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The evolution of nephrology practice in Egypt: legacy, current challenges, and future directions—a narrative review

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ABSTRACT

Egypt, home to over 114 million people, hosts a diverse and expanding nephrology landscape, anchored by leading academic institutions and tertiary care centers that provide services across the full spectrum of kidney disease—from acute kidney injury (AKI) and chronic kidney disease (CKD) to dialysis and transplantation. Some centers have earned international recognition for their scientific contributions and attract referrals from across the region. Notwithstanding the range of services offered, the Egyptian healthcare system—which includes insurance-based, commercial, and governmental models—faces significant obstacles, such as unequal access to care, a lack of adequate data infrastructure, and resource limitations. This narrative review, authored by a multidisciplinary team of Egyptian nephrology experts, provides a comprehensive overview of nephrology care in Egypt, highlighting current strengths, identifying key challenges, and offering future-oriented solutions to advance kidney health nationwide. It aims to serve as a roadmap for policymakers, stakeholders, clinicians, and researchers committed to improving nephrology care delivery in Egypt and shaping a more equitable, enhanced, and sustainable future.

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Introduction

Egypt, one of the most populous countries in the Middle East, has a distinct healthcare landscape shaped by its economic status, environmental factors, and healthcare infrastructure. As a lower-middle-income country with healthcare expenditure at ~4.6% of Gross Domestic Products, Egypt faces significant challenges in providing equitable access to nephrology care. The country has a high burden of kidney disease, with chronic kidney disease (CKD) affecting an estimated 13% of the population. However, the true prevalence remains uncertain due to the absence of a national CKD registry. Environmental and occupational exposures further contribute to kidney disease risk, with water pollution from the Nile River, heavy metal contamination, and pesticide exposure among agricultural workers playing a substantial role in disease progression. Nephrology services in Egypt are extensive, with several university and tertiary care hospitals providing specialized care in acute kidney injury (AKI), CKD, dialysis, and transplantation. However, access to care is highly variable. While dialysis is largely funded by the government, early CKD management and post-transplant immunosuppression often require out-of-pocket expenses, limiting early intervention and long-term transplant success. Rural and underserved areas remain particularly affected, as most nephrology centers are concentrated in major urban regions, such as Cairo and Alexandria. Furthermore, while Egypt has one of the highest dialysis populations globally, peritoneal dialysis remains significantly underutilized due to financial constraints and limited provider expertise. Kidney transplantation is similarly challenged by the lack of a deceased donor program, resulting in an overwhelming reliance on living-related donation [1–4]. Egypt receives international referrals from neighboring countries to avail the nephrology services.

This review, authored by a multidisciplinary team of Egyptian nephrology specialists, provides a comprehensive analysis of nephrology practice in Egypt, exploring the

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strengths and challenges of the current system while proposing expert-driven solutions for future improvements. It is structured around five key areas: AKI, CKD, dialysis, transplantation, and a glimpse of future directions (including education, research, and emerging innovations).

Domain 1: AKI in Egypt: epidemiology, facts, challenges, and opportunities

AKI is largely preventable, particularly in developing countries, where prevention is crucial to reduce morbidity and mortality. The International Society of Nephrology's (ISN) '0 by 25' initiative aims to eliminate preventable AKI by 2025 [5]. However, a snapshot from the ISN reveals a significant underestimation of the AKI burden in Egypt [6].

Epidemiology and burden of AKI in Egypt

The epidemiology of AKI in developing countries differs from that in developed nations. In Egypt, AKI is primarily community-acquired, offering a potential for effective prevention. The disease typically affects younger individuals, with various environmental and socioeconomic factors unique to developing regions [7].

Figure 1 illustrates the multiple factors influencing AKI care in Egypt. The exact incidence of AKI in Egypt is unclear due to the lack of large-scale epidemiological studies, with most research being small, single-center reports. One study found the incidence of AKI in intensive care unit (ICU) patients ranges from 16 to 39.6% [2,8], while another study found an AKI incidence of 0.59% among pregnant women [9].

Risk factors for developing AKI

Elderly age, smoking, and excessive use of herbal medicines are known risk factors for AKI in Egypt [6,8]. Water pollution and waterborne infections are other significant contributors to AKI. Egypt's main water source is the Nile River, with an allocation of 55.5 km^3 under the 1959 Nile Agreement with Sudan [10]. However, population and agricultural growth, coupled with the construction of the Grand Ethiopian Renaissance Dam (GERD), are creating a mismatch between water supply and demand [11]. This has led Egypt to import 'virtual water', with imports reaching 40 km^3 in 2010 and expected to rise [10,12].

Water pollution remains a significant issue, particularly in rural and impoverished areas, raising the risk of kidney damage from heavy metal exposure [13]. Studies have shown that the Nile River is heavily polluted with protozoa, parasites, and heavy metals, further exacerbating health risks [14,15]. Water pollution remains a significant issue, particularly in rural and impoverished areas, raising the risk of kidney damage from heavy metal exposure [13]. Waterborne diseases, including diarrhea, are a major cause of AKI in developing countries, with Egypt also experiencing a high incidence of travelers' diarrhea [16].

Important epidemiological studies have demonstrated an increasing trend with diarrheal illness over the last years [15].

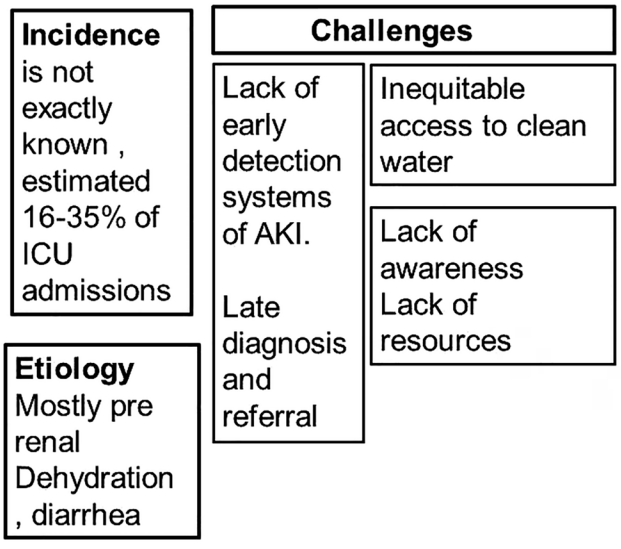

Figure 1. Overview and factors influencing AKI care in Egypt.

Diagnosis, prevention of AKI, and Egypt

Many AKI cases in the community present late, often when uremic symptoms appear. Locally adapted guidelines can account for regional variations in disease prevalence, resource availability, environmental exposures, and healthcare infrastructure, thereby offering more practical and implementable recommendations for frontline providers.

Egypt's healthcare system consists of both public and private sectors, with access largely determined by financial and economic resources. Kidney diseases, including AKI, are more prevalent in lower socio-economic groups (Figure 1). Effective AKI diagnosis requires timely monitoring of creatinine and eGFR, necessitating a robust health record-keeping system. One key suggested intervention revolving around this area is to enable telemedicine services and virtual consultations with nephrologists, extending specialized care to populations with limited access to renal services (Figure 2).

Management of AKI in Egypt

Managing AKI in Egypt remains challenging due to late diagnoses and limited healthcare access, especially in remote areas. However, tertiary care centers, including university and teaching hospitals, as well as elite private hospitals, generally adhere more closely to clinical guidelines.

Renal replacement therapy for AKI in Egypt

When AKI progresses to stage D and dialysis is required, access to dialysis is limited, especially in rural areas. Hemodialysis is the primary treatment modality for AKI, while continuous renal replacement therapy (CRRT) and slow low-efficiency dialysis (SLED) are used in critical care settings

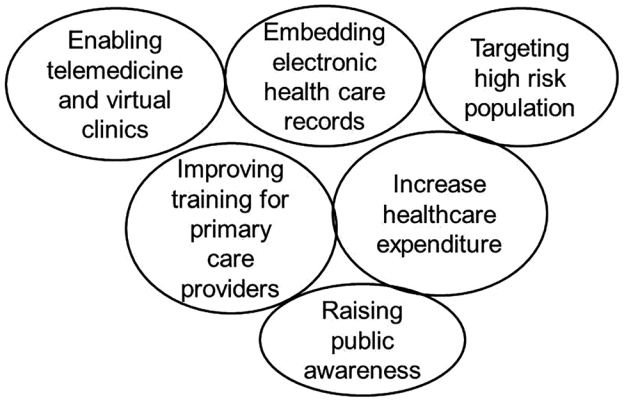

Figure 2. Suggested improvements—telemedicine implementation.

for patients with sepsis or hemodynamic instability. Peritoneal dialysis is not commonly used, except in pediatric settings (19). Therapeutic plasma exchange has also shown promise in treating critically ill AKI patients) [17].

Domain 2: The growing burden of CKD in Egypt—a model for resource-limited settings

CKD is a rising global health concern. This paper outlines the Egyptian model of CKD and dialysis care as a potential blueprint for resource-limited countries.

Historical and epidemiological overview

Recognition of kidney disease in Egypt dates back to ancient times when urine was used diagnostically by early physicians [18]. In the twentieth century, the development of blood tests and GFR estimation significantly enhanced diagnostic capabilities [19]. National efforts now focus on early detection and intervention to reduce the burden of end-stage kidney disease (ESKD), aiming to improve outcomes and quality of life.

Approximately 13% of adults in Egypt are affected by CKD [20], though the true prevalence remains uncertain due to the absence of a national registry for non-dialysis CKD [21]. In 2017, an estimated 7.1 million Egyptians were living with CKD [22]. Prevalence can be as high as 33% among individuals with hypertension [20]. Over the past decade, the burden of CKD in Egypt has increased by 36%, mirroring global trends that place CKD as the fifth leading cause of death worldwide [22]. Small-scale studies have reported microalbuminuria in 14.4% of screened populations, with CKD significantly associated with increased mortality in Egyptian patients [23,24].

Environmental and occupational risk factors

A significant portion of Egypt's population is employed in agriculture, an occupation increasingly associated with CKD due to exposure to pesticides and heavy metals. These substances disrupt key renal processes, such as carbonic anhydrase function and acid-base regulation, and are known to trigger oxidative stress in renal tissues [25].

The phenomenon of nontraditional CKD—seen in young agricultural workers in Central America and South Asia, particularly sugarcane harvesters—raises concerns about a similar risk profile in Egypt, which is also a major sugarcane producer [26]. However, this potential link remains under-researched.

CKD of unknown etiology (CKDu)

CKD of undetermined etiology (CKDu) represents a significant yet under-recognized public health threat. Often diagnosed late, it frequently presents as ESKD [27]. Studies have reported CKDu prevalence in Egypt as high as 15.2%, with regional variations: 21% in Beheira, 27% in Minya, and 32% in Minoufia governorates [28].

Part of this uncertainty arises from inconsistent application of KDIGO definitions and staging, likely resulting in underestimation of true prevalence. Accurate diagnosis of CKDu requires a comprehensive clinical evaluation to rule out established causes of CKD. This includes a detailed medical history, assessment of risk factors, such as diabetes, hypertension, and nephrotoxic exposures, along with laboratory investigations (e.g., urine studies, renal function tests, serologies), and imaging. A diagnosis of CKDu is made only after known etiologies have been systematically excluded. In older adults, the absence of clearly defined diagnostic thresholds for CKD further complicates accurate classification and may contribute to underreporting [29].

Late referral and underdiagnosis

Timely referral to nephrologists is essential for early CKD management. Yet, data from the 2020 Egyptian Renal Data System (ERDS) showed that 80% of ESKD patients on dialysis were referred late [30].

Evolution of CKD screening in Egypt

In the 1990s, CKD screening was virtually non-existent. The 2000s marked the first urban screening programs, led by the Egyptian Society of Nephrology and Transplantation (ESNT). During the 2010s, the Ministry of Health integrated CKD screening into primary care, increasing public awareness and promoting cost-effective testing methods [31]. In the 2020s, sophisticated screening methods and technological integration improved CKD detection accuracy.

Major milestones included the 2011 launch of the National Diabetes and Hypertension Program and the 2015 '100 Million Health' campaign, which screened 60 million residents for hepatitis C, hypertension, diabetes, and CKD at a cost of around US $115 million—demonstrating strong cost-effectiveness [32]. The hepatitis C, diabetes, hypertension, and CKD, This campaign covered 60 million people with the expenditure of about US $115 million and has been found to be highly cost-effective [32].

In 2020, Egypt launched the National CKD Registry to track prevalence and outcomes, although full implementation is still pending.

Barriers to CKD screening and care

Multiple structural, economic, and educational challenges hinder CKD screening in Egypt:

- **Healthcare infrastructure**: Many rural areas lack laboratory resources and trained personnel needed for CKD screening [33].
- **Geographic disparities**: Most nephrology services are concentrated in Cairo, Alexandria, and other urban centers, leaving rural populations underserved.
- **Public awareness**: Knowledge about CKD and its early detection remains limited.
- **Economic constraints**: The cost of tests can be prohibitive for uninsured individuals. As of 2021, healthcare expenditure represented only 4.61% of Egypt's gross national income, below the MENA average of 5.5% [34].

Egypt has announced plans to increase healthcare funding by 16% for the 2023/2024 fiscal year. The Universal Health Insurance (UHI) project, launched in 2019, aims to provide full coverage by 2027 [35]. Egypt is also actively collaborating with international partners, including the WHO and The Global Fund, and has established multiple academic and research partnerships [36].

Challenges for CKD management in Egypt

CKD care in Egypt faces numerous barriers:

- **Limited screening**: Widespread, regular screening is not yet standard.
- **High-risk behaviors**: Smoking, poor dietary habits, and low health literacy are prevalent.
- **Cost and access**: Many high-risk patients lack insurance coverage, and medication costs remain a major barrier.
- **Workforce shortages**: There is a shortage of nephrologists and a pattern of delayed referrals.
- **Lack of genetic testing**: There are no genetic screening programs for hereditary kidney disease.
- **Comorbidities**: CKD rarely occurs in isolation, making management more complex.

Despite these challenges, implementation of proven interventions—such as blood pressure control and the use of renin-angiotensin system blockers—remains the most effective and feasible approach in Egypt's healthcare context.

Domain 3: Dialysis in Egypt—challenges and opportunities

Incident hemodialysis in Egypt

Incident hemodialysis (HD) patients, newly diagnosed with ESKD, require urgent renal replacement therapy (RRT) and face high short-term mortality. Egypt ranks fourth globally in the number of newly diagnosed ESKD patients. As of 2016, more than 100,000 patients were on hemodialysis, with many awaiting transplantation [37,38].

Importance of early dialysis initiation

Early HD initiation can reduce mortality and improve outcomes, particularly when performed *via* arteriovenous access. Delays, especially in elderly patients, worsen the quality of life. More studies are needed to define optimal initiation timing, but Egypt's high mortality rates highlight the urgency of timely HD initiation [39].

Barriers to hemodialysis services

The prevalence of RRT in Egypt is 117 per million, predominantly *via* HD due to limited peritoneal dialysis (PD) capacity. Poor policy infrastructure and regulatory gaps contribute to the rising CKD and ESKD burden. Dialysis centers are unevenly distributed, overcrowded, and understaffed, increasing infection risks. Most centers lack multidisciplinary capacity, and many clinicians acquire HD knowledge through experience rather than formal training [39,40].

Opportunities for improving incident hemodialysis in Egypt

System-level interventions

Without systemic reforms, high morbidity and mortality will persist. The Ministry of Health should prioritize improved infrastructure, early screening, affordable care, and equitable access. Investment in training, community outreach, and public-private partnerships can expand service coverage, which currently reaches only 30% of the population. Remote monitoring could alleviate transportation burdens in rural areas. Public education campaigns and age-specific prevention programs may promote early intervention. Antiviral access and infection control measures should be widely implemented [41].

Policy and research priorities

To improve HD services, Egypt must increase healthcare funding, expand and upgrade dialysis centers, offer affordable insurance, and implement a structured referral system. Protocols for equitable service distribution and staff training are crucial. Psychosocial support, outside of clinical care, must also be addressed. Future research should evaluate the impact of policy changes and explore innovative care models.

Vascular access for HD in Egypt

Effective HD requires reliable vascular access—typically *via* arteriovenous fistulas (AVF) or grafts (AVG). Central venous catheters (CVC) are commonly used in Egypt despite their association with higher complication rates [37,42].

Current status of vascular access for hemodialysis in Egypt

Egypt lacks a national registry or electronic surveillance system for vascular access. AVF use remains suboptimal, and most patients initiate dialysis without pre-planned access. Ultrasound is used in only 6% of cases. Access type often varies by region and facility capacity, with CVC being the default in many units. Informal surveys confirm substantial geographic variation and limited sterile handling protocols [43]. Tunneled vascular access is also offered at major tertiary care centers, where it can be placed by interventional radiologists or experienced nephrologists [44]. Highly skilled nephrologists have also successfully used the transhepatic approach to place permanent catheters for dialysis in patients with exhausted vascular access options [45].

Challenges in providing adequate vascular access in Egypt

CVC use leads to high infection, thrombosis, and stenosis rates. AVF maturation delays further compromise care. The shortage of trained providers, limited budgets, and inadequate training contribute to poor outcomes. These systemic issues are exacerbated by poverty and lack of awareness—common in many low-resource settings [46–48].

Pathways for improvement, innovation and future directions in vascular access for hemodialysis

Despite current limitations, opportunities exist to improve vascular access services. Technologies like magnetic resonance angiography, ultrasonography, and carbon dioxide arteriography can enhance access evaluation and creation. Introducing temporary AVF techniques and establishing standardized training programs—with support from international partners—can raise care quality [49,50]. A hybrid approach combining modern tools and increased provider training is essential. Educational initiatives to promote AVF over CVCs, as well as region-specific research, are needed. A centralized registry and surveillance efforts should guide future practice and policy.

Peritoneal dialysis in Egypt

Peritoneal dialysis (PD) is a home-based therapy for ESKD that offers advantages like hemodynamic stability and reduced anemia. Globally underutilized, PD remains particularly underused in low- and middle-income countries (LMICs), including Egypt [51,52]. Only ~1% of Egyptian dialysis patients use PD, despite the therapy being available in 45 hospitals. From 2016–2018, 13,000 patients started PD compared to 37,000 on HD. No formal training, certification, or national oversight exists for PD practice in Egypt. Utilization varies by institution and physician experience [52]. No formal training, certification, or national oversight exists for PD practice in Egypt. Utilization varies by institution and physician experience [40,53].

Barriers to PD implementation

Financial and logistical constraints

PD is hindered by poor patient affordability, rising inflation, and the devaluation of the Egyptian pound since March 2022. Patients struggle to afford supplies, labs, medications, and transportation. PD fluids are not subsidized by the government, and there is limited access to home health services. Supply chain disruptions, low provider awareness, and poor infection control, particularly high rates of peritonitis—further deter PD use [52,54]. Although the cost of peritoneal dialysis globally are less costly than hemodialysis., there is a significant cost to set up the service in Egypt as there has been much reliance about hemodialysis. Automated peritoneal dialysis and continuous ambulatory peritoneal dialysis are rarely used in Egypt.

Opportunities and recommendations for PD expansion

Egypt could benefit from national policy reform to allocate more resources to PD and kidney transplantation. PD can serve as a bridging therapy to transplant. Government subsidies and advocacy are needed to support catheter insertion and expand PD programs.

Public education campaigns can promote PD as a viable alternative to HD. Collaborations with international PD programs can help develop training pathways for healthcare professionals. Innovations like mobile dialysis clinics, compact cyclers, and virtual care platforms can improve rural accessibility and reduce peritonitis rates. These models require further study to ensure feasibility and sustainability [54,55]. Finally, PD has untapped potential in Egypt. A coordinated national effort involving stakeholders, investments in infrastructure, public-private partnerships, and rigorous research can drive PD growth. Education and awareness must be prioritized at all levels—from patients to providers—to ensure long-term adoption and improved ESKD outcomes.

Domain 4: Transplantation in Egypt

Kidney transplantation (KT) improves life expectancy and quality of life for patients with ESKD. Egypt's journey in organ transplantation began in 1976, with the first KT performed at the Urology and Nephrology Center (UNC) at Mansoura University [56]. Six months later, Cairo University followed suit with its first KT [57]. Between 1976 and 2011, ~10,000 KTs were performed. The annual average rose to 1,100 KTs/year between 2011 and 2016, primarily in Cairo, where most tertiary care services are located. The number of licensed KT centers also increased, from 12 in 1997 to 35 by 2016 [58].

Kidney transplantation models and hospital types in Egypt

There are three main types of healthcare institutions involved in KT in Egypt:

- **University-affiliated centers** (e.g., Cairo and Mansoura): These cover all transplant-related costs regardless of insurance.
- **Governmental non-university hospitals**: Costs are covered for patients with public insurance.
- **Private hospitals**: Costs are either fully or partially borne by insurance companies or patients.

- **Public hospitals**: They do not perform KTs but may supply post-transplant medications.

Most KTs are still from living-related donors [4]. Combined liver-kidney transplants are rare and limited to select cases. Stem cell transplantation in nephrology exists only in research settings [59].

Deceased donation: legislative progress, practical stagnation in Egypt

Egypt's only cadaveric KT was conducted in 1992 at Kasr El Aini Hospital, Cairo [60]. Although a 2010 law provided a legal foundation for deceased donation, implementation remains stalled due to the absence of a clear legal definition of death and persistent religious and cultural concerns [3]. To address this, the Egyptian Society of Nephrology and Transplantation (ESNT), in collaboration with the Ministry of Health, is working to establish a national renal transplant registry and an electronic donor registration system [3]. The Egyptian President has also directed the establishment of a regional organ transplant center, poised to be the largest in the MENA region, as part of the new medical city replacing Nasser Medical Institution.

Transplantation infrastructure and medical capacity

All KT centers require licensure. Most are housed within nephrology units and staffed with specialized nurses trained in dialysis and plasma exchange. Each transplant team must be separately licensed by its host hospital. While transplant teams typically include nephrologists and urologic surgeons (with vascular surgeons for complex cases), requirements for nutritionists or psychiatrists are not mandated. Immunologists often work in external facilities. Modern diagnostic and therapeutic facilities are available, including molecular HLA typing, antibody titration, and single-gene testing. Laparoscopic donor nephrectomy (LLDN) is widely practiced, although open donor nephrectomy (OLDN) remains in use [61]. All major immunosuppressive agents are accessible, including cyclosporine, everolimus, mycophenolate, and azathioprine. Induction with CsA and MMF is also utilized [62]. National guidelines recommend inactive immunizations against hepatitis B, *Haemophilus influenzae*, seasonal influenza, and meningococcus for KT recipients.

Legal framework

Prior to 2010, transplantation was governed by the Egyptian Medical Syndicate's ethical code [63]. Following pressure from international stakeholders, including representatives of the Istanbul Declaration in 2008, Egypt passed its first organ transplant legislation. The law established a 'Higher Committee for Organ Transplants' (7–11 experts) to regulate and oversee all transplantation activities. In 2017, the legislation was further amended to impose even harsher penalties [4]. It explicitly criminalizes organ trafficking and mandates hospital licensing, informed consent, and Supreme Committee approval for all KTs. Key legislative articles include:

- **Articles I–II**: All KT must comply with legal and medical standards.
- **Article III**: KTs from Egyptians to foreigners are prohibited, except for spouses.
- **Article IV**: Non-related donation is allowed only in critical cases with special approval.
- **Articles V–VIII**: Donation must be voluntary, uncompensated, and informed. Deceased donation is allowed only if pre-authorized by the donor in a documented request.

Financial landscape

KT is more costly than hemodialysis (HD), which is generally fully government-funded. In contrast, KT costs are fully covered only in university hospitals. Governmental and private hospitals offer partial coverage, with patients often bearing the cost of immunosuppression and follow-up care.

Sociocultural considerations

Despite legislative support for deceased donation since 2010, implementation has lagged due to strong cultural and religious resistance. Living non-related donation is generally more accepted than deceased donation. Efforts to shift public opinion—such as legal frameworks, religious endorsement, campaigns, and academic collaborations (e.g., with Barcelona University, 2014–2016)—have not yet achieved broad societal acceptance. A formal donor consent form was introduced by the Ministry of Health to encourage donation [3].

Research and innovation

Transplant centers across Egypt actively engage in research aimed at improving transplant outcomes and minimizing complications. However, gaps remain in structured pre- and post-transplant education and psychological support, especially for pediatric recipients transitioning into adolescence.

Ongoing challenges

Financial constraints

Economic instability, currency devaluation, and global supply disruptions have strained access to essential medical supplies. Many multinational pharmaceutical companies have exited the Egyptian market, forcing reliance on less potent generics.

Social determinants of health

(73) Poverty, low education, malnutrition, substandard housing, environmental hazards, and stress significantly impact kidney disease prevalence and outcomes. National and global crises—including wars in Ukraine and Gaza—have disrupted care, particularly for dialysis and KT patients, and contributed to mass displacement and suffering [64].

Educational gaps

The absence of comprehensive transplant education and psychological support programs remains a major barrier to optimal patient outcomes.

Lack of deceased donor program

Despite legal readiness, deceased donation has not been implemented. Public awareness, societal acceptance, and trust remain essential to unlocking the potential of cadaveric KT in Egypt.

Domain 5: Education and research in Egypt

As of 2015, Egypt had over 27 medical schools listed in the World Directory of Medical Schools [65]. Historically, most Egyptian medical schools followed a French-inspired model consisting of a six-year undergraduate program. In recent years, however, this structure has been revised to a five-year program across most institutions. Nephrology is introduced during undergraduate medical training, though only at a basic level. Physicians seeking specialization in nephrology must complete general internal medicine training, followed by advanced nephrology training. Recently, the Egyptian Board/Fellowship of Nephrology was established, offering a comprehensive curriculum encompassing various nephrology subspecialties.

Egypt benefits from international support, particularly from the International Society of Nephrology (ISN), which fosters educational and clinical collaborations through multiple sister center programs.

Nephrology research in Egypt is active and supported by several universities and teaching hospitals, often through academic degree programs. However, critical gaps remain. Most epidemiological studies are limited in scope, primarily due to the absence of a national renal registry. This shortcoming hampers the development of evidence-based, locally tailored clinical guidelines and limits understanding of disease prevalence and treatment efficacy among Egyptian kidney patients.

Clinical trials involving new therapies, technologies, and genetic studies are emerging but remain insufficient to ensure adequate representation of the Egyptian population in global nephrology research and drug development.

Conclusion

Nephrology care in Egypt has seen notable progress in medical education and clinical practice, supported by robust training programs and expanding research efforts. Despite these advances, the field faces persistent challenges including scarce national health data, minimal representation in international studies, and a need for locally adapted treatment guidelines. For continued growth, strategic priorities should include modernizing research infrastructure, fostering global academic partnerships, and implementing cutting-edge tools like artificial intelligence. These steps will help develop a more comprehensive and accessible nephrology framework to better serve Egypt's population.

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References

[1] Nagib SN, Abdelwahab S, Amin GEE, et al. Screening and early detection of chronic kidney disease at primary healthcare. Clin Exp Hypertens. 2021;43(5):416–418. doi: 10.1080/10641963.2021.1896726.
[2] Hafez MZE, Kassem SA, Saleh SA. Epidemiology of acute kidney injury in intensive care units in Aswan University Hospital. EJHM. 2020;78(2):265–270. doi: 10.21608/ejhm.2020.70968.
[3] Hafez MH. Road to deceased donor transplantation in Egypt. Exp Clin Transplant. 2024;22(Suppl 4):33–36. doi: 10.6002/ect.BDCDSymp.L17.
[4] Shokeir AA, Hassan S, Shehab T, et al. Egyptian clinical practice guideline for kidney transplantation. Arab J Urol. 2021;19(2):105–122. doi: 10.1080/2090598X.2020.1868657.
[5] Mehta RL, Cerdá J, Burdmann EA, et al. International Society of Nephrology's 0 by 25 initiative for acute kid-

ney injury (zero preventable deaths by 2025): a human rights case for nephrology. Lancet. 2015;385(9987):2616–2643. doi: 10.1016/S0140-6736(15)60126-X.

[6] Elrggal ME, Shemies RS, Hassanein M. Global perspectives in acute kidney injury: Egypt. Kidney360. 2024;5(5):761–764. doi: 10.34067/KID.0000000000000418.

[7] Kashani K, Macedo E, Burdmann EA, et al. Acute kidney injury risk assessment: differences and similarities between resource-limited and resource-rich countries. Kidney Int Rep. 2017;2(4):519–529. doi: 10.1016/j.ekir.2017.03.014.

[8] Abd ElHafeez S, Tripepi G, Quinn R, et al. Risk, predictors, and outcomes of acute kidney injury in patients admitted to intensive care units in Egypt. Sci Rep. 2017;7(1):17163–17167. doi: 10.1038/s41598-017-17264-7.

[9] Elshinnawy HA, Aref HM, Rezk KM, et al. Study of pregnancy related AKI in Egyptian patients: incidence, risk factors and outcome. QJM. 2020;113:hcaa052.016.

[10] Nikiel CA, Eltahir EAB. Past and future trends of Egypt's water consumption and its sources. Nat Commun. 2021;12(1):4508. doi: 10.1038/s41467-021-24747-9.

[11] Ahmed M, Abdelrehim R, Elshalkany M, et al. Impacts of the Grand Ethiopian Renaissance Dam on the Nile river's downstream reservoirs. J Hydrol. 2024;633:130952. doi: 10.1016/j.jhydrol.2024.130952.

[12] Salman SMA. The new state of South Sudan and the hydro-politics of the Nile Basin. Water Int. 2011;36(2):154–166. doi: 10.1080/02508060.2011.557997.

[13] Cerdá J, Bagga A, Kher V, et al. The contrasting characteristics of acute kidney injury in developed and developing countries. Nat Clin Pract Nephrol. 2008;4(3):138–153. doi: 10.1038/ncpneph0722.

[14] El-Kowrany S, El- Zamarany EA, El-Nouby K, et al. Water pollution in the Middle Nile Delta, Egypt: an environmental study. J Adv Res. 2016;7(5):781–794. doi: 10.1016/j.jare.2015.11.005.

[15] Saad-Hussein A, Helmy MA, Ellaithy LS, et al. Temporal trend of diarrhea morbidity rate with climate change: Egypt as a case study. Environ Sci Pollut Res Int. 2023;30(2):5059–5075. doi: 10.1007/s11356-022-22431-z.

[16] Batte A, Shahrin L, Claure-Del Granado R, et al. Infections and acute kidney injury: a global perspective. Semin Nephrol. 2023;43(5):151466. doi: 10.1016/j.semnephrol.2023.151466.

[17] Momtaz M, Fayed A, Marzouk K, et al. Therapeutic plasma exchange outcomes in Cairo University hospitals: 6 years experience. Ther Apher Dial. 2018;22(6):666–673. doi: 10.1111/1744-9987.12710.

[18] The Editors of Encyclopaedia Britannica. Ebers papyrus. Encyclopedia Britannica; 2019 [cited 2024 Nov 19]. Available from: https://www.britannica.com/topic/Ebers-papyrus

[19] Levin A, Ahmed SB, Carrero JJ, et al. Executive summary of the KDIGO 2024 clinical practice guideline for the evaluation and management of chronic kidney disease: known knowns and known unknowns. Kidney Int. 2024;105(4):684–701. doi: 10.1016/j.kint.2023.10.016.

[20] Nagib SN, Abdelwahab S, Amin GEE, et al. What is the prevalence of chronic kidney disease among hypertensive non-diabetic Egyptian patients attending primary healthcare? Clin Exp Hypertens. 2023;45:2203411.

[21] Gawad MA, Yousri NM, Hammad M. Renal registry for chronic kidney disease patients in Egypt: causes and comorbidities, data from a private clinic in an urban area. J Egypt Soc Nephrol Transplant. 2024;24(1):54. doi: 10.4103/jesnt.jesnt_21_23.

[22] Farag YMK, El-Sayed E. Global dialysis perspective: Egypt. Kidney360. 2022;3(7):1263–1268. doi: 10.34067/KID.0007482021.

[23] Yamany A, Shehata H, Essameldin M, et al. Screening of incidental kidney disease in normoglycemic, normotensive healthy adults. Egypt J Intern Med. 2017;29(3):127–131. doi: 10.4103/ejim.ejim_35_17.

[24] Abu Salem ME, El Batanony MA, Mahrous OA, et al. The role of microalbuminuria in population screening for chronic kidney disease in an Egyptian village. Menoufia Med J. 2013;26(1):18–22.

[25] Farag YMK, Karai Subramanian K, Singh VA, et al. Occupational risk factors for chronic kidney disease in Andhra Pradesh: 'Uddanam Nephropathy'. Ren Fail. 2020;42(1):1032–1041. doi: 10.1080/0886022X.2020.1824924.

[26] Nagai K. Environment and chronic kidney disease in farmers. Ren Replace Ther. 2021;7(1):55. doi: 10.1186/s41100-021-00377-1.

[27] Ben Khadda Z, Lahmamsi H, El Karmoudi Y, et al. Chronic kidney disease of unknown etiology: a global health threat in rural agricultural communities—prevalence, suspected causes, mechanisms, and prevention strategies. Pathophysiology. 2024;31(4):761–786. doi: 10.3390/pathophysiology31040052.

[28] El-Ballat M, El-Sayed M, Emam HK. Epidemiology of end stage renal disease patients on regular hemodialysis in El-Beheira Governorate, Egypt. EJHM. 2019;76(3):3618–3625. doi: 10.21608/ejhm.2019.40003.

[29] Liu P, Quinn RR, Lam NN, et al. Accounting for age in the definition of chronic kidney disease. JAMA Intern Med. 2021;181(10):1359–1366. doi: 10.1001/jamainternmed.2021.4813.

[30] Hassaballa M, El-Wakil H, Elsharkawy M, et al. Egyptian renal data system (ERDS) 2020: an annual report of end-stage kidney disease patients on regular hemodialysis. J Egypt Soc Nephrol Transplant. 2022;22(1):1–28. doi: 10.4103/jesnt.jesnt_37_21.

[31] Barsoum RS. A decade after the KDOQI CKD guidelines: a perspective from Egypt. Am J Kidney Dis. 2012;60(5):745–746. doi: 10.1053/j.ajkd.2012.08.010.

[32] Dong D, Zhang Y, Elshalakani A, et al. Population-wide NCD screening and management in Egypt's 100 million healthy lives campaign: a cost-effectiveness of study. Available from: https://ssrn.com/abstract=4010888

[33] Gouda Z, Mashaal G, Bello AK, et al. Egypt Information, Prevention, and Treatment of Chronic Kidney Disease (EGIPT-CKD) Programme: prevalence and risk factors for microalbuminuria among the relatives of patients with CKD in Egypt. Saudi J Kidney Dis Transplant. 2011;22(5):1055–1063.

[34] World Bank Group Current Health Expenditure-Egypt Arab Republic. [cited 2025 Jan 12]. Available from: http://datawroldbanck.org/indicator/SH.XPD.GHED.PC?locations=EG

[35] Oxford Business Group. How is Egypt's investment in Healthcare is improving access and outcomes. 2022 [cited 2025 Jan 7]. Available from: http://oxfordbusinessgroup.com/reports/Egypt/2022-resport

[36] Mohsen L, Shabrawy M, Hassan W, et al. Challenging the ordinary: a healthcare education partnership be-

tween universities in the UK and Egypt. Asia Pac Sch. 2024;9(2). doi: 10.29060/TAPS.2024-9-2/GP3089.
[37] Aziz MM, Bazaraa H, Aboulmakarem AS, et al. Vascular access modalities in a pediatric intensive care unit in tertiary hospital indications and outcomes: a single-center cross-sectional study. Egypt Pediatr Assoc Gaz. 2023;71(1):62. doi: 10.1186/s43054-023-00209-3.
[38] Kamal MM, Zaki NFW, Yousef EAAM, et al. An Egyptian study of sleep disorders and its correlates in end-stage renal disease patients receiving hemodialysis. Sleep Vigilance. 2020;4:213. doi: 10.1007/s41782-020-00095-4.
[39] Tayea K, Hussein M, Khalil B, et al. Effect of hemodialysis long life program on the quality of life of patients with end stage renal disease. EJHC. 2022;13(2):857–871. doi: 10.21608/ejhc.2022.235596.
[40] Gadelkareem RA, Abdelgawad AM, Reda A, et al. Preemptive living donor kidney transplantation: access, fate, and review of the status in Egypt. World J Nephrol. 2023;12(3):40–55. doi: 10.5527/wjn.v12.i3.40.
[41] Fabre A, Straub S. The impact of Public–Private Partnerships (PPPs) in infrastructure, health, and education. J Econ Lit. 2023;61(2):655–715. doi: 10.1257/jel.20211607.
[42] Rabie D, Mostafa MF, Abdel Halim RM, et al. Central line-associated bloodstream infection (CLABSI) with three different vascular access in neonatal intensive care unit. Egypt Pediatr Assoc Gaz. 2022;70(1):16. doi: 10.1186/s43054-022-00108-z.
[43] Kashgary A, Attiah FOA, AlKhateeb NA, et al. Incidence of bone fractures among patients on maintenance hemodialysis. Ren Fail. 2023;45(1):2224456. doi: 10.1080/0886022X.2023.2224456.
[44] Pethő Á, Tapolyai M, Szakács-Pál T, et al. Safety and efficacy of placement of tunneled hemodialysis catheter without the use of fluoroscopy. Clin Nephrol. 2020;94(5):237–244. doi: 10.5414/CN110076.
[45] Fatthy M, Abdelaziz TS, Marie MA, et al. Placing a hemodialysis catheter in patients with multiple access failure and exhausted usual approachable veins: Egyptian single center experience. J Assoc Vasc Access. 2021;26(1):47–53. doi: 10.2309/JAVA-D-20-00029.
[46] Abu El-Kass S, Ahmed N, Kannan T, et al. Nurses' knowledge toward hemodialysis vascular access devices: a cross-sectional study in Palestine. SAGE Open Med. 2024;12:20503121241264444. doi: 10.1177/20503121241264444.
[47] Abdel Hakeim EH, Desoky GM, Hamza MF. The effect of nursing intervention guidelines on vascular access self-care practices and quality of life among patients on maintenance hemodialysis. EJNHS. 2024;5(1):64–82. doi: 10.21608/ejnhs.2024.347646.
[48] Mahmoud Mahrous H, Amin Ahmed D, Elsayed Rady S. Nurses' knowledge and practices regarding permanent vascular access care among patients on hemodialysis. EJHC. 2024;15(2):1470–1489. doi: 10.21608/ejhc.2024.371885.
[49] Kerollos KMN, El-Ameen H, El Wahed LA, et al. Prevalence and seroconversion of hepatitis C among hemodialysis patients in Assiut Governorate, Egypt. Egypt J Intern Med. 2020;32. doi: 10.1186/s43162-020-00005-0.
[50] Osman FK, El Banna HM, Sharaf AY, et al. The effects of educational interventions on nurses' knowledge and practices in hemodialysis unit regarding infection control practices. EJHM. 2021;84(1):1739–1748. doi: 10.21608/ejhm.2021.176470.
[51] Thanapongsatorn P, Wanichwecharungruang N, Srisawat N. Outcomes of continuous renal replacement therapy versus peritoneal dialysis as a renal replacement therapy modality in patients undergoing venoarterial extracorporeal membrane oxygenation. J Crit Care. 2024;84:154895. doi: 10.1016/j.jcrc.2024.154895.
[52] Darwish R, Brown E. Global perspective on challenges and potential solutions to increasing peritoneal dialysis in Egypt. Kidney360. 2024;5(12):1913–1916. doi: 10.34067/KID.000000595.
[53] Abou-Bakr A, Hussein RR, Khalil E, et al. The frequency of periodontitis in end-stage renal disease on hemodialysis in a sample of Egyptian population: multicenter clinical cross-sectional study. BMC Oral Health. 2022;22(1):1. doi: 10.1186/s12903-021-02032-x.
[54] Karkar A, Wilkie M. Peritoneal dialysis in the modern era. Perit Dial Int. 2023;43(4):301–314. doi: 10.1177/08968608221114211.
[55] 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(11):2080–2089. doi: 10.1093/ndt/gfac193.
[56] Bakr MA, Shehab El-Dein AB, Refaie AF, et al. Renal transplantation in Mansoura, Egypt. Transplantation. 2020;104(8):1519–1521. doi: 10.1097/TP.0000000000003268.
[57] Saadi MG, El-Khashab S, Mahmoud RMA. Renal transplantation experience in Cairo University hospitals. Egypt J Intern Med. 2016;28(3):116–122. doi: 10.4103/1110-7782.200967.
[58] Elrggal M, Gendia M, Zyada RS, et al. The journey of kidney transplantation in Egypt: still extra-miles to go. Nephrol Dial Transplant. 2020;35:gfaa142.P1841.
[59] El-Ansary M, Saadi G, Abd El-Hamid SM. Mesenchymal stem cells are a rescue approach for recovery of deteriorating kidney function. Nephrology. 2012;17(7):650–657. doi: 10.1111/j.1440-1797.2012.01622.x.
[60] Fischer N. Egypt's draft laws on organ transplantation. J Int Biotechnol Law. 2009;6:168–172.
[61] Fettouh HA, Raouf HA, Shenoufy A, et al. Laparoscopic donor nephrectomy: single-center experience in Egypt with 400 consecutive cases. Transplant Proc. 2007;39(4):807–810. doi: 10.1016/j.transproceed.2007.03.080.
[62] Maamoun H, Soliman A, Zayed B. Cyclosporine and mycophenolate mofetil 48 hours before renal transplantation enables the use of low cyclosporine doses and achieves better graft function. Transplant Proc. 2010;42(10):4033–4036. doi: 10.1016/j.transproceed.2010.09.065.
[63] Luyckx VA, Tuttle KR, Abdellatif D, et al. Mind the gap in kidney care: translating what we know into what we do. Kidney Int. 2024;105(3):406–417. doi: 10.1016/j.kint.2023.12.003.
[64] Abdellatif DA. Social and humanitarian issues in nephrology and hypertension. Curr Opin Nephrol Hypertens. 2024;33(6):652–657. doi: 10.1097/MNH.0000000000001026.
[65] Abdelaziz A, Kassab SE, Abdelnasser A, et al. Medical education in Egypt: historical background, current status, and challenges. Health Prof Educ. 2018;4(4):236–244. doi: 10.1016/j.hpe.2017.12.007.