

Nursing Care and Postgraduate Education of Nephrology and Dialysis Nurses in Italy

Specialità e professioni a colloquio

Stefano Mancin^{1,2}, Federica Bragaglia², Desirèe Andreoli³, Sara Morales Palomares⁴, Giovanni Cangelosi⁵, Marco Sguanci⁶, Maruska Bedin¹, Lea Godino⁷, Cinzia Fabbri⁸, Domenica Gazineo⁹, Gaetano Ferrara¹⁰, Beatrice Mazzoleni²

1 IRCCS Humanitas Research Hospital, Rozzano, Italy

2 Department of Biomedical Sciences, Humanitas University, Pieve Emanuele, Italy

3 Azienda Ospedaliera Santa Maria della Misericordia, Perugia, Italy

4 Department of Pharmacy, Health and Nutritional Sciences (DFSSN), University of Calabria, Rende, Italy

5 Unit of Diabetology, ASUR Marche, Fermo, Italy

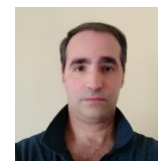
6 A.O. Polyclinic San Martino Hospital, Genova

7 Medical Genetics Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Italy

8 Nephrology, Dialysis, Hypertension Unit, IRCCS Azienda Ospedaliero-Universitaria di Bologna

9 Governo clinico e qualità, IRCCS Azienda Ospedaliero-Universitaria di Bologna, Bologna, Italy

10 Nephrology and Dialysis Unit, Ramazzini Hospital, Carpi, Italy



Marco Sguanci

Corresponding author:

Dr. Marco Sguanci

A.O. Polyclinic San Martino Hospital,

Largo R. Benzi 10, 16132 Genova

E-mail: sguancim@gmail.com

ABSTRACT

Introduction. Patients with chronic kidney disease undergoing renal replacement therapy have complex care needs. To address this, nephrology and dialysis nurses must possess expertise in advanced specialist and disciplinary skills. The aim of this review is to analyze post-graduate academic training pathways and clinical-care training in the field of nephrology and dialysis nursing in the Italian context.

Methodology. A narrative review of the literature was conducted in May 2024, using databases such as CINAHL and Medline-PubMed, with a selection criterion limited to primary and secondary studies published in Italian and English. To supplement the search, particularly within the Italian context, grey literature sources were consulted.

Results. Post-graduate nephrology nursing education in Italy is mainly offered through First-Level Masters, as well as Second Level Masters and specialization courses, which are provided at various academic institutions. Analysis of the educational programs revealed the presence of common “core” teachings across all pathways, covering renal disease pathophysiology, hemodialysis, peritoneal dialysis, and dialysis nursing care, alongside significant heterogeneity in other proposed teachings. Clinical-care training emerged as a fundamental aspect in both post-graduate education, professional integration for newcomers, and continuous professional development.

Conclusions. The growing healthcare need for specialist skills suggests the necessity of integrating field-based training with standardized post-graduate academic pathways, possibly in collaboration with relevant Nursing Scientific Societies. This synergy would not only promote the enhancement of nursing competencies but also ensure a high quality of care delivery.

KEYWORDS: nephrology, dialysis, university education, postgraduate education

Introduction

Chronic Kidney Disease (CKD) has become an increasingly important clinical issue in contemporary healthcare due to its rising incidence and the inherent complexity of its management [1]. CKD is characterized by a progressive and irreversible loss of kidney function, which can develop over a long period, often without noticeable symptoms in the early stages [2]. The causes of CKD are multifactorial, including conditions such as hypertension [3], diabetes mellitus, cardiovascular diseases [4], polycystic kidney disease [5], and neoplasms [6]. Early diagnosis is crucial given the asymptomatic nature of the disease in its initial stages. However, diagnosis often occurs only when kidney function is significantly impaired, underscoring the importance of awareness campaigns and regular screenings, particularly in high-risk populations [7]. The management of CKD focuses on slowing its progression and addressing complications such as anemia, bone disorders, electrolyte imbalances, and metabolic acidosis, especially in its terminal stage, End-Stage Renal Disease (ESRD) [8]. Nephrology and dialysis specialist nurses not only provide specialized care during dialysis sessions, hospitalizations, and outpatient visits, but also operate within a complex care environment characterized by a significant degree of multi-morbidity in nephrology patients [9]. Nephrology nursing care is distinguished by its involvement in various clinical and care settings, including hospital, community, and home environments. These settings encompass hemodialysis, peritoneal dialysis, kidney transplantation, pediatric nephrology, intensive care, hematology, and operating rooms, all of which demand a high level of complexity and specialization in professional skills [10, 12]. In addition to their specialized roles, nephrology nurses provide emotional and psychosocial support, playing a fundamental role in interpersonal relationships and contributing to an improved quality of life for patients through the establishment of trust and understanding [13]. Through active listening, they ensure that patients feel understood and supported not only medically but also on a human and relational level. Nephrology nurses are required to have a high level of education characterized by clinical, technical, care, and relational skills [14]. These competencies can be acquired through inter-company training programs such as clinical and care field training, as well as postgraduate academic programs such as first-level master's degrees in nephrology and dialysis. The objective of this narrative review was to analyze the postgraduate academic training programs and the clinical and care field training of nephrology and dialysis nurses in the Italian context.

Methods

A narrative review of the literature was conducted using the Medline (via PubMed) and Cumulative Index to Nursing and Allied Health Literature (CINAHL) databases. The research question was formulated using the PICO framework [15], specifically: P: Nephrology and dialysis nurses; I: identification of postgraduate training programs and clinical field training experiences in the Italian context; O: analysis of postgraduate training programs and clinical field training experiences in the Italian context. No comparison intervention was identified in this study. The literature search was conducted in May 2024, using both Italian and English keywords such as "Nephrology Nursing" "Postgraduate Education" "Clinical Experience", and "Field Training" combined with the Boolean operators AND and/or OR. Primary and secondary studies in Italian or English that addressed the postgraduate education of nephrology and dialysis nurses in Italy were included. Excluded were conference abstracts, letters to the editor, comments, book chapters, and studies not relevant to the research question. Grey literature was also consulted, particularly: 1) websites of Italian universities or other institutional sources; 2) Google Scholar. Relevant data for this review were extracted by two authors (FB; SM), discussed to resolve any potential conflicts, and reported as a narrative summary based on the study objectives, and finally summarized in graphs and tables.

Any discrepancies were resolved by a third author (MB). To avoid potential conflicts of interest and ensure the integrity of the results, the names of the universities and institutions were anonymized where possible.

Results

The search in electronic databases yielded 1,638 records (PubMed n = 294 and CINAHL n = 1,344); an additional 322 articles were found through the consultation of grey literature via Google Scholar and websites of Italian universities. Out of a total of 1,960 results, 62 records were excluded as duplicates, leaving 1,898 for detailed evaluation, initially based on the title. Of these, 1,385 were excluded, and 513 articles were analyzed after reading the abstracts, of which 462 were not relevant to the research question. The screening process led to a full-text evaluation of 51 records, of which 35 were excluded as they did not meet the defined inclusion criteria or were not available in full text. The final screening process resulted in the inclusion of 16 records, which were deemed eligible for this literature review (Figure 1).

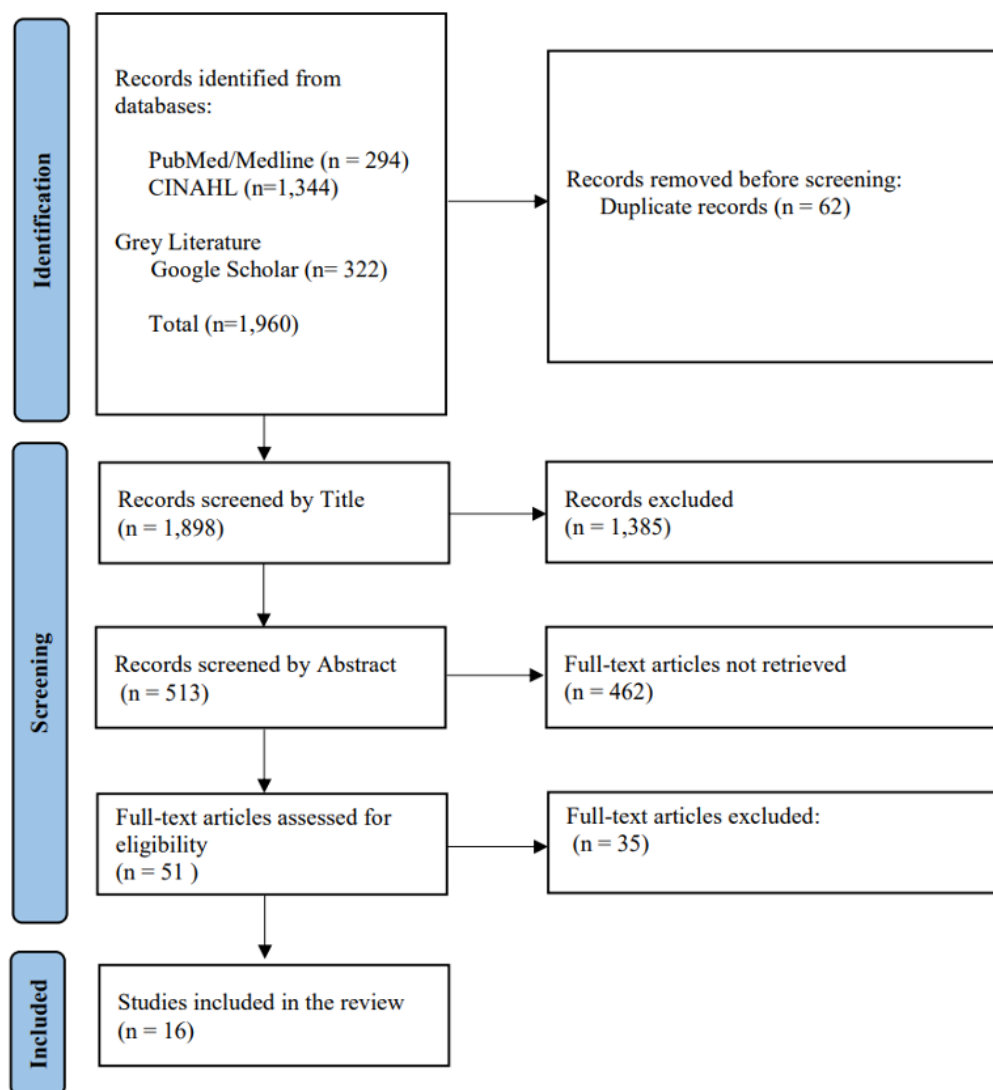


Figure 1. Flowchart of Study Selection.

Postgraduate University Programs for Nephrology and Dialysis Nurses in Italy

In the context of postgraduate educational offerings in nephrology nursing in Italy, there is an

exclusive presence of first-level master's programs [16, 26], one second-level master's program [27], and one advanced training course [28]. The geographical distribution of these programs includes two universities in Central Italy (15,38%) [16, 17], five in Northern Italy (38,46%) [18, 21, 23, 28], five in Southern Italy (38,46%) [20, 24, 27] and one offering online instruction (7,69%) [19]. Analyzing the training programs available on the official websites of the universities studied [16, 28], the duration of the master's programs varies between 12 and 18 months, with significant heterogeneity in the modes of instruction. Specifically, the majority of the universities analyzed use a blended or distance learning approach [16, 17, 19, 21, 23, 27] (69,23%), while the remaining universities opt for in-person instruction [18, 20, 22, 28] (30,76%) (Table 1).

University*	Academic Program	Duration	Title**	ECTS – Hours	Training Method
University "A"	First-Level Master	12 Months	Kidney Transplantation Hemodialysis	60 – 1500	Distance Learning; On-site Internship
University "B"	First-Level Master	12 Months	Nephropathies Dialysis Cardiovascular Diseases	60 – 1500	Blended Learning; Individual Study; Interactive Teaching; Seminars; On-site Internship
University "C"	First-Level Master	18 Months	Nephrology Dialysis	60 – 1500	In-person Teaching; Alternative Teaching; Individual Study; On-site Internship
University "D"	First-Level Master	12 Months	Peritoneal Dialysis	60 – 1500	Distance Learning for some activities. Includes in-person teaching, curricular internship, seminars, guided study, training internships, and/or project work at companies.
University "E"	Second-Level Master	12 Months	Peritoneal Dialysis	60 – 1500	Distance Learning for some activities. Includes in-person teaching, curricular internship, seminars, guided study, training internships, and/or project work at companies.
University "F"	First-Level Master	12 Months	Dialysis	60 – 1500	Blended Learning, including 300 hours of in-person teaching
University "G"	First-Level Master	12 Months	Vascular Access Critical Care	60 – 1500	Distance Learning for some activities. Includes in-person teaching, curricular internship, seminars, guided study, training internships, and/or project work at companies.
University "H"	Advanced Training Course	12 Months	Home Dialysis	16 – 400	In-person Teaching
University "I"	First-Level Master	12 Months	Hemodialysis	60 – 1500	Blended Learning; E-learning for theoretical lessons and in-person practical lessons
University "L"	First-Level Master	12 Months	Nephrology (Nutrition)	60 – 1500	In-person Teaching (1000 hours) and 500 hours of Internship at companies
University "M"	First-Level Master	12 Months	Kidney Transplantation Dialysis	60 – 1500	Interactive Distance Learning
University "N"	First-Level Master	12 Months	Dialysis	60 – 1500	In-person Lessons; Advanced Training Activities: Internship or Project Work
University "O"	First-Level Master	12 Months	Hemodialysis Critical Care	60 – 1500	In-person lessons, labs, exercises, seminars, in vitro simulations, clinical case studies, field lessons, expert testimonies, project work, internships, final exam discussion. Zoom connections for some activities (lectures, exercises, seminars, clinical case studies, expert testimonies, project work).

Table 1. Postgraduate University Programs. Legend: ECTS = European Credit Transfer and Accumulation System; *University names anonymized with letters in alphabetical order; ** to anonymize the names of individual master's programs/advanced training courses, relevant keywords have been used.

Further analysis revealed that, despite some similarities in the titles of the courses identified, such as "Master in Nephrology" or "Master in Dialysis", there are significant divergences in the specific

teachings of each course (Table 1). These postgraduate training courses, while sharing a common nomenclature, have inherently heterogeneous and distinct curricula. Additionally, there is a marked emphasis on certain teaching areas, shared by all the identified university programs [16, 28] and definable as “core” teachings. These include the pathophysiology and diagnostics of kidney diseases, dialysis nursing care, kidney transplantation, acute/chronic hemodialysis treatment, and vascular access management. However, there is a limited presence of integrated processes, a lack of communication elements, and a moderate interest in research (Figure 2).

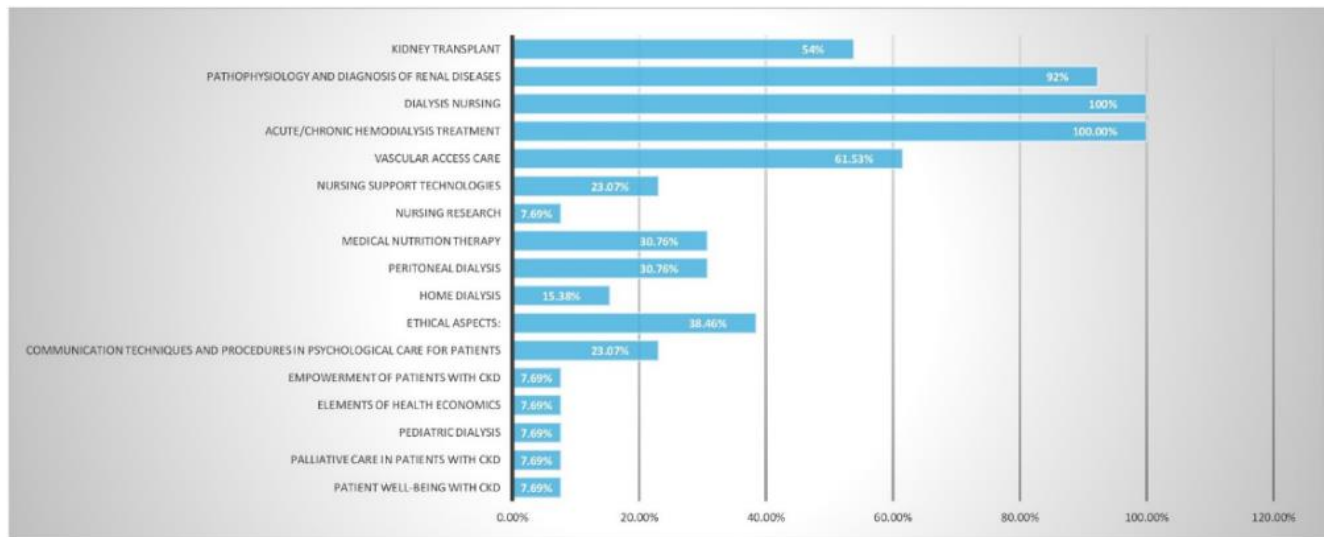


Figure 2. Frequency of Teachings in Postgraduate Training Courses in Nephrology and Dialysis.

Among the master’s programs analyzed [16, 28], there is a notable clinical-care orientation with a specific focus on hemodialysis, peritoneal dialysis, and kidney transplantation. These programs include specific teachings on kidney transplant coordination and vascular access management [16, 28]. Similarly, there is an emphasis on nursing care in dialysis and kidney transplantation, with particular attention to ethical aspects.

In addition to core teachings such as hemodialysis and the management of central and peripheral vascular access, other identified teachings include diet therapy, home dialysis, physical activity in kidney disease, and nursing research [17, 18, 22, 24, 26]. Conversely, some universities focus on nursing care by integrating ethics, nutrition, and communication techniques in psychological support, as well as elements of health economics and patient empowerment [19, 20]. It is noteworthy that none of the analyzed master’s programs included apheresis treatments, specifically therapeutic plasmapheresis, in their curriculum.

Additionally, several master’s programs address the importance of multidisciplinary management for critically ill patients undergoing extracorporeal purification, with a particular emphasis on promoting patient safety in critical care settings [21, 23, 25].

Moreover, some of these master’s programs offer in-depth studies in peritoneal dialysis, including the utility of tele-dialysis [22, 24, 27]. Finally, one advanced training course [28] specifically focuses on providing home dialysis care, an aspect not covered by other training courses, emphasizing the presence of specialized nurses in community settings and not just within hospital environments (Table 2).

University	PHYS	HD	PD	KT	OR	ICU	PLF	PED	COMM	VA	TECH	RES	NUTR	ETH	THER	MGMT	PALL	PRED	PA
University "A"	♦	♦		♦	♦	♦				♦									
University "B"		♦		♦										♦					
University "C"	♦	♦		♦					♦	♦		♦	♦						♦
University "D"	♦		♦	♦						♦	♦		♦	♦		♦		♦	
University "E"	♦		♦	♦		♦				♦	♦		♦	♦		♦		♦	
University "F"	♦	♦	♦	♦						♦				♦	♦				
University "G"	♦			♦		♦		♦		♦	♦		♦		♦	♦			
University "H"	♦	♦							♦	♦			♦	♦	♦	♦			
University "I"	♦	♦				♦				♦									
University "L"	♦	♦	♦	♦									♦						
University "M"	♦	♦	♦	♦										♦					
University "N"	♦	♦								♦	♦					♦			
University "O"	♦	♦				♦				♦	♦					♦			

Table 2. Teachings of Postgraduate Courses in Nephrology and Dialysis.

Legend: PHYS = pathophysiology of kidney diseases; HD = hemodialysis; PD = peritoneal dialysis; KT = kidney transplantation; OR = nephrology nursing care in the operating room; ICU = nephrology nursing care in intensive care; PLF = plasmapheresis; PED = pediatric dialysis; COMM = community/home nephrology nursing care; VA = vascular access management; TECH = new technologies; RES = research; NUTR = diet therapy; ETH = ethics; THER = therapeutic relationship; MGMT = management; PALL = nephrology palliative care; PRED = pre-dialysis; PA = physical activity.

On-the-job training courses in the clinical-care field

Two studies [29, 30] have identified that clinical-care field training plays an essential role in acquiring technical and professional skills for nephrology and dialysis nurses. New nurses are directly placed in clinical settings to apply their theoretical knowledge, while experienced nurses act as tutors, teaching specific skills such as vascular access management and conducting dialysis sessions [29]. Specifically, in the two analyzed studies [29, 30] it is highlighted that professional training for nephrology and dialysis nurses primarily takes place in hospital wards or dialysis clinics, with mentorship periods ranging from three to six months. The same authors also noted the integration of specific training aimed at gaining additional experience to manage services such as on-call duty and telephone support for home dialysis patients. An additional study [31] evaluated the potential of incorporating training sessions within the multidisciplinary nephrology and dialysis team, focusing on vascular access management, intensive care treatments, kidney transplantation, and peritoneal dialysis. These sessions facilitated the sharing of clinical-care protocols and the review of operating procedures, enhancing staff competencies and promoting greater awareness and safety among all professionals. Lastly, the study by Andreoli [30], evaluated postgraduate training for dialysis nurses, highlighting specific issues related to the lack of a structured and shared pathway, even with relevant Scientific Societies. This pathway would define the timeframes, methods, and specific basic skills that new nurses should acquire during their professional induction in these specialized areas.

Discussion

This narrative review aimed to analyze postgraduate academic training pathways and clinical-care field training in nephrology and dialysis nursing in Italy. The results revealed significant

heterogeneity in nephrology nursing education across the country, particularly in postgraduate programs offered through first-level master's degrees, second-level master's degrees, and advanced training courses at various academic institutions and training schools. The analysis of the training programs identified core teachings common to all pathways, including the pathophysiology of kidney diseases, hemodialysis, peritoneal dialysis, and dialysis nursing care. However, significant disparities emerged regarding specific topics such as kidney transplantation, vascular access management, and renal palliative care, which are not uniformly covered by all programs [16, 28].

The development of dedicated master's degrees in CKD treatment are essential for specific training. Educational programs should focus on aspects of disease management such as nephrological therapy, nutritional education and control, hydration management, and communication, promoting learning of each aspect of multidimensional patient management [32].

Similarly, there is a notable lack of teachings on essential topics for managing this population, such as renal palliative care and pediatric dialysis. Additionally, the therapeutic relationship is addressed by very few of the identified institutions. In the clinical field, specific areas of competence, such as hemodialysis in intensive care settings and apheresis techniques like plasmapheresis, are minimally or not covered in most of the training programs examined. This may be because these teachings could be addressed in other postgraduate or specialized courses, such as first-level master's degrees in critical care. A significant aspect to highlight is territorial nephrology nursing care, which is addressed by only two of the examined postgraduate courses: a first-level master's degree [18] and an advanced training course [28]. The latter specifically targets family and community nurses or operators working in residential facilities that accommodate dialysis patients, particularly elderly non-autonomous individuals. Given the growing importance of nursing care at the community level, and consequently, the significance of home hemodialysis and peritoneal dialysis, the inclusion of this topic, considering its constant increase, could represent a highly relevant teaching area [33]. This aligns with the evolving regulations and organizational framework of the National Health Service towards proximity care. It would result in the training of professionals equipped with specialized nephrology knowledge in areas currently managed predominantly by community health services. Another aspect overlooked by the examined postgraduate training programs is the promotion of physical activity for these patients. Encouraging physical activity is crucial for improving the quality of life and reducing the risk of cardiovascular diseases in nephrology patients [34]. Additionally, nephrology nursing research is another area that is inadequately addressed. Emphasizing this area is essential to ensure patient care is based on the best scientific evidence. The heterogeneity of the training programs highlighted could be attributed to the vast array of topics that need to be covered. However, this inconsistency could be addressed by considering the conclusions of a previous study [10] conducted by EDTNA/ERCA Italian Branch, which identified six specific areas of nephrology care (outpatient, inpatient, peritoneal dialysis, hemodialysis, critical care, and transplants). These areas could serve as a common foundation for all training programs, integrating with additional technical-specialist teachings to further enrich the postgraduate pathway.

Another aspect analyzed in the postgraduate training programs was the method of delivering educational content and the type of internship provided. In this regard, distance learning or blended learning significantly facilitates the accessibility of theoretical content for students. However, it is important to consider that many topics are clinical and application-based in nature. This variation could lead to a potential bias among different courses, as teaching technical content requires both theoretical instruction and hands-on field training. Comprehensive coverage of these topics necessitates in-person activities such as seminars, simulation exercises, or specialized on-site internships. However, not all master's programs offer these in-person components [35].

Similarly, considering the European context, the analysis conducted by the Association of Nephrology Nurses UK (ANN UK) on nephrology nurse training revealed that the diversity of courses offered by institutions is due to the lack of a nationally accredited program. This study highlighted that in the UK, various universities provide courses, both in-person and online, aimed at achieving a level of “nephrology specialization” equivalent to level six (Senior Practitioner). This flexibility among academic institutions has arisen due to the lack of national standardization in nephrology nursing education [36].

Ultimately, it is crucial to recognize the vital role of clinical-care training in the field of nephrology and dialysis, given the technical and specialized nature of this discipline. This training not only prepares new hires for effective integration into various nephrology settings but also ensures continuous professional development for practitioners in the field. This is particularly relevant considering the ongoing technological advancements aimed at improving the performance and quality of renal therapies, as well as the expansion of specialization towards community-based care.

Moreover, continuous education represents one of the fundamental pillars for ensuring optimal patient care and promoting professional development in nephrology nursing. This concept is supported by previous studies that highlight the importance of recognizing specialization and professional affiliation as key elements for maintaining high standards of care and competence in the nephrology sector [10, 30, 37]. However, it should be noted that continuous education and professional development are not solely individual responsibilities but require institutional and organizational commitment to ensure access to adequate training programs and sufficient resources to support these activities [38].

An included study [31] also highlighted the importance of a multidisciplinary approach in the management of CKD. Adopting a multidisciplinary team (MDT) can ensure better care of chronic kidney disease and a reduction in its progression. Bayliss et al., in a cohort study compared 1769 persons referred for usual nephrology care versus 233 referred for MDT care: the study demonstrated that MDT care was associated with a mean annual decline in Glomerular Filtration Rate (GFR) [39]. The multidisciplinary team is also essential in the processes of therapeutic education and on CKD progression. An open-label, controlled cohort study demonstrated how multidisciplinary predialysis education (MPE) in accordance with the guidelines of the National Kidney Foundation Dialysis Outcomes Quality Initiative (NKF/DOQI) improves the post-dialysis outcomes of CKD patients and decreases the incidence of dialysis and reduces mortality in late-stage [40]. A recent cohort study [41] evaluated the effect of medical cooperation on all-cause mortality and renal prognosis in CKD patients; the results suggest that multidisciplinary cooperation influences the quality of medical care in CKD patients.

Very recently, the experience of the “case manager” nurse of renal diseases is increasingly asserting itself, able to act in synergy with the Nephrologist to reduce morbidity, increase compliance and improve the outcome of treatments [42].

A nurse trained in Nephrological care will always know how to avoid major complications of venous or arteriovenous access, save the vascular heritage, how to suggest an adequate diet, how to teach correct urinary collection, how to set up an adequate therapeutic plan for the nephropathic patient in its various forms [42]. In the case of hospitalization in a non-nephrological setting, the training of nurses on renal topics can make even more significant differences in patient outcomes.

In this sense, the training of healthcare professionals in multidisciplinary teams is of great importance to improve the quality of interventions. A recent study states that there is a need to strengthen on-the-job training through education for primary care physicians, including interactive workshops and symposiums on the guidelines [41].

Additionally, the active involvement of academic institutions, professional organizations, and health authorities is essential to develop and promote targeted training programs that address emerging needs in the field of nephrology and dialysis. This ensures better care for patients with nephrological conditions and their caregivers.

Study Limitations and Future Perspectives

The main limitation of this narrative review is the limited availability of studies specifically dedicated to nephrology competencies and nephrology and dialysis nursing training programs in Italy. Another limitation to consider is the source of the evidence gathered, particularly concerning the training programs obtained from the websites of various universities or institutional online sources. These sources may not comprehensively reflect the content of the individual postgraduate programs analyzed and may not be fully available or accessible online, which could limit the findings of this review.

In line with the recommendations of the FNOPI 2023 Consensus Conference [43], it becomes essential to ensure uniformity in postgraduate training programs by orienting towards nursing specializations through a clinically focused master's degree. Specifically, nephrology competencies could be incorporated into various specialization programs or acquired through an "additional" highly specialized training pathway, such as a Second-Level master's degree. This approach would ensure that nurses develop advanced skills necessary to meet the complex needs of patients and to manage cross-cutting care issues in nephrology clinical settings. A clinically focused master's degree integrates clinical competencies with research, organization, training, and education skills, providing a comprehensive and specialized preparation aligned with the current healthcare system's needs. Moreover, this framework aligns with the International Council of Nurses (ICN) [44] recommendations regarding the advanced and specialized role of nurses, aimed at establishing high and uniform standards, ensuring an integrated and advanced approach in managing clinical issues and health needs associated with various contexts of nephrology nursing care.

Conclusions

This narrative review highlights the high complexity of nephrology nursing education, reflecting the diverse clinical areas in which nephrology and dialysis nurses work. There is a pressing need for a unified definition of the competencies required for nephrology and dialysis nurses. Establishing such a definition would provide a foundational basis for Italian universities and healthcare facilities to strategically plan and implement training programs for nephrology nurses.

Furthermore, it is essential to consider the continuous technological advancements in the nephrology field. Integrating these advancements into the curriculum of clinically focused master's degrees would not only enhance the competencies of nephrology nurses but also promote national nursing research in nephrology and dialysis. This strategic approach will ensure that nurses are well-prepared to meet the complex needs of patients and contribute to the advancement of nephrology nursing care.

BIBLIOGRAPHY

1. Romagnani P, Remuzzi G, Glassock R, Levin A, Jager KJ, Tonelli M, et al. Chronic kidney disease. *Nat Rev Dis Primers*. 2017 Nov 23; 3:17088. <https://doi.org/10.1038/nrdp.2017.88>.
2. Saucedo AL, Marlene Marisol Perales-Quintana, Paniagua-Vega D, Concepción Sánchez-Martínez, Cordero-Pérez P, Noemí Waksman Minsky Chronic Kidney Disease and the Search for New Biomarkers for Early Diagnosis. *Current Medicinal Chemistry*. 2018 25(31):3719–3747. <https://doi.org/10.2174/0929867325666180307110908>.
3. Bidani, AK, Griffin, KA. Pathophysiology of hypertensive renal damage: implications for therapy. *Hypertension* 2004;44: 595–601. <https://doi.org/10.1161/01.HYP.0000145180.38707.84>.
4. Thomas MC, Brownlee M, Susztak K, Sharma K, Jandeleit-Dahm KA, Zoungas S, Rossing P. Diabetic kidney disease. *Nat Rev Dis Primers*. 2015 Jul 30; 1:15018. <https://doi.org/10.1038/nrdp.2015.18>.
5. Villacorta J, Diaz-Crespo F, Acevedo M, Cavero T, Guerrero C, Praga M. Renal vasculitis presenting with acute kidney injury. *Rheumatol Int*. 2017 Jun;37(6):1035-1041. <https://doi.org/10.1007/s00296-017-3697-2>.
6. Bergmann C, Guay-Woodford LM, Harris PC, Horie S, Peters DJM, Torres VE. Polycystic kidney disease. *Nat Rev Dis Primers*. 2018 Dec 6; 4(1):50. <https://doi.org/10.1038/s41572-018-0047-y>.
7. Kim CS, Kim B, Suh SH, Oh TR, Kim M, Choi HS. Risk of Kidney Failure in Patients With Cancer: A South Korean Population-Based Cohort Study. *Am J Kidney Dis*. 2022 Apr;79(4):507-517.e1. <https://doi.org/10.1053/j.ajkd.2021.06.024>.
8. Ammirati AL. Chronic Kidney Disease. *Revista da Associação Médica Brasileira*. 2020 66(suppl 1): s03–s09. <https://doi.org/10.1590/1806-9282.66.s1.3>.
9. Eck van der Sluijs A, Vonk S, van Jaarsveld BC, Bonenkamp AA, Abrahams AC. Good practices for dialysis education, treatment, and eHealth: A scoping review. *PLoS One*. 2021 Aug 1;16(8):e0255734. <https://doi.org/10.1371/journal.pone.0255734>.
10. Pegoraro M, Zito MP, Galeotti P, Delalio A, Rossi F, Guadagno V. Infermieristica Nefrologica: Competenze Assistenziali Generali e Specifiche. *Giornale di Tecniche Nefrologiche e Dialitiche* [Internet]. Aboutscience Srl; 2014 Jan;26(1):42–49. Available from: <http://dx.doi.org/10.5301/gtnd.2014.12110>.
11. Hassan A.M.A, Elgamil A.E.E., Yakout R.A. Nurses' Knowledge and Practices toward Patients Undergoing. *ASNJ*. 2022; Vol.24 No.1. <https://doi.org/10.21608/asalexu.2022.246007>.
12. Batista AF, Caminha M de FC, Silva CC, Sales CC da S. Conhecimento, Atitude E Prática Dos Cuidadores De Crianças E Adolescentes Em Hemodiálise Ou Diálise Peritoneal. *Revista Eletrônica De Enfermagem*. 2016; 18. <https://doi.org/10.5216/ree.v18.34269>.
13. Camedda C, Bici G, Magi CE, Guzzon A, Longobucco Y. The Therapeutic Nurse-Patient Relationship in Hemodialysis: A Pilot Mixed-Method Study on the Perceived Quality of Nurses' Attitudes and Caring Behaviors. *Nurs Rep*. 2023 Jul 20;13(3):990-1003. <https://doi.org/10.3390/nursrep13030087>.
14. McCrory G, Patton D, Moore Z, O'Connor T, Nugent L. The impact of advanced nurse practitioners on patient outcomes in chronic kidney disease: A systematic review. *J Ren Care*. 2018 Dec;44(4):197-209. <https://doi.org/10.1111/jorc.12245>.
15. McCrory G, Patton D, Moore Z, O'Connor T, Nugent L. The impact of advanced nurse practitioners on patient outcomes in chronic kidney disease: A systematic review. *J Ren Care*. 2018 Dec;44(4):197-209. <https://doi.org/10.1111/jorc.12245>.
16. Trapianti d'organo ed emodialisi: Struttura e programma didattico | Università Cattolica [Internet]. Università Cattolica del Sacro Cuore. Available from: <https://www.unicatt.it/master-trapianti-d-organo-ed-emodialisi-struttura-e-programma-didattico>.
17. Master universitario di Primo livello in Nefropatie, dialisi e patologie cardiovascolari. Piano Formativo. [Internet]. Sapienza Università di Roma Available from: https://www.uniroma1.it/sites/default/files/piano_formativo_26769_0.pdf.
18. Nefrologia e dialisi per infermieri. [Internet]. Università di Torino Available from: <https://www.unito.it/ugov/degree/51404>.
19. Master Infermieristica avanzata in Nefrologia: Dialisi, Trapianti e Cure complesse | UniPegaso [Internet]. Università Telematica Pegaso. Available from: <https://www.unipegaso.it/master-1-livello/infermieristica-avanzata-in-nefrologia-dialisi-trapianti-e-cure-complesse>.
20. Organizzazione e Gestione dell'Assistenza Nefro-Dialitica Ospedaliera e Domiciliare – LUM School of Management [Internet]. LUM School of Management. 2024. Available from: <https://management.lum.it/master/organizzazione-e-gestione-dellassistenza-nefro-dialitica-ospedaliera-e-domiciliare/>.
21. Master I livello in depurazione extracorporea nel paziente critico (DEAC) [internet]. UNIPD – Università di Padova. Available from: <https://uel.unipd.it/master-e-corsi/deac-depurazione-extracorporea-nel-paziente-critico/>
22. Master I livello in Nutrizione e Dietetica in Nefrologia [internet] Università di Pisa. Available

- from:
<https://www.unipi.it/index.php/master/dettaglio/4229>.
23. Master I livello in Purificazione ematica extracorporea nel paziente critico [internet]. Università degli studi di Firenze. Available from: <https://e-l.unifi.it/enrol/index.php?id=26744>.
 24. Corso di perfezionamento in Infermiere per dialisi domiciliare [internet]. Università degli studi di Pavia. Available from: <https://web.unipv.it/wp-content/uploads/2021/09/All-2-al-BD-Infermiere-per-dialisi-domiciliare-rivisto.pdf>.
 25. Master I livello in Tecniche per accessi vascolari e Tecnologie nell'assistenza in area critica cardiovascolare [internet] UMG – UniCZ. Available from: <https://sites.google.com/unicz.it/altaformazione/2023-2024/m1/446>.
 26. Master di I livello Infermieristico in Terapie Dialitiche [internet] Università degli studi della Campania “Luigi Vanvitelli”. Available from: <https://www.unicampania.it/index.php/didattica/master/bandi-di-ammissione/9484-master-di-i-livello-in-terapie-dialitiche-a-a-2023-2024>.
 27. Master II livello in Update per dialisi peritoneale [internet] UMG – UniCZ. Available from: https://asi.unicz.it/altaformazione/front-end/pages/riepilogo?master_id=479.
 28. Master I livello in Dialisi Peritoneale: dalla teoria alla pratica [internet] UMG – UniCZ. Available from: https://asi.unicz.it/altaformazione/front-end/pages/riepilogo?master_id=441
 29. De Pietro C. Infermieri e nefrologia in Italia. *Giornale Italiano di Nefrologia*. 2010; 27(2): 178-187.
 30. Andreoli D. The Construction of Nephrology Nurse's Core Competencies between Problems and Safety. *Giornale Italiano Di Nefrologia*. 2022 Jul 26.
 31. Palmisano A, Greggio V, Corrain O, Del Vecchio A, Malagoli A, Dian S, Et Al. La Formazione Sul Campo Migliora La Consapevolezza E La Qualità Assistenziale. 2023. <https://sianitalia.it/wp-content/uploads/2023/06/R1-15-Ab-230508-PALMISANO.pdf>.
 32. Xia Huang, Yu Shi, HongMei Peng et al. Construction of a core competency evaluation index system for nurses specializing in chronic kidney disease management in China: a Delphi study, 25 August 2023, PREPRINT (Version 1) available at Research Square <https://doi.org/10.21203/rs.3.rs-3256896/v1>.
 33. Mendu ML, Divino-Filho JC, Vanholder R, Mitra S, Davies SJ, Jha V, Damron KC, Gallego D, Seger M; International Home Dialysis Roundtable Steering Committee. Expanding Utilization of Home Dialysis: An Action Agenda From the First International Home Dialysis Roundtable. *Kidney Med*. 2021 May 25;3(4):635-643. <https://doi.org/10.1016/j.xkme.2021.04.004>.
 34. Battaglia Y, Lamberti N, Piva G, Manfredini F, Storari A. L'esercizio fisico nella malattia renale cronica: una vecchia storia da raccontare o un efficace intervento da attuare? *G Ital Nefrol*. 2021; V 6 (1).
 35. Pikhart M, Klimova B, Cierniak-Emerych A, Dziuba S. A Comparative Analysis of Perceived Advantages and Disadvantages of Online Learning. *Behav Sci (Basel)*. 2023 Mar 16;13(3):262. <https://doi.org/10.3390/bs13030262>.
 36. Richards CA. Education, certification, and professional membership can help with career goals. *Nephrology news & issues*. 2016; 30:5.
 37. Giannerini D, Rossi F, Bocci Benucci S, Pertici M, Troiani S, Sanchez Pisfil J, et al. Specialità E Professioni a Colloquio Le Competenze Specialistiche dell'infermiere in emodialisi: Report Di Una Indagine esplorativa. Una Sfida per Il Riconoscimento Professionale. *G Ital Nefrol*. 2020;37 (5) 11.
 38. Price S, Reichert C. The Importance of Continuing Professional Development to Career Satisfaction and Patient Care: Meeting the Needs of Novice to Mid- to Late-Career Nurses throughout Their Career Span. *Administrative Sciences*. 2017; 7(2):17. <https://doi.org/10.3390/admsci7020017>.
 39. Bayliss EA, Bhardwaja B, Ross C, Beck A, Lanese DM. Multidisciplinary team care may slow the rate of decline in renal function. *Clin J Am Soc Nephrol*. 2011 Apr;6(4):704-10. <https://doi.org/10.2215/CJN.06610810>.
 40. Wu IW, Wang SY, Hsu KH, Lee CC, Sun CY, Tsai CJ, Wu MS. Multidisciplinary predialysis education decreases the incidence of dialysis and reduces mortality—a controlled cohort study based on the NKF/DOQI guidelines. *Nephrol Dial Transplant*. 2009 Nov;24(11):3426-33. <https://doi.org/10.1093/ndt/gfp259>.
 41. Onishi Y, Uchida HA, Maeshima Y, Okuyama Y, Otaka N, Ujike H, et al. The Effect of Medical Cooperation in the CKD Patients: 10-Year Multicenter Cohort Study. *J Pers Med*. 2023 Mar 26;13(4):582. <https://doi.org/10.3390/jpm13040582>.
 42. Quintaliani G, Gambirasio C, Strippoli G. Ci sono differenze nel trattamento del nefropatico se il paziente è ricoverato in medicina o in nefrologia? Sì le differenze sono notevoli Are there differences in the treatment of kidney patients if they are admitted to general medicine vs nephrology units? Yes, and they are significant. *G Ital Nefrol*. 2010 Jan-Feb;27(1):10-9.
 43. Federazione Nazionale Ordine delle Professioni Infermieristiche FNOPI. Consensus Conference 2023. 2023; 20:4. Available at: https://www.fnopi.it/wp-content/uploads/2023/02/FNOPI_Consensus-2023.pdf

44. International Council of Nurses. Guidelines on advanced practice nursing. 2020; Geneva: ICN. Available at:

https://www.icn.ch/system/files/documents/2020-04/ICN_APN%20Report_EN_WEB.pdf