



## Prevalence and Burden of Chronic Kidney Disease in Developing Countries: A Review

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### Authors' contributions

This work was carried out in collaboration among all authors. Author FA draft the concept. Author FA also did the literature research with input from author SA. Authors RS and SYD critically reviewed and approved the drafted document. All authors read and approved the final manuscript.

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### ABSTRACT

Chronic kidney disease (CKD) is becoming more widely accepted as a public health issue around the world. However, there is a scarcity of data from low- and middle-income countries on the prevalence, challenges, and management of CKD. People in developed countries are expected to bear the impact of the consequences due to economic hardship and high treatment costs. Due to numerous environmental, racial, socioeconomic, and rural-urban variations, the prevalence of CKD varies greatly around the world. Rather than hypothesizing or making assumptions based on Western evidence, it is critical for developing countries to recognize the true nature of the disease and its prevalence. Understanding the situation in a developing country like Pakistan is important so that recommendations can be made for policymakers to revamp our health care system. Just a few studies have looked into the prevalence of CKD and its risk factors in Pakistan.

**Objectives:** To determine the importance of finding prevalence of CKD in countries of South Asia and challenges that are being faced by the burden of CKD.

**Methods:** A literature search was done using key words related to CKD burden, its challenges and prevalence accordingly to geographical locations conducted by various case reports, cohort and observational studies through authentic search engines like; PubMed, Google Scholar, Research gate, RCT and meta-analysis.

**Results:** CKD burden in middle and low-income countries is high, prevalence of CKD in Karachi, the biggest urban city of Pakistan is very high and there are less researches available who have looked into the prevalence of CKD and its risk factors.

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**Conclusion:** There are few studies done in Pakistan related to the burden of chronic kidney disease, the prevalence of CKD is high in lower and middle-income countries. It is recommended that there should be a systematic approach for the management of CKD burden with successful intervention and public awareness for lifestyle changes and screening and management of disease, as well as better medical practitioner training and improved chronic kidney disease testing and screening systems should be available.

*Keywords: Chronic kidney disease; prevalence of CKD; risk factors; CKD challenges.*

## 1. INTRODUCTION

Chronic kidney disease is a massive problem related to public and global health, as well as a major predictor of poor health outcomes that affects people around the world [1,2]. The economic and social implications of chronic kidney disease are extensive not only due to mortality and morbidity related to kidney disease progression, but also because of its association with other diseases like cardiovascular diseases and diabetes [3]. Although the CKD's burden is fairly well known in the developed countries, growing evidence suggests that the burden of chronic kidney disease in developing countries could be much greater than portrayed through data. There are traditional and nontraditional risk factors for CKD, the traditional risk factors for CKD are hypertension, diabetes mellitus, and obesity that contribute substantially to the global burden of disease. The non-traditional risk factors for CKD such as nephrotoxin toxicity, maternal and fetal factors, kidney stones, environmental factors, kidney infections, and acute kidney injury are also considered as major threats to the global health [4].

According to a 2003 study, patients with a Glomerular-Filtration-Rate of 15 to 59 ml/min/1.73 m<sup>2</sup> have a 38 percent increase risk for cardiovascular diseases than those with a Glomerular-Filtration-Rate of 90 to 150 ml/min/1.73 m<sup>2</sup> [5]. CKD has an effect on one's wellbeing, but it also has an impact on one's social life and is related to a loss of productivity. Financial burden is the most common type of social impact caused by CKD [6]. Patients with CKD are more likely to develop end-stage renal disease that necessitates expensive procedures such as dialysis and kidney transplantation [7]. CKD must be prioritized since it is the result of untreated diabetes and hypertension, which are already considered global epidemics [8]. The prevalence of CKD was found to be 23.4 percent in Stages 1–5 and 10.6 percent in Stages 3–5 in a systematic study and meta-analysis [9].

Despite its serious and long-term implications, CKD is understudied, especially in Asia and Africa's low- and middle-income countries. In India, Bangladesh, Nepal, and Sri Lanka, a few separate studies have been conducted; however, there is very little information available in Pakistan about the CKD's burden. As a result, policymakers and public health leaders find it difficult to get a full picture of the CKD's burden in developing countries and devise appropriate strategies to reduce kidney disease related death and illness. Therefore, this review is written to determine importance of finding prevalence of CKD in countries of South Asia and challenges that are being faced by the burden of CKD.

## 2. METHODOLOGY

To gain better understanding of issue total of 42 articles were used. A literature search was done using key words related to CKD burden, its challenges and prevalence accordingly to geographical locations conducted by various case reports, cohort and observational studies through authentic search engines like; Pubmed, Google Scholar, Research gate, RCT and meta-analysis.

## 3. RESULTS AND DISCUSSION

### 3.1 Prevalence of CKD in Developing Countries

Kidney disease (chronic) is a critical public health concern and it is a progressive and complex condition [10] that arises from both communicable (infectious diseases like malaria, schistosomiasis, hepatitis B and Human immunodeficiency virus) and non-communicable diseases [11,12]. The global prevalence of CKD is 8-16 percent, which translates to nearly 500 million people, with 78 percent (387.5 million) living in developing countries [13].

According to studies, CKD also increases mortality rate for infectious disease, especially in

low- and middle-income countries that are developing with higher burden of infectious diseases [14]. The increase in global diabetes and hypertension pandemics are largely to blame for the rise in chronic kidney disease and its advancement to end-stage renal failure [15,16,17]. Globally, there has been a significant regional variation in the prevalence of CKD (Table 1.1). For instance, population response rates and ethnicity, differences in laboratory techniques for measuring creatinine, and the form of equation used to calculate the approximate glomerular filtration rate are all factors to consider (eGFR) [18].

According to current evaluations, chronic kidney disease is a lot more common in people that are 65 years and older (38%) than in people 45–64 years (12%) or 18–44 years (18–44 years) (6%). Women have a significantly higher rate of CKD (14%) than men (12%) [19].

### 3.2 Burden of CKD in PAKISTAN

Among Pakistani population mostly adults, the prevalence of chronic kidney disease is 21.2%. Different researches showed highest prevalence in Pakistan to be 29.9% and lowest reported was 12.5% [20,21]. Age specific prevalence of CKD was reported by Alam et al among Pakistani population, according to the study, highest prevalence in elderly population was found 43.6% with age over 50 years and lower prevalence in younger participants was found 10.5% with age < 30 years [22]. The prevalence of CKD in people having type II diabetes mellitus is around 30-50% [23].

According to a 2015 study, CKD's prevalence is very high among the asymptomatic population of Karachi, Pakistan's largest urban area, who are unaware of the diagnosis of this disease and also about hypertension and diabetes mellitus.

Surprisingly, the majority of the patients with CKD were not getting any medical attention. This emphasizes the importance of early screening and risk stratification [24]. Chronic kidney disease is often misdiagnosed in the developing countries, where patients receive no care. This can also lead to end stage renal disease, which in future necessitates a kidney transplant and dialysis. [25]. Due to financial costs and a lack of availability, access to dialysis therapy is restricted in Pakistan, where healthcare is a luxury rather than a fundamental right. Other problems that patients face include a lack of access to transplant centers, issues with quality and safety, and abuse related to transplant tourism [26]. It is wise to invest in end stage renal disease prevention with limited resources by enacting healthcare policies that delay CKD progression [27].

### 3.3 Challenges

There is a huge population for which the exact cause of renal failure is uncertain, and large community-based research can look into the likelihood of environmental causes like water and air pollution, low birth weight, and kidney stone disease [28]. In a study from St. Louis VA Medical Center, there is a 25-37% increase in the number of kidney disease patients in veterans for every increase of 10 mg/m<sup>3</sup> of polluted air. An increase of about 36% in the rapid loss of kidney function and also chances of kidney failure (31%). Low birth weight babies (about 5 and a half pounds) were also found to be 70 percent more likely to develop chronic kidney disease later in life than average birth weight [29]. Several studies also found association of stone formation that eventually lead to chronic kidney disease and kidney failure [30].

**Table 1.1. Prevalence of CKD in different countries**

Country/City	Prevalence of CKD (STAGE 3-5) in %
Bangladesh	22.48
India	10.2 (stage 1-5)
Nepal	10.6
Unites states (Delaware, Pennsylvania)	4.3
United states (Florida)	16.7
United states (California)	6.7
Mid-west stated of US	13.4
Norway	3.31
Northwest Germany	5.9
Central Italy	1.0
South China	6.7
Southwest china	18.3
Pakistan	21.2

Many low-income countries have a median annual health expenditure per capita as compared to high income countries. Lack of funds would delay progress in chronic kidney disease prevention and early detection for a long time [31]. Health systems in many developing countries, have been undermined by a shortage of human resources (HR) and efficient and skilled workforce and lack of facilities. The inability of primary health care services to work makes following up on people with early chronic kidney disease extremely difficult [32]. Community participation is another challenge in primary health care [33].

A well-functioning primary health care system can ensure that community members are screened on a regular basis. The issue of who pays for the screening is a major concern regarding the success of screening services. The Thai government and a large pharmaceutical corporation jointly sponsored the Screening and Early Evaluation of Kidney Disease program [34]. In India, a pharmaceutical firm supported a similar screening program [35]. Furthermore, there is a scarcity of evidence in developing countries demonstrating the cost-effectiveness of community-based screening services, making it more difficult for health officials in these areas to make decisions on how to fund CKD screening programs [36].

In many developing countries, the chronic kidney disease's burden and its related risk factors are not documented due to lack of availability of data. Due to this, it is more difficult to plan for the prevention and treatment of CKD. There is a global shortage of qualified nephrology staff, which is particularly acute in developing countries [37]. Because of the staff shortage, secondary and tertiary prevention services are difficult to implement, as the number of people with chronic kidney disease who need prevention may outnumber the available workforce.

#### **4. RECOMMENDATIONS**

There is now compelling evidence that CKD can be diagnosed using simple laboratory tests, and that treatment can avoid or postpone kidney-related complications, slow kidney disease progression, and lower the risk of CVDs. The goal of converting these developments into easy and applicable public health interventions should be implemented globally. Understanding the connection between CKD and other chronic

diseases is critical for designing public health policies that will improve outcomes [38].

It is important to provide a holistic, systematic approach for the management of CKD burden with successful intervention. For more focused, reliable, and organized efforts to tackle the global problem of CKD, more global epidemic financing should be aligned with the burden of CKD, accountability of programs, data access, and better information sharing. The emerging burden of chronic kidney disease among other chronic diseases must be taken into account in health initiatives and international efforts, particularly as the general burden of public health due to chronic kidney disease and its related diseases is becoming increasingly excessive for many countries. Developing country preventive and primary health care services must be improved and unified.

Public awareness for lifestyle changes and screening and management of disease, better medical practitioner training and their availability, as well as improved chronic kidney disease testing and screening systems, are all desperately needed. The 'Disease Control Priorities Project' makes a similar recommendation, urging the development of international chronic kidney disease centers of excellence that can collaborate with cardiovascular diseases and diabetes centers [39]. The 'International Society of Nephrology and Kidney Disease Improving Global Outcomes' has responded to the increasing burden of chronic kidney disease by keeping in contact with organizations such as the 'International Diabetes Federation', the 'World Health Organization', and the 'World Bank' to impact public health policies. The 'International Society of Nephrology and Kidney Disease Improving Global Outcomes' has also responded to the rising challenge of chronic kidney disease by forming alliances with organizations such as the World Bank, the International-Diabetes-Federation, and World-Health-Organization to impact global and national health policy. There should be implementation of other similar programs as well [40,41].

Certain amount of funds should be allocated for screening purposes for the people at risk in developing countries by makers of the health policies together with the assistance of multi-national corporation as their social rational to explicit an subsidize for the screening program. CKD primary prevention activities in Low- and middle-income countries can be smoothly carried

**Table 1.2. Primary, secondary and tertiary prevention of CKD**

Primary prevention	Secondary prevention	Tertiary prevention
<ul style="list-style-type: none"> <li>Public awareness about healthy lifestyle such as increase physical exercise, restriction is salt intake</li> <li>Restrict the use of over-the-counter medications</li> <li>Improve training and awareness of the medical practitioners</li> <li>Development of international CKD centers of excellence that can collaborate with CVD and diabetes centers</li> <li>Provide funds for screening programs, especially for the at-risk population</li> <li>Long-term training programs of the nephrology workforce instituted by health policy makers in various LMICs</li> <li>Local research for the documentation of burden of CKD</li> </ul>	<ul style="list-style-type: none"> <li>Enhance monitoring and screening programs for chronic kidney disease</li> <li>Two staged-approach:</li> <li>Screen to identify individuals unaware of the presence of hypertension/diabetes</li> <li>Screen to identify individuals for the presence of CKD</li> </ul>	<ul style="list-style-type: none"> <li>Management of uremia and related comorbidities such as anemia, bone disorders and cardiovascular disorders</li> <li>Effective control of blood pressure</li> <li>Effective control of albuminuria/Proteinuria</li> <li>Fluid management</li> <li>Cardiovascular and nutritional therapy</li> <li>Pharmacotherapy</li> </ul>

out due to intensification of communal living such as in rural communities. Detection of cases should be an uninterrupted process is one of the important guiding propositions for screening programs instead of it being "once and for all" intend. Local research is therefore critical, not only for documenting the CKD's prevalence and its associated risk factors, but also for spreading awareness about practices and behaviors that can help developing countries to introduce kidney disease prevention and treatment programs.

Health officials in numerous developing countries should create long-term nephrology workforce training programs. Furthermore, as cell phone and telemedicine penetration should also improve in developing countries, so in result early intervention can become more feasible [42].

## 5. CONCLUSION

Chronic kidney disease's pattern and risk factors, such as diabetes, hypertension and cardiovascular diseases are common in other parts of the world, mentioned in this review. There is a lot of variation and confusion when it comes to reporting prevalence in various research, both internationally and regionally. In Pakistan, studies are few, underpowered, not reflective of the population, and mainly not planned to evaluate. Many low-income countries have a median annual health expenditure per capita as compared to high income countries. There is a global shortage of qualified

nephrology staff, which is particularly acute in developing countries. Lack of funds would delay progress in chronic kidney disease prevention and early detection for a long time. Early screening and risk factor identification is recommended due to high incidence of chronic kidney disease as well as other preventive measures as seen in Table 1.2. Public awareness for lifestyle improvements and management of disease, as well as improved medical practitioner training and availability, and improved chronic kidney disease surveillance and screening services, are all desperately needed. More global funding should be aligned with the burden of CKD, accountability of programs, data access, and better information sharing.

## CONSENT

Not applicable.

## ETHICAL APPROVAL

Not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Prevalence of chronic kidney disease in the United States. Coresh J, Selvin E,

- Stevens LA, Manzi J, Kusek JW, Eggers P, Van Lente F, Levey AS JAMA. 2007;298(17):2038-47.
2. Prevalence of CKD in the United States: A sensitivity analysis using the National Health and Nutrition Examination Survey (NHANES) 1999-2004. Snyder JJ, Foley RN, Collins AJ Am J Kidney Dis. 2009;53(2):218-28.
3. Sarnak MJ, Levey AS, Schoolwerth AC, Coresh J, Culleton B, Hamm LL, McCullough PA, Kasiske BL, Kelepouris E, Klag MJ, Parfrey P, Pfeffer M, Raij L, Spinosa DJ, Wilson PW, American Heart Association Councils on Kidney in Cardiovascular Disease, High Blood Pressure Research, Clinical Cardiology, and Epidemiology and Prevention. Circulation. 2003;108(17):2154-69.
4. Luyckx, Valerie A, et al. Reducing major risk factors for chronic kidney disease." Kidney international supplements. 2017;7(2):71-87. DOI:10.1016/j.kisu.2017.07.003
5. Manjunath G, Tighiouart H, Ibrahim H, MacLeod B, Salem DN, Griffith JL, et al. Level of kidney function as a risk factor for atherosclerotic cardiovascular outcomes in the community. J Am Coll Cardiol. 2003;41(1):47-55.
6. Weiner DE. Public health consequences of chronic kidney disease. Clin Pharmacol Ther. 2009;86(5):566-9. Available: <https://doi.org/10.1038/clpt.2009.137>.
7. Lysaght MJ. Maintenance dialysis population dynamics: current trends and long-term implications. J Am Soc Nephrol. 2002;13(Suppl 1):S37-40.
8. Hill NR, Fatoba ST, Oke JL, et al. Global prevalence of chronic kidney disease -A systematic review and meta-analysis. PLoS One. 2016;11:e0158765
9. National Kidney Foundation: K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Am J Kidney Dis. 2002;39(suppl 1):S1-S266.
10. Sumaili EK, et al. High prevalence of undiagnosed chronic kidney disease among at-risk population in Kinshasa, the Democratic Republic of Congo. BMC Nephrol. 2009;10:18.
11. Hossain MP, et al. CKD and poverty: a growing global challenge. Am J Kidney Dis. 2009;53:166-174.
12. Levey AS, et al. Chronic kidney disease as a global public health problem: approaches and initiatives – a position statement from Kidney Disease Improving Global Outcomes. Kidney Int. 2007;72:247-259.
13. Jha V, Garcia-Garcia G, Iseki K, et al. Chronic kidney disease: global dimension and perspectives. Lancet. 2013;382:260-72.
14. Yach D, et al. The global burden of chronic diseases: overcoming impediments to prevention and control. JAMA. 2004;291:2616-2622.
15. Beaglehole R, Yach D. Globalisation and the prevention and control of non-communicable disease: the neglected chronic diseases of adults. Lancet. 2003;362:903-908.
16. Ezzati M, et al. Rethinking the 'diseases of affluence' paradigm: global patterns of nutritional risks in relation to economic development. PLoS Med. 2005;2:e133.
17. Jha V, Wang AY, Wang H. The impact of CKD identification in large countries: The burden of illness. Nephrol Dial Transplant 2012;27 Suppl 3:iii32-8
18. Centers for Disease Control and Prevention. Chronic Kidney Disease in the United States, 2021. Atlanta, GA: US Department of Health and Human Services, Centers for Disease Control and Prevention; 2021.
19. Levey AS, Atkins R, Coresh J, Cohen EP, Collins AJ, Eckardt KU, Nahas ME, Jaber BL, Jadoul M, Levin A, Powe NR. Chronic kidney disease as a global public health problem: approaches and initiatives—a position statement from Kidney Disease Improving Global Outcomes. Kidney international. 2007;72(3):247-59.
20. Jafar TH, Schmid CH, Levey AS. Serum creatinine as marker of kidney function in south Asians: a study of reduced GFR in adults in Pakistan. J Am Soc Nephrol. 2005;16(5):1413-9.
21. Jessani S, Bux R, Jafar TH. Prevalence, determinants, and management of chronic kidney disease in Karachi, Pakistan - a community based cross-sectional study. BMC Nephrol. 2014;15:90.
22. Alam A, Amanullah F, Baig-Ansari N, Lotia-Farrukh I, Khan FS. Prevalence and risk factors of kidney disease in urban Karachi: baseline findings from a community cohort study. BMC Res Notes.

- 2014;7(1):179. <https://doi.org/10.1186/1756-0500-7-179>.
23. Pavkov ME, Knowler WC, Bennett PH, Looker HC, Krakoff J, Nelson RG. Increasing incidence of proteinuria and declining incidence of end-stage renal disease in diabetic Pima Indians. *Kidney Int.* 2006;70:1840–6
  24. Imran S, Sheikh A, Saeed Z, Khan SA, Malik AO, Patel J, Kashif W, Hussain A. Burden of chronic kidney disease in an urban city of Pakistan, a cross-sectional study. *J Pak Med Assoc.* 2015;65(4):366-9.
  25. Jha V. End-stage renal care in developing countries: the India experience. *Ren Fail.* 2004 ;26:201-8.
  26. Akoh JA. Renal transplantation in developing countries. *Saudi J Kidney Dis Transpl* ;22:637-50.
  27. Laliberte F, Bookhart BK, Vekeman F, Corral M, Duh MS, Bailey RA, et al. Direct all-cause health care costs associated with chronic kidney disease in patients with diabetes.
  28. Imtiaz S, Salman B, Qureshi R, Drohlia MF, Ahmad A. A review of the epidemiology of chronic kidney disease in Pakistan: A global and regional perspective. *Saudi Journal of Kidney Diseases and Transplantation.* 2018;29(6):1441.
  29. National Kidney Foundation. Environmental Pollution and Kidney Disease;2018. [online] Available:<https://www.kidney.org/newsletter/environmental-pollution-and-kidney-disease>.
  30. Rule AD, Krambeck AE, Lieske JC. Chronic kidney disease in kidney stone formers. *Clinical journal of the American Society of Nephrology : CJASN*, [online] 2011;6(8):2069–75. Available:<https://www.ncbi.nlm.nih.gov/pubmed/21784825> [Accessed 28 Jan. 2020].
  31. World Health Organization Public Spending on Health: A Closer Look at Global Trends. World Health Organization, Geneva;2018.
  32. Kheang S, Janssens B, Damme W, Zachariah R, eds. Delivering anti-retroviral treatment within the framework of a chronic disease’s clinic, MSF’s experience in Cambodia. Paper presented at: International Conference on AIDS;2004.
  33. Demaio AR, Nielsen KK, Tersbøl BP, et al. Primary Health Care: a strategic framework for the prevention and control of chronic non-communicable disease. *Global Health Action.* 2014;7:24504.
  34. Ingsathit A, Thakkinstian A, Chairprasert A, et al. Prevalence and risk factors of chronic kidney disease in the Thai adult population: Thai SEEK study. *Nephrol Dial Transplant.* 2009;25:1567-157
  35. Osman M.A. Alrukhaimi M. Ashuntantang G.E. et al. Global nephrology workforce: gaps and opportunities toward a sustainable kidney care system. *Kidney Int Suppl.* 2018;8:52-63
  36. Ulasi I.I. Ijoma C.K. Onwubere B.J. et al. High prevalence and low awareness of hypertension in a market population in Enugu, Nigeria. *Int J Hypertens.* 2011;2011:869676
  37. Osman M.A. Alrukhaimi M. Ashuntantang G.E. et al. Global nephrology workforce: gaps and opportunities toward a sustainable kidney care system. *Kidney Int Suppl.* 2018;8:52-63
  38. Levey AS, Atkins R, Coresh J, Cohen EP, Collins AJ, Eckardt KU, Nahas ME, Jaber BL, Jadoul M, Levin A, Powe NR. Chronic kidney disease as a global public health problem: approaches and initiatives—a position statement from Kidney Disease Improving Global Outcomes. *Kidney international.* 2007;72(3):247-59.
  39. Jamison D, Mosley W, Measham A. *Disease Control Priorities in Developing Countries.* Washington, World Bank;2006.
  40. Iseki K. Metabolic syndrome and chronic kidney disease: a Japanese perspective on a worldwide problem. *J Nephrol.* 2008;21:305–312.
  41. Atkins RC: The epidemiology of chronic kidney disease. *Kidney Int Suppl.* 2005;94:S14–S18.
  42. Wilson JMG. Jungner G *World Health Organization Principles and Practice of Screening for Disease.* World Health Organization, Geneva;1968.

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