce of nephrology clinical nurse specialist (CNS) in Korea]. *Taehan Kanho Hakhoe Chi* 2003;**33**:284–92.
21. Nirel N, Grinstien-Cohen O, Eyal Y *et al*. Models for projecting supply and demand for nurses in Israel. *Isr J Health Policy Res* 2015;**4**:46. https://doi.org/10.1186/s13584-015-0043-6
22. National Institute of Statistics and Economic Studies. Home page. https://www.insee.fr/en/accueil [last accessed 14 December 2023].
23. Himmelfarb J, Vanholder R, Mehrotra R *et al*. The current and future landscape of dialysis. *Nat Rev Nephrol* 2020;**16**:573–85. https://doi.org/10.1038/s41581-020-0315-4
24. ERA Registry. *ERA Registry Annual Report 2020*. https://academic.oup.com/ckj/article/16/8/1330/7136179 [last accessed 14 December 2023].
25. Kramer A, Pippias M, Noordzij M *et al*. The European Renal Association-European Dialysis and Transplant Association (ERA-EDTA) Registry Annual Report 2016: a summary. *Clin Kidney J* 2019;**12**:702–20. https://doi.org/10.1093/ckj/sfz011
26. Nadeau-Fredette AC, Sukul N, Lambie M *et al*. Mortality trends after transfer from peritoneal dialysis to hemodialysis. *Kidney Int Rep* 2022;**7**:1062–73. https://doi.org/10.1016/j.ekir.2022.02.016
27. Paterson B, Fox DE, Lee CH *et al*. Understanding home hemodialysis patient attrition: a cohort study. *Can J*

Kidney Health Dis 2021;**8**:20543581211022195. https://doi.org/10.1177/20543581211022195
28. Canaud B, Couchoud C. Global dialysis perspective: France. *Kidney360* 2021;**3**:168–75. https://doi.org/10.34067/KID.0003722021
29. Eurostat. Health personnel. https://ec.europa.eu/eurostat/databrowser/view/HLTH_RS_PRS2/default/table?lang=en [last accessed 14 December 2023].
30. Eurostat. Health graduates. https://ec.europa.eu/eurostat/databrowser/view/HLTH_RS_GRD2/default/table?lang=en [last accessed 14 December 2023].
31. Heinen MM, van Achterberg T, Schwendimann R *et al*. Nurses' intention to leave their profession: a cross sectional observational study in 10 European countries. *Int J Nurs Stud* 2013;**50**:174–84. https://doi.org/10.1016/j.ijnurstu.2012.09.019
32. United Nations Department of Economic and Social Affairs. 2022 Revision of World Population Prospects. https://population.un.org/wpp/ [last accessed 14 December 2023].
33. Pani A, Capasso G. Global dialysis perspective: Italy. *Kidney360* 2022;**3**:1948–52. https://doi.org/10.34067/KID.0007462021
34. Spanish National Statistics Institute. Population figures. Latest data. https://www.ine.es/dyngs/INEbase/en/operacion.htm?c=Estadistica_C&cid=1254736176951&menu=ultiDatos&idp=1254735572981 [last accessed 14 December 2023].
35. Roca-Tey R, Ibeas J, Sánchez Alvarez JE. Global dialysis perspective: Spain. *Kidney360* 2020;**2**:344–9. https://doi.org/10.34067/KID.0005722020
36. Office for National Statistics. Population estimates for the UK, England, Wales, Scotland, and Northern Ireland: mid-2021. https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/bulletins/annualmidyearpopulationestimates/mid2021 [last accessed 14 December 2023].
37. Roberts G, Holmes J, Williams G *et al*. Current costs of dialysis modalities: a comprehensive analysis within the United Kingdom. *Perit Dial Int* 2022;**42**:578–84. https://doi.org/10.1177/08968608211061126
38. Nursing & Midwifery Council. Registration data reports. https://www.nmc.org.uk/about-us/reports-and-accounts/registration-statistics/ [last accessed 14 December 2023].
39. Rys A. Health-EU newsletter 250 – Focus. Put the horse before the cart: investing in health requires investing in health workforce. https://health.ec.europa.eu/other-pages/basic-page/health-eu-newsletter-250-focus_en [last accessed 14 December 2023].
40. Berlin G, Lapointe M, Murphy M. Surveyed nurses consider leaving direct patient care at elevated rates. https://www.mckinsey.com/industries/healthcare/our-insights/surveyed-nurses-consider-leaving-direct-patient-care-at-elevated-rates [last accessed 14 December 2023].
41. Berlin G, Burns F, Essick C *et al*. *Nursing in 2023: how hospitals are confronting shortages*. https://www.mckinsey.com/industries/healthcare/our-insights/nursing-in-2023#/ [last accessed 14 December 2023].
42. Auerbach DI, Buerhaus PI, Donelan K *et al*. A worrisome drop in the number of young nurses. https://www.healthaffairs.org/content/forefront/worrisome-drop-number-young-nurses [last accessed 14 December 2023].
43. NHS Digital. NHS Vacancy Statistics, England, April 2015–31 Dec 2023. https://digital.nhs.uk/data-and-information/publications/statistical/nhs-vacancies-survey/april-2015-december-2023-experimental-statistics [last accessed 14 December 2023].
44. Kelly DM, Anders HJ, Bello AK *et al*. International Society of Nephrology Global Kidney Health Atlas: structures, organization, and services for the management of kidney failure in Western Europe. *Kidney Int Suppl (2011)* 2021;**11**:e106–18. https://doi.org/10.1016/j.kisu.2021.01.007
45. Osman MA, Alrukhaimi M, Ashuntantang GE *et al*. Global nephrology workforce: gaps and opportunities toward a sustainable kidney care system. *Kidney Int Suppl (2011)* 2018;**8**:52–63. https://doi.org/10.1016/j.kisu.2017.10.009
46. Nygård HT, Nguyen L, Berg RC. Effect of remote patient monitoring for patients with chronic kidney disease who perform dialysis at home: a systematic review. *BMJ Open* 2022;**12**:e061772. https://doi.org/10.1136/bmjopen-2022-061772
47. Brown EA, Ekstrand A, Gallieni M *et al*. Availability of assisted peritoneal dialysis in Europe: call for increased and equal access. *Nephrol Dial Transplant* 2022;**37**:2080–9. https://doi.org/10.1093/ndt/gfac193
48. Gomez NJ, Castner D, Hain D. Nephrology nursing scope and standards of practice: integration into clinical practice. *Nephrol Nurs J* 2017;**44**:19–26.
49. HRSA Health Workforce. Projecting health workforce supply and demand. https://bhw.hrsa.gov/data-research/projecting-health-workforce-supply-demand [last accessed 15 December 2023].

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