

Knowledge and Awareness of Chronic Kidney Disease in Patients with Diabetes Mellitus: Evidence from a Systematic Review and Meta-Analysis**Roshini M.¹, Mohamed Shaik Faaiz J. F.², Sivaram S.³, Shruthi Ravindhranathan⁴,
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Abstract**Background:** Chronic kidney disease (CKD) is a common and serious complication of diabetes mellitus and a leading cause of end-stage renal disease worldwide. Adequate patient awareness is essential for early detection, prevention, and effective disease management. However, evidence regarding CKD awareness among diabetic patients remains inconsistent across different populations and healthcare settings.**Methods:** A systematic review and meta-analysis were conducted accordance with PRISMA 2020 guidelines. Electronic databases including PubMed, Google Scholar, and the Cochrane Library were systematically searched for observational studies assessing knowledge and awareness of CKD among patients with diabetes mellitus. Cross-sectional, cohort, and case-control studies published in English between 2016 and 2026 were included. The primary outcome was the pooled prevalence of CKD awareness. A random-effects model was used to calculate pooled estimates with 95% confidence intervals (CI).**Results:** A total of five cross-sectional studies involving 1,903 participants from India, Sri Lanka, Malaysia, and Saudi Arabia were included. The prevalence of adequate CKD awareness ranged from 21.36% to 75.1% across studies. Meta-analysis demonstrated a pooled CKD awareness prevalence of 39.6% (95% CI: 37.4%–41.8%), indicating that fewer than half of diabetic patients possessed adequate knowledge regarding CKD and its complications. Substantial heterogeneity was observed among studies ($I^2 \approx 90\%$). Educational status, socioeconomic factors, marital status, and the presence of diabetic complications were commonly associated with awareness levels.**Conclusion:** CKD awareness among patients with diabetes mellitus remains suboptimal, with less than half of patients demonstrating adequate knowledge. Strengthening patient education, routine kidney screening, and healthcare counseling programs may improve awareness and support early detection and prevention of CKD among high-risk diabetic populations.**Keywords:** Chronic Kidney Disease, CKD Awareness, Diabetes Mellitus, Diabetic Kidney Disease, Knowledge, Health Education, Systematic Review, Meta-Analysis.**DOI:** 10.25258/ijcpr.18.7.47

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Introduction

Chronic Kidney Disease (CKD) is a progressive and irreversible decline in kidney function that persists for more than three months and is characterized by structural or functional abnormalities of the kidneys, including reduced glomerular filtration rate (GFR <60 mL/min/1.73 m²), albuminuria, and electrolyte disturbances [1].

CKD has emerged as a major global public health challenge due to its increasing prevalence, associated morbidity and mortality, and substantial economic burden on healthcare systems. According

to recent estimates, approximately 788 million individuals worldwide were living with CKD in 2023, affecting nearly 14% of the adult population globally [2]. In India, the prevalence of CKD is estimated to range from 13% to 16%, with a steadily increasing trend attributed to the rising burden of non-communicable diseases and population aging [3].

Diabetes mellitus (DM) is recognized as the leading cause of CKD and end-stage renal disease (ESRD) worldwide, accounting for nearly 40–50%

of CKD cases in many countries [4]. Hypertension is another major contributor, often coexisting with diabetes and accelerating renal damage [1]. Other established risk factors include obesity, cardiovascular disease, and smoking, advancing age, family history of kidney disease, nephrotoxic drug exposure, and recurrent renal disorders [5]. Among individuals with diabetes mellitus, diabetic kidney disease (DKD) develops in approximately one-third of patients and remains one of the most serious microvascular complications associated with diabetes [6].

The global prevalence of diabetes continues to increase at an alarming rate. The International Diabetes Federation estimates that more than 537 million adults were living with diabetes in 2021, and this number is expected to rise to 643 million by 2030 and 783 million by 2045 [7]. Consequently, the burden of CKD attributable to diabetes is also expected to increase substantially. Studies conducted in South Asia have reported CKD prevalence rates ranging from 27% to 31% among adults with diabetes and hypertension, indicating a significant public health concern in the region [8]. A recent systematic review and meta-analysis also reported a high prevalence of CKD among patients with type 2 diabetes mellitus, highlighting the need for early preventive interventions and regular renal monitoring in this high-risk population [9].

Early detection and timely management of CKD can significantly delay disease progression, reduce complications, and improve patient outcomes. Evidence suggests that strict glycemic control, blood pressure management, lifestyle modifications, and routine kidney function monitoring can substantially reduce the risk of CKD progression among diabetic patients [10]. However, CKD is often asymptomatic during its early stages, leading to delayed diagnosis and treatment initiation. Consequently, many patients remain unaware of their renal status until advanced stages of the disease, when therapeutic options become limited and healthcare costs increase substantially [11].

Patient knowledge and awareness regarding CKD are critical determinants of successful prevention and management strategies. Adequate awareness enables individuals with diabetes to recognize their susceptibility to kidney disease, adhere to prescribed medications, adopt healthier lifestyles, and participate in regular screening programs [12].

Furthermore, informed patients are more likely to engage in self-management practices, maintain optimal glycemic and blood pressure control, and seek timely medical attention when symptoms arise [13]. Despite the importance of awareness, several studies conducted across different countries have

consistently demonstrated inadequate knowledge of CKD among patients with diabetes mellitus. Research from India reported limited understanding of CKD risk factors, symptoms, preventive measures, and screening practices among individuals with type 2 diabetes mellitus [5]. Similarly, studies from Canada and other regions found that a substantial proportion of diabetic patients were unaware of their CKD diagnosis, treatment options, and the importance of regular kidney function assessment [6].

Low levels of awareness have been associated with poor health-seeking behavior, delayed diagnosis, medication non-adherence, inadequate glycemic control, and an increased likelihood of progression to ESRD [14].

Educational interventions have demonstrated significant potential in improving CKD-related knowledge and awareness among diabetic populations. Patient-centered educational programs, counseling initiatives, and community-based awareness campaigns have been shown to enhance understanding of kidney disease risk factors, encourage routine screening, and promote preventive health behaviors [15].

Therefore, assessing the current level of CKD knowledge and awareness among individuals with diabetes mellitus is essential for identifying educational gaps and developing effective interventions aimed at reducing CKD-related morbidity and mortality.

Although numerous observational studies have investigated CKD awareness among diabetic patients, their findings vary considerably across different populations and healthcare settings. To date, there is limited synthesized evidence summarizing the overall level of knowledge and awareness regarding CKD among individuals with diabetes mellitus. Therefore, conducting a systematic review and meta-analysis of observational studies is necessary to comprehensively evaluate the existing evidence, estimate the pooled level of CKD awareness, identify factors associated with awareness, and provide evidence-based recommendations for healthcare professionals and policymakers.

The findings of this review may contribute to the development of targeted educational strategies and public health interventions aimed at promoting early detection and prevention of CKD among high-risk diabetic populations.

Methods

Study Design and Eligibility: This systematic review and meta-analysis was conducted accordance with PRISMA 2020 guidelines to evaluate knowledge and awareness of chronic

kidney disease (CKD) among patients with diabetes mellitus. Observational studies (cross-sectional, cohort, and case-control) published in English between 2016 and 2026 were included. Studies involving non-diabetic populations, reviews, editorials, conference abstracts, case reports, and studies with insufficient data were excluded.

Search Strategy: A comprehensive search of PubMed, Google Scholar, and the Cochrane Library was conducted using MeSH terms and keywords including “chronic kidney disease,” “CKD awareness,” “CKD knowledge,” “diabetes mellitus,” and “diabetic patients.” Boolean operators (AND, OR, NOT) were applied to refine the search.

Reference lists of eligible studies were also screened manually.

Study Selection and Data Extraction: Following removal of duplicates, titles, abstracts, and full texts were screened according to predefined eligibility criteria. Data extracted included author, year, country, study design, sample size, assessment tools, prevalence of CKD awareness, and associated factors.

Quality Assessment and Statistical Analysis: Methodological quality was assessed using the Joanna Briggs Institute (JBI) Critical Appraisal Checklist for Cross-Sectional Studies. Meta-analysis was performed using a random-effects model, and pooled prevalence estimates were reported with 95% confidence intervals (CI). Heterogeneity was assessed using Cochran’s Q test and the I^2 statistic. Publication bias was not evaluated because fewer than ten studies were included.

Outcomes: The primary outcome was the pooled prevalence of CKD knowledge and awareness among patients with diabetes mellitus. Secondary outcomes included regional variations in awareness and factors associated with CKD awareness.

Search Results

A total of five observational studies involving 1,903 participants met the inclusion criteria and were included in the qualitative and quantitative synthesis. The study selection process was documented using a PRISMA 2020 flow diagram.

Figure 1: PRISMA flowchart of the selection of studies

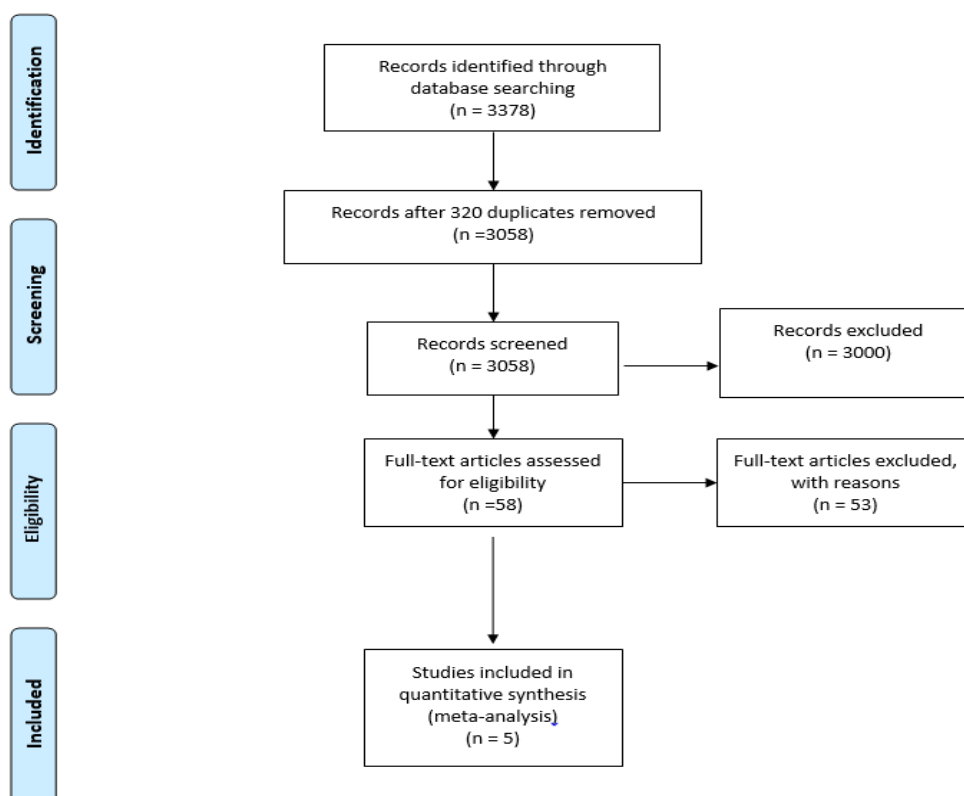


Figure 1: PRISMA flowchart of the selection of studies

Result

A total of five cross-sectional studies were included in this systematic review and meta-analysis, comprising 1,903 participants. The studies were conducted across different regions, including Malaysia, Saudi Arabia, India, and Sri Lanka. All

included studies assessed knowledge and/or awareness of chronic kidney disease (CKD) among patients with diabetes mellitus. Detailed characteristics of the included studies are presented in table 1.

Table 1: Characteristics of the Studies Included

S.No	Author	Year	Study Title	Country	Study Design	Population
1	Hussain et al. 2019	2019	Limited Knowledge of Chronic Kidney Disease among Type 2 Diabetes Mellitus Patients in India	India	Cross-sectional	Type 2 Diabetes Mellitus (T2DM) patients
2	Susanjalee et al. 2023	2023	Awareness and Practices on Preventing Chronic Kidney Disease among Diabetes Mellitus Patients at Teaching Hospital, Batticaloa, Sri Lanka	Sri Lanka	Cross-sectional	Diabetes mellitus patients attending clinic
3	Al-Qahtani et al. 2024	2024	The Awareness, Prevalence, and Risk Factors of Chronic Kidney Disease Among Diabetes Mellitus and Hypertensive Patients in the Aseer Region, Saudi Arabia	Saudi Arabia	Cross-sectional	Diabetes mellitus and/or hypertensive patients
4	Rosedi et al. 2025	2025	Knowledge, Attitude, And Practice in Diabetic Kidney Disease Prevention and Its Associated Factor Among Type 2 Diabetes Mellitus Patients in Northeast Peninsular Malaysia	Malaysia	Cross-sectional	Type 2 Diabetes Mellitus (T2DM) patients
5	Esmaeel et al. 2026	2026	Awareness and Perceived Risk Factors of Chronic Kidney Disease Among Patients with Diabetes in the Northern Borders of Saudi Arabia: Implications for a Strategic Monitoring and Management Plan	Saudi Arabia	Cross-sectional	Patients with diabetes mellitus

The sample sizes ranged from 290 to 600 participants. The level of knowledge and awareness regarding chronic kidney disease among diabetic patients varied considerably across the included studies. The proportion of participants with adequate CKD knowledge and awareness ranged from 21.36% to 75.1%. Table 2 summarizes the awareness levels reported in the included studies along with the corresponding sample sizes and

study settings. The lowest level of awareness was observed in an Indian study, whereas the highest awareness level was reported in a Saudi Arabian study. This variation highlights the differences in CKD awareness across diverse populations and healthcare settings. The extracted data also demonstrate variability in awareness assessment methods and reported prevalence estimates among the included studies,

Table 2: Knowledge and Awareness of Chronic Kidney Disease among Patients with Diabetes Mellitus in Included Studies

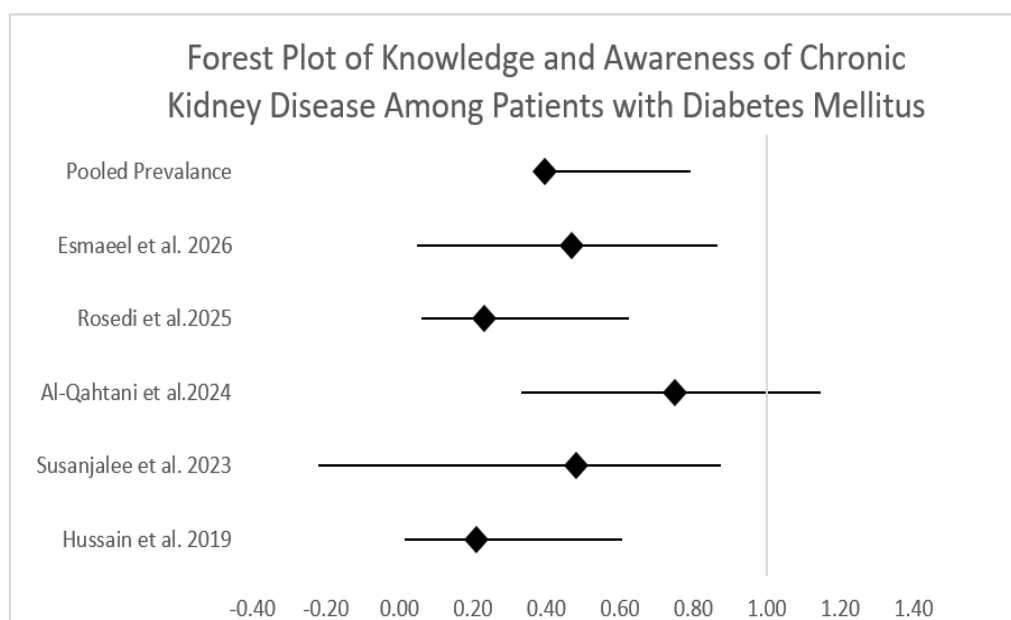
S.No	Author	Country	Total Sample Size (n)	Good Awareness Level(n)	Good Awareness Level Percentage%
1	Hussain et al.2019	India	323	69	21.36
2	Susanjalee et al.2023	Sri Lanka	290	139	47.9
3	Al-Qahtani et al.2024	Saudi Arabia	301	226	75.1
4	Rosedi et al.2025	Malaysia	600	138	23
5	Esmaeel et al.2026	Saudi Arabia	389	182	46.8

Meta-analysis of the included studies demonstrated that the pooled prevalence of knowledge and awareness regarding chronic kidney disease among patients with diabetes mellitus was 39.6% (95% CI: 37.4%–41.8%), indicating that less than half of diabetic patients possessed adequate awareness regarding CKD.

Table 3: Meta-analysis Results of CKD Knowledge and Awareness among Patients with Diabetes Mellitus

S.No	Study	Events	Total	P	SE	Lower CI	Upper CI	Lower Error	Upper Error
1	Hussain et al. 2019	69	323	0.21	0.023	0.169	0.258	0.045	0.045
2	Susanjalee et al. 2023	139	290	0.48	0.029	0.422	0.537	0.057	0.057
3	Al-Qahtani et al. 2024	226	301	0.75	0.025	0.702	0.800	0.049	0.049
4	Rosedil et al.2025	138	600	0.23	0.017	0.196	0.264	0.034	0.034
5	Esmaeel et al. 2026	182	389	0.47	0.025	0.418	0.517	0.050	0.050
6	Pooled Prevalance	754	1903	0.40	0.011	0.374	0.418	0.022	0.022

A high level of heterogeneity was observed among the included studies ($I^2 \approx 90\%$), suggesting substantial variability in awareness levels across different study populations, healthcare settings, and assessment methods. The forest plot demonstrated considerable variation in awareness estimates, with some studies reporting relatively higher awareness while others showed poor understanding of CKD among diabetic patients.

**Figure 2: Forest Plot of Knowledge and Awareness of Chronic Kidney Disease among Patients with Diabetes Mellitus**

Quality assessment of the included observational studies indicated generally moderate methodological quality, with most studies clearly reporting study objectives, participant selection,

and awareness-related outcomes, although differences in sampling techniques and awareness assessment approaches were identified across studies.

Table 4: Quality Assessment and Risk of Bias of Included Studies

S.No	Author	Sampling Method	Measurement Tool	Risk of Bias	Overall Quality
1	Hussain et al. 2019	Convenience sampling	Standard questionnaire	Moderate	Fair
2	Susanjalee et al. 2023	Systematic sampling	Validated questionnaire	Low	Good
3	Al-Qahtani et al. 2024	Convenience (online survey)	Structured questionnaire	Moderate	Fair
4	Rosedil et al. 2025	Systematic sampling	Validated questionnaire	Low	Good
5	Esmaeel et al. 2026	Convenience sampling	Validated questionnaire	Moderate	Fair

Table 5: Key Findings and Factors Associated with CKD Awareness among Patients with Diabetes Mellitus

S.No	Author	Key Findings	Associated Factors
1	Hussain et al. 2019	Very low knowledge (21.36%) among diabetic patients	Education, socioeconomic status, income
2	Susanjalee et al. 2023	More than half had poor awareness (52.1%), despite relatively good clinical follow-up	Lifestyle factors, lack of education, limited knowledge of risk factors
3	Al-Qahtani et al. 2024	High level of awareness (75.1%) among diabetic and hypertensive patients	Age, education level, presence of DM/HTN
4	Rosedi et al. 2025	Majority of patients had poor knowledge (77%), indicating low CKD awareness among diabetic patients	Education level, marital status, diabetic complications
5	Esmacel et al. 2026	Moderate awareness (46.8%) observed among diabetic patients	Gender (male), marital status, comorbidities

Discussion

The present systematic review and meta-analysis synthesized evidence from observational studies to evaluate the level of knowledge and awareness regarding chronic kidney disease (CKD) among patients with diabetes mellitus. The pooled prevalence of adequate CKD knowledge and awareness was 39.6%, indicating that fewer than half of diabetic patients possess sufficient awareness regarding CKD, its risk factors, preventive strategies, and long-term complications. This finding is clinically significant because diabetes mellitus remains the leading cause of CKD worldwide, and inadequate patient awareness may contribute to delayed diagnosis, poor adherence to preventive measures, and accelerated progression to end-stage kidney disease.

The included studies demonstrated considerable variability in awareness levels, with prevalence estimates ranging from 21.36% to 75.1%. The lowest awareness was reported in the Indian study by Hussain et al., whereas the highest prevalence was observed in the Saudi Arabian study by Al-Qahtani et al. These differences are likely attributable to variations in healthcare infrastructure, patient education strategies, literacy levels, socioeconomic status, accessibility to healthcare services, and national diabetes management programs. Countries with well-established chronic disease education and routine diabetes follow-up services generally reported higher awareness levels, suggesting that structured educational interventions can substantially improve patients' understanding of CKD.

Educational attainment emerged as one of the most important determinants of CKD awareness across the included studies. Individuals with higher educational status or previous exposure to diabetes education programs demonstrated better understanding of kidney disease, its complications, and the importance of routine renal function assessment. Since early CKD is frequently asymptomatic, inadequate knowledge may delay

timely screening and appropriate intervention. Improved awareness may encourage patients to undergo regular kidney function testing, maintain optimal glycemic and blood pressure control, adhere to prescribed medications, adopt healthier dietary practices, and seek medical attention promptly when complications arise.

The findings of the present review are consistent with previous studies reporting that disease-specific knowledge is associated with improved self-management, medication adherence, and utilization of preventive healthcare services among individuals with chronic illnesses. However, despite ongoing diabetes education initiatives in many healthcare settings, substantial knowledge gaps continue to exist, particularly in low- and middle-income countries where healthcare resources, patient counseling services, and public awareness campaigns remain limited. These findings highlight the need for standardized educational strategies tailored to diabetic populations, particularly those at high risk of developing kidney disease.

A substantial degree of heterogeneity was observed among the included studies ($I^2 \approx 90\%$), indicating considerable variability in study findings. This heterogeneity may be explained by differences in study populations, sample sizes, healthcare settings, cultural backgrounds, and the instruments used to assess CKD awareness. Furthermore, variations in the definition of "adequate awareness," questionnaire design, and scoring methods limited direct comparability across studies. Although a random-effects model was applied to account for this variability, the high heterogeneity suggests that the pooled estimate should be interpreted with appropriate caution.

The present review possesses several strengths. It provides a comprehensive synthesis of available observational evidence, follows a systematic methodology, and generates a pooled estimate of CKD awareness among diabetic patients using meta-analytic techniques. Nevertheless, certain

limitations should be acknowledged. Only a limited number of eligible studies were available for quantitative synthesis, and all included studies employed cross-sectional designs, precluding causal inference. Additionally, restricting the review to English-language publications may have introduced language bias, while differences in awareness assessment tools reduced methodological consistency across studies.

Overall, the findings demonstrate that knowledge and awareness regarding CKD among patients with diabetes mellitus remain suboptimal worldwide.

Strengthening patient-centered education, integrating routine CKD counseling into diabetes care, promoting regular renal screening, and implementing culturally appropriate awareness programs are essential strategies to facilitate early detection, improve self-management, and ultimately reduce the burden of diabetic kidney disease.

Conclusion

This systematic review and meta-analysis included five observational studies involving 1,903 patients with diabetes mellitus. The pooled prevalence of CKD awareness was 39.6%, indicating that fewer than half of diabetic patients had adequate knowledge of chronic kidney disease and its complications.

Awareness levels varied across countries and healthcare settings, likely due to differences in education, healthcare access, and awareness initiatives. Despite moderate methodological quality, substantial heterogeneity was observed among studies.

These findings emphasize the need for enhanced patient education, regular kidney screening, and effective healthcare counseling to improve early detection and prevention of CKD in diabetic populations.

Limitations and Future Implications

This review included a limited number of cross-sectional studies, restricting causal interpretation. Significant heterogeneity existed due to variations in sample characteristics, healthcare settings, and awareness assessment methods. The inclusion of only English-language studies may have introduced language bias. Additionally, differences in questionnaires and definitions of CKD awareness affected comparability across studies.

Future large-scale multicenter studies using standardized assessment tools are needed to better evaluate CKD awareness and the impact of educational and screening interventions among diabetic patients.

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