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Diabetes and kidney failure: a narrative review

Diabetes e insuficiencia renal: una revisión narrativa

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ABSTRAC

Objective: to conduct a literature review on diabetes and kidney failure, focusing on risk factors, treatments, and complications.
Method: literature review with narrative synthesis. Data sources: Scopus, ScienceDirect, and PubMed. Data selection: Documents were selected and analyzed using critical review, considering inclusion and exclusion criteria.
Results: a corpus of 25 articles was analyzed, of which 6 were retrospective, longitudinal, systematic, narrative, correlational, and observational studies. The population included children, adolescents, adults, and older adults (18 to 86 years), as well as general population registries in various settings. The studies were conducted in several countries: Hong Kong, Taiwan, Japan, Denmark, Thailand, Mexico, Finland, Korea, India, China, Glasgow, Babylon, Ethiopia, Ghana, United Arab Emirates, Italy, United Kingdom, Spain, France, United States, Australia, Germany, Bulgaria, and New Zealand, providing unique perspectives. Diagnoses were distributed among 12 articles on risk factors, 9 on treatment, and 4 on complications. Regarding socioeconomic status, the studies included low- and middle-income countries, and others that were not specified.
Conclusion: diabetic nephropathy and chronic kidney disease (CKD), frequently associated with multivessel fatty liver disease (MAFLD), are key complications of diabetes that worsen cardiovascular prognosis. Ultra-EGF is emerging as a promising biomarker, and SGLT2 inhibitors, such as dapagliflozin, offer renal and cardiac protection. In coronary revascularization, bypass is superior to angioplasty in diabetics with multivessel disease, with CKD being a worse prognostic factor that does not contraindicate the benefit of the intervention.

Keywords: Diabetes; Renal Insufficiency; Chronic Kidney Disease.

RESUMEN

Objetivo: realizar una revisión de literatura sobre diabetes e insuficiencia renal, basándose en factores, tratamientos y complicaciones.
Método: revisión de la literatura con síntesis narrativa. Fuentes de datos: Scopus, Science Direct y PubMed. Selección de datos: Los documentos fueron seleccionados y analizados mediante revisión crítica, considerando criterios de inclusión y exclusión.

Resultados: se analizó un corpus de 25 artículos, de los cuales 6 corresponden a estudios retrospectivos, longitudinales, sistemáticos, narrativos, correlacionales y observacionales. La población incluyó niños, adolescentes, adultos y adultos mayores (18 a 86 años), así como registros poblacionales generales en distintos contextos. Los estudios se realizaron en diversos países: Hong Kong, Taiwán, Japón, Dinamarca, Tailandia, México, Finlandia, Corea, India, China, Asia, Glasgow, Babilonia, Etiopía, Ghana, Emiratos Árabes Unidos, Italia, Reino Unido, España, Francia, Estados Unidos, Australia, Alemania, Bulgaria y Nueva Zelanda, aportando perspectivas únicas. Los diagnósticos se distribuyeron en 12 artículos sobre factores, 9 sobre tratamiento y 4 sobre complicaciones. En cuanto al nivel socioeconómico, los estudios incluyeron países de bajos y medianos ingresos, y otros sin especificación.
Conclusión: la nefropatía diabética y la enfermedad renal crónica (ERC), frecuentemente asociadas al hígado graso (MAFLD), son complicaciones clave de la diabetes que agravan el pronóstico cardiovascular. El uEGF emerge como biomarcador prometedor, y los inhibidores SGLT2, como la dapagliflozina, ofrecen protección renal y cardiaca. En revascularización coronaria, el bypass es superior a la angioplastia en diabéticos con enfermedad multivaso, siendo la ERC un factor de peor pronóstico que no contraindica el beneficio de la intervención.

Palabras clave: Diabetes; Insuficiencia Renal; Enfermedad Renal Crónica.

INTRODUCTION

Diabetes is one of the leading causes of chronic kidney disease worldwide, ranking second in morbidity and third in mortality in kidney patients (Ganji et al., 2024), affecting more than 75 million people worldwide who are prone to diseases such as osteoarthritis, diabetes, and depression, posing a growing public health burden with increased risk, given that many people do not know they have type 2 diabetes, including children (Nardi et al., 2025). In industrialized countries, it is associated with hypertension, even with early diagnosis (Thipsawat, 2021). However, in low- and middle-income countries, it is projected to reach 783 million patients by 2045 (T. K. Chen et al., 2019), seeking to ensure that people with diabetes receive dialysis and know how to manage their diabetes (Younis et al., 2025).

Some findings report that diabetic kidney disease affects type 2 diabetes by increasing its mortality, which is why its early identification is based on the search for microalbuminuria and the management of risk factors such as high blood pressure, hyperglycemia, and smoking (Persson et al., 2021). In addition, acute renal failure (ARF) increases the risk of progression to end-stage renal disease, cardiac events, and cerebrovascular events (Kaur et al., 2023).

Regarding treatment, SGLT2 Inhibitors and GLP-1 receptor agonists offer cardiovascular and renal benefits in type 2 diabetes that go beyond glycemic control (Kunutsor et al., 2024). On the other hand, Finerenone provides renal protection in chronic kidney disease (CKD) and T2DM, although the benefits are uncertain due to wide confidence intervals and heterogeneity across studies.

The risk of hyperkalemia justifies careful selection and monitoring in patients (Diaz et al., 2025). Also, supplementation with saffron and crocin reduces levels of AST (aspartate aminotransferase, a liver enzyme), SBP (systolic blood pressure), and fasting glucose in patients with diabetes, but, despite its lack of clinical relevance, it does not affect ALT, renal function, or DBP. (J. W. Zhang et al., 2025). Finally, this approach is not beneficial for everyone, as it can lead to therapeutic inertia.

Therefore, a more proactive therapeutic strategy should be considered to optimize care, with the goals of glucose and blood pressure control, along with simultaneous or sequential therapies (Cheng et al., 2025).

Globally, CKD affects more than 75 million people and is the twelfth leading cause of death, with diabetes identified as one of the main contributors, significantly increasing the risk of death in advanced stages of kidney disease (Faghir Ganji et al., 2024). Type 2 diabetes affects everyone, including children, and many people do not know they have it until complications arise, increasing the likelihood of developing serious diseases while placing increasing pressure on public health systems (Nardi et al., 2025).

Diabetic nephropathy is the most common complication of type 2 diabetes and the leading cause of end-stage renal disease worldwide, affecting 40 % of patients within a decade of diagnosis and characterized by persistent albuminuria along with a progressive decline in glomerular filtration rate leading to renal failure (Thipsawat, 2021). This disease is the sixteenth leading cause of years of life lost worldwide, making its detection, diagnosis, and proper treatment essential to prevent adverse consequences, including cardiovascular disease, end-stage renal disease, and death (T. K. Chen et al., 2019).

Diabetic patients undergoing dialysis face serious complications, requiring frequent hospitalizations with high mortality rates, as there is a notable lack of studies and research exploring the specific strategies these patients use for the daily management of their diabetic condition (Younis et al., 2025).

For this reason, the present study aims to conduct a literature review on diabetes and renal failure, based on the factors, treatments, and complications involved.

METHOD

A comprehensive narrative review was conducted to explore the existing scientific literature, drawing on the following databases: Scopus, SciELO, PubMed, and Google Scholar. To refine the search, the following terms were used: (Diabetes and kidney failure) and (kidney failure) AND (Diabetes). In addition, the Boolean operator AND was used to refine and broaden the search scope, and the search period was extended from August to September 2025, with articles published between 2020 and 2025 included in the review.

This search covered texts written in any language, specifically excluding case reports, interviews, letters to the editor, theses, and books, due to their less empirical nature or specific focus. Within the databases, a total of 219,930 articles were initially identified using the designed search thread. Of these, 97 678 corresponded to the Scopus database, 77 955 to Science Direct, 40 900 to Google Scholar, and 3 397 to PubMed.

Next, 0 duplicate articles were removed. Subsequently, 20 articles that did not align with the study objective and others that did not meet the established inclusion criteria were excluded. As a result of this filtering and selection process, a final corpus of 30 articles relevant to the review was obtained.

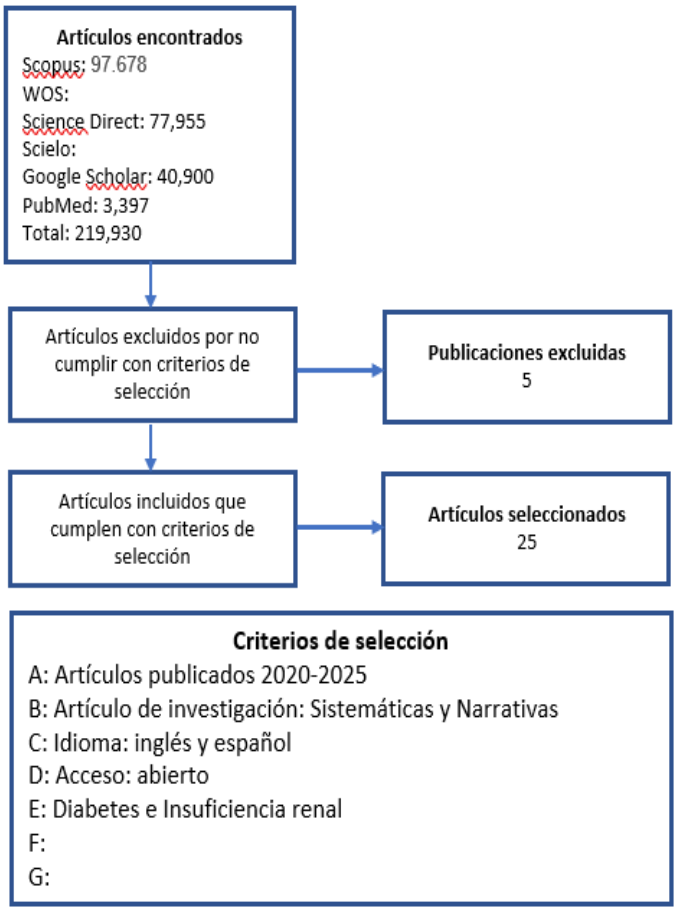

Figure 1. Flow diagram

RESULTS

A corpus of 25 articles was analyzed, of which 6 correspond to retrospective studies, 1 to longitudinal studies, 7 to systematic studies, 1 to narrative studies, 1 to research, 1 to correlational studies, 1 to FLOW studies, 3 to observational studies, 3 to coherent studies, and 1 to analysis. The population studied included children, adolescents, young adults aged 18 to 24, adults, older adults aged 65 to 86, and general population records from countries with different contexts. The studies were conducted in various countries, such as Hong Kong (3), Taiwan (4), Japan, Denmark (4), Thailand, Mexico, Finland, Korea (2), India, China (2), Asia, Glasgow, Babylon, Ethiopia (2), Ghana, United Arab Emirates, Italy, United Kingdom (2), Spain, France, United States (2), Australia (2), Germany, Bulgaria, and New Zealand, providing perspectives from different social, economic, and cultural realities. Twelve articles focused on factors, nine on treatment, and four on complications. The clinical conditions of the participants in the aforementioned studies: eight articles analyzed results for type 1 diabetes mellitus, type 2 diabetes mellitus, acute kidney injury, diabetes, renal failure, heart failure, cardiac kidney disease, chronic kidney disease, and diabetic nephropathy.

Table 1. Results

Study title	Methodology	Objective/Sample	Main results
Trends in kidney failure and kidney replacement therapy in people with diabetes in Hong Kong, 2002-2015: A retrospective cohort study (H. Wu et al., 2021)	A retrospective cohort study	To report trends in the incidence of kidney failure and kidney replacement therapy, as well as related mortality in people with diabetes in Hong Kong between 2002 and 2015. Sample: 7,3 million records	After coronary revascularization therapy, mortality rates from renal failure decreased, even after transplantation (KRT).
Integrating traditional Chinese medicine healthcare into diabetes care by reducing the risk of developing kidney failure among type 2 diabetic patients: A population-based case control study (Hsu et al., 2014)	Population-based case-control study. Logistic regression model	The objective of the study was to evaluate the integration of TCM into diabetes treatment and its effect on reducing the risk of developing renal failure. Sample: 1 million beneficiaries	It was observed that the integration of TCM (Traditional Chinese Medicine, such as acupuncture, which is a practice that helps control glucose) into diabetes care is associated with a decreased risk of developing renal failure.
Safety and Efficacy of GLP-1 Receptor Agonists in Type 2 Diabetes Mellitus with Advanced and End-Stage Kidney Disease: A Systematic Review and Meta-Analysis (Krisanapan et al., 2024)	A systematic review and meta-analysis	To evaluate the safety and efficacy of GLP-1RAs in patients with type 2 diabetes mellitus with advanced chronic kidney disease and end-stage kidney disease.	The evidence supports the safety and efficacy of GLP-1RAs (medications that control blood sugar) in patients with type 2 diabetes with advanced chronic kidney disease and end-stage renal disease.
Urinary epidermal growth factor in kidney disease: A systematic review (Ríos-Silva et al., 2023)	This systematic review	The objective of this review was to describe uEGF levels in the presence or progression of kidney disease.	uEGF (urinary epidermal growth factor associated with kidney disease) levels can predict the presence or progression of acute kidney injury, chronic kidney disease, and nephropathy.
Concomitant renal failure and diabetes mellitus as prognostic factors for acute myocardial infarction (Kim et al., 2011)	Retrospective cohort study	Objective: To investigate clinical outcomes according to the concomitance of renal dysfunction and diabetes mellitus in patients with AMI. Sample: 1 804 patients	Diabetic renal failure increases the likelihood of MACE (Major Adverse Cardiovascular Events), which is associated with a worse prognosis in AMI (Acute Myocardial Infarction)

Rate of Kidney Function Decline is Associated With Kidney and Heart Failure in Individuals With Type 1 Diabetes (Sandholm et al., 2023)	Longitudinal study	Objective To study whether the previous rate of kidney function decline, i.e., the slope of eGFR (blood test that assesses kidney function), is independently associated with the incidence of clinical cardiorenal events. Sample: 2 498 people from Finland	Rapid decline in kidney function independently predicts kidney failure, heart failure, and death, but does not significantly improve the overall prediction of these events.
Diabetic Retinopathy Is a Predictor of Progression of Diabetic Kidney Disease: A Systematic Review and Meta-Analysis (Gupta et al., 2022)	Systematic review.	To evaluate the predictive value of diabetic retinopathy (DR) in the progression of diabetic kidney disease (DKD).	Diabetic retinopathy is a strong predictor of kidney disease progression, with risk increasing with severity.
Effects of allopurinol on renal function in patients with diabetes: a systematic review and meta-analysis (Luo et al., 2022)	Systematic review and meta-analysis	To evaluate the efficacy and safety of allopurinol in patients with diabetes mellitus.	Allopurinol was shown to effectively reduce SUA (uric acid levels in the blood or urine) in patients with diabetes, protecting renal function.
Association Between Diabetes, Chronic Kidney Disease, and Outcomes in People With Heart Failure From Asia (Lawson et al., 2023)	Research article	To investigate clinical outcomes according to the concomitance of renal dysfunction and diabetes mellitus in patients with AMI (Acute Myocardial Infarction).	The combination of DM and CKD was associated with worse outcomes, with CKD being a consistent predictor of adverse outcomes regardless of HF subtype.
Analysis of the kidney failure risk equation implementation in routine clinical practice and health inequalities in chronic kidney disease care: a retrospective cohort study (Walker et al., 2025)	Design and setting Retrospective cohort study.	To analyze the implementation of KFRE (Kidney Failure Risk Equation) in clinical practice and investigate whether albuminuria testing varied among patients with CKD, particularly in disadvantaged groups.	Patients with hypertension are at greater risk of undergoing albuminuria testing, requiring improvements in the implementation of KFRE (Kidney Failure Risk Equation).
The Relationship between Diabetes Mellitus and Renal Failure in Babylon Province. (Yahya Ahmed & Hashim Abd Ali, 2020)	Correlational study	To estimate the level of blood urea, serum creatinine, and fasting serum glucose in patients with chronic renal failure and diabetes mellitus and to study the correlation between diabetes mellitus and renal failure. Sample: The study included 70 patients (42 men and 28 women), as well as 30 blood samples as a control group with diabetes mellitus and chronic renal failure, aged between 24 and 84 years.	Diabetic nephropathy (inadequate use of blood glucose), related to type 2 diabetes, is a cause of end-stage renal disease, with risk factors including hypertension, hyperlipidemia (high blood glucose and fat levels), and smoking.

Prognosis for Type 1 Diabetes with Diabetic Nephropathy between 2000 and 2020—Changes in Kidney Function Decline Over Time and Development of Cardiovascular Disease, Kidney Failure, and Mortality (Poulsen et al., 2024)	Register-based cohort study	Investigate whether the prognosis has improved even further for people with type 1 diabetes and newly diagnosed DN between 2000 and 2020. Sample: 591 individuals. Registration between 2000 and 2020	People with type 1 diabetes and recent diabetic nephropathy (DN) have better eGFR (estimated glomerular filtration rate) kidney function than patients with five years of DN, with loss of that function or slower.
Associations between depressive and anxiety symptoms and incident kidney failure in patients with diabetic nephropathy. (Qin et al., 2025)	Retrospective study	To analyze the associations between depressive and anxiety symptoms and the risk of incident kidney failure in patients with biopsy-proven diabetic nephropathy Sample: This retrospective study included 241 patients with type 2 diabetes and DN diagnosed by biopsy.	Depression and anxiety increase the risk of renal failure, requiring early detection
Prevalence of metabolic dysfunction associated fatty liver disease among patients with diabetic kidney disease: a systematic review and meta-analysis. (Rahmanian et al., 2024a)	Systematic review, and meta-analysis	Describe for the first time the specific association between NAFLD (non-alcoholic fatty liver disease) and ERD	High variability in the prevalence of MAFLD (fatty liver) was observed in patients with diabetic kidney disease
A cost-utility analysis of adding SGLT2 inhibitors for the management of type 2 diabetes with chronic kidney disease in Thailand (Chitpim et al., 2025)	Cohort study	This study evaluates the cost-utility of adding iSGLT2 to standard care for patients with type 2 diabetes and CKD in Thailand. Sample Included patients diagnosed with CKD, as well as patients with a previous diagnosis of CKD.	The addition of iSGLT2 (blocks the sodium-glucose transporter, found in the kidney) for patients with type 2 diabetes and chronic kidney disease is costly over a lifetime, but includes increased life expectancy and better outcomes.
Machine learning for risk prediction of acute kidney injury in patients with diabetes mellitus combined with heart failure during hospitalization (G. Li et al., 2025)	Correlational study:	Develop a machine learning model to predict the risk of acute kidney injury in diabetic patients with heart failure during hospitalization. Sample: 1 457 patients.	Machine learning models were effective in predicting the risk of renal failure in hospitalized patients with diabetes and heart failure, identifying key risk factors (anemia, atrial fibrillation, other arrhythmias, obesity).

Screening, prevalence, and burden of chronic kidney disease in people with type 2 diabetes managed by endocrinologists: A nationwide cross-sectional study (Martínez-Montoro et al., 2025)	Observational study	To describe and characterize the prevalence of chronic kidney disease (CKD), screening practices, and the associated burden in people with type 2 diabetes (T2D) managed by endocrinologists. Sample Study population 19 709.	In people with type 2 diabetes, CKD is common, and they may have other diseases such as hypertension, high cholesterol, and HF (heart failure). There is a significant lack of adequate detection and identification of CKD.
Kidney Biopsy: Diabetic and Non-diabetic Kidney Diseases and Outcomes in Patients with Type 2 Diabetes Receiving Dialysis: The REIN Registry (Ingwiller et al., 2025)	Observational cohort study	The aim is to outline and compare the clinical characteristics, survival rate, and access to kidney transplantation in patients with type 2 diabetes who start dialysis, classified by renal biopsy with ERD or non-ERD. SAMPLE 2 869 patients underwent renal biopsy.	After renal biopsy, dialysis outcomes were similar in diabetics with and without nephropathy, indicating that diabetes itself is the main factor influencing outcomes.
Estimated Glomerular Filtration Rate Variability and Incident Heart Failure in Adults With Type 2 Diabetes (Kaze et al., 2025)	Secondary analysis	The study evaluated the association of eGFR variability with incident heart failure in a large sample of adults with type 2 diabetes. Sample: 10 251 participants aged 40 to 79 years with cardiovascular disease were included.	Greater eGFR (glomerular filtration rate) variability was independently associated with an increased risk of HF (heart failure) in adults with T2DM (type 2 diabetes mellitus).
Effects of Semaglutide on Heart Failure Outcomes in Diabetes and Chronic Kidney Disease in the FLOW Trial (Pratley et al., 2024)	The FLOW study (Research study to see how semaglutide works compared to placebo in people with type 2 diabetes and chronic kidney disease)	Examine the effects of semaglutide on HF outcomes in this high-risk population.	Semaglutide (drug) was shown to reduce the risk of heart failure events or cardiovascular death in patients with type 2 diabetes and chronic kidney disease.
Outcome trends in people with heart failure, type 2 diabetes mellitus, and chronic kidney disease in the UK over twenty years (Lawson et al., 2021)	Observational study	To investigate the separate and combined associations between type 2 diabetes and chronic kidney disease comorbidities, hospital admissions, and cause-specific death in people with heart failure in England. Sample: There were 87 709 patients with HF.	Type 2 diabetes, chronic kidney disease, and heart failure are complex diseases, but they share common risk factors and mechanisms.

The Impact of Donor and Recipient Diabetes on Patient and Graft Survival in Kidney Transplant Recipients (Orsillo et al., 2025)	Analysis study	This study investigated graft and patient survival when the donor, recipient, or both have diabetes. Sample: 11 423 recipients were considered for analysis.	Graft survival was only worse if both the donor and recipient had diabetes. However, there were no differences in rejection and only a slight reduction in kidney function with diabetic donors.
Probiotics improve renal function, glucose, lipids, inflammation, and oxidative stress in diabetic kidney disease: a systematic review and meta-analysis (Dai et al., 2022)	A systematic review and meta-analysis	Systematically evaluate the impact of probiotics in patients with Diabetic Kidney Disease (DKD).	It was revealed that probiotics (such as Lactobacillus rhamnosus) could delay the progression of kidney damage, improve metabolism, and reduce inflammation and stress in patients with chronic kidney disease.
Association of SGLT2 inhibitors with cardiovascular, kidney, and safety outcomes among patients with diabetic kidney disease: a meta-analysis (Kaze et al., 2022a)	A systematic review and meta-analysis	To summarize and update the current evidence on the effects of iSGLT2 on cardiovascular, renal, and safety outcomes among patients with diabetic kidney disease.	The use of SGLT2 (sodium-glucose cotransporter) inhibitors (such as dapagliflozin) was shown to significantly reduce the risk of serious events such as death, major adverse cardiovascular events, and renal complications.
Prognostication of Mental Health Risk Clusters on Hospitalization and Mortality in Patients With Coexisting Diabetes and Kidney Failure: The Hidden Burden of Loneliness (She et al., 2025)	Prospective cohort study.	Identify psychosocial factors, characterize patient profiles with diabetes and kidney failure, model their prognostic effects on hospitalization and mortality, and explore the underlying mechanisms linking psychosocial factors to clinical outcomes. Sample: A total of 221 participants with coexisting diabetes and kidney disease.	This study revealed that patients with profiles of loneliness and distress are at greater risk of hospitalization.

DISCUSSION

The findings have enabled the identification of the factors, treatments, and complications of diabetes that lead to kidney failure, which other sources will analyze.

Factors

Type 2 diabetes, chronic kidney disease, and heart failure are complex diseases. However, they share common risk factors and mechanisms (Lawson et al., 2021), with diabetic nephropathy (inadequate blood glucose control) increasing the risk of hypertension, hyperlipidemia (high blood fat levels), and smoking (Yahya Ahmed & Hashim Abd Ali, 2020). However, people who have recently been diagnosed with type 1 diabetes have better estimated glomerular filtration rate (eGFR) than patients with five years of diabetes, who have lost some or all this function. (Poulsen et al., 2024) found that after a kidney biopsy, dialysis outcomes were similar in people with diabetes with and without nephropathy, indicating that diabetes itself is the main factor influencing outcomes (Ingwiller et al., 2025). These types of patients may have other diseases, such as hypertension, high cholesterol, and HF (heart failure) (Martínez-Montoro et al., 2025). They may have albuminuria, as assessed by the KFRE (Kidney Failure Risk Equation) (Walker et al., 2025). On the other hand, uEGF (urinary epidermal growth factor associated with kidney disease) levels can predict the presence or progression of acute kidney injury, chronic kidney disease, and nephropathy (Ríos-Silva et al., 2023), presenting greater variability in eGFR (Glomerular Filtration Rate) that is independently associated with an increased risk of HF (Heart Failure) (Kaze et al., 2025), as well as variability in the prevalence of patients with MAFLD (fatty liver) (Rahmanian et al., 2024a). Finally, depression and anxiety increase the risk of kidney failure, requiring early detection (Qin et al., 2025) and risk of hospitalization (She et al., 2025).

Diabetic nephropathy

Diabetic nephropathy (inadequate use of blood glucose) is caused by hypertension, hyperlipidemia (high blood fat levels), and smoking (Yahya Ahmed & Hashim Abd Ali, 2020), with excess insulin being the main cause due to insulin resistance (Abaj et al., 2025). Its progression is linked to corisin, a key peptide in renal fibrosis (Yasuma et al., 2025). It also has unique inflammatory mechanisms that differentiate it from other diseases, such as pituitary tumors (Fu & Chen, 2025). For diagnosis, the AOPEP gene and the miR-27b-3p molecule enable non-invasive analysis to differentiate kidney damage due to diabetic nephropathy from that due to another disease (Conserva et al., 2025). However, maintaining a high LE8 score (8 essential elements of life) reduces the risk of death (F. Zhang & Li, 2025).

Hypertension

Patients with diabetes often have diseases such as hypertension, high cholesterol, and heart failure (Martínez-Montoro et al., 2025), with hypertension being the second leading cause of chronic kidney disease (Yirga et al., 2025) due to renin, dopamine, and norepinephrine, which are responsible for irreversible changes in renal function and structure (Heryć et al., 2025), increasing the risk of dementia because insulin resistance causes vascular dysfunction (Y. Y. Chen et al., 2025), and people with hypertension consume fewer plant-based foods and healthy fats, without a consistent eating pattern (Daidone et al., 2025). On the other hand, the albuminuria test performed in adults with chronic kidney disease cannot be performed on women and people with hypertension (Walker et al., 2025).

UEGF (urinary epidermal growth factor)

uEGF (urinary epidermal growth factor) predicts the presence or progression of acute kidney

injury, chronic kidney disease, nephropathy, and diabetes (Ríos-Silva et al., 2023). It acts as a biomarker that signals problems in the renal tubule (Norvik et al., 2021), leading to an increased risk of kidney function impairment, since this protein is produced in a globular form in the kidney, specifically in the loop of Henle and the distal convoluted tubule (Cortvrindt et al., 2022). It also functions as an early indicator of diabetic nephropathy in children and adolescents (Ledeganck et al., 2021). uEGF also increases the levels of important biomarkers in urine, which can predict the onset and progression of kidney disease (L. Wu et al., 2020).

MAFLD (Metabolically associated fatty liver disease)

The prevalence of MAFLD (fatty liver) was observed in patients with diabetes (Rahmanian et al., 2024b), affecting more than one-third of the adult population, with hepatic, cardiovascular, and renal risk (Lu et al., 2025). It is a common and growing condition in people with type 2 diabetes (Benlloch et al., 2024), acting as an independent predictor of chronic kidney disease (CKD), regardless of sex, weight, or other risk factors (W. Liu & Sun, 2024). In addition, abdominal fat is a better predictor of mortality in patients with CKD than body mass index (BMI), which is why early detection should be used to reduce mortality (Cheng et al., 2025) and the risk of hospitalization for heart failure (Lee et al., 2023).

Treatment

Treatments that prevent the progression of kidney damage, such as SGLT2 (sodium-glucose cotransporter) inhibitors (such as dapagliflozin), reduce the risk of mortality, cardiovascular events, and kidney complications. (Kaze et al., 2022), Moreover, longer life expectancy and better outcomes are guaranteed with the additional use of iSGLT2 (an inhibitor of the sodium-glucose transporter in the kidney). (Chitpim et al., 2025). Treatment with GLP-1RA (Krisanapan et al., 2024) is effective for controlling blood sugar. Similarly, semaglutide (medication) has been shown to reduce the risk of heart failure or cardiovascular death in patients with type 2 diabetes and chronic kidney disease. (Pratley et al., 2024). On the other hand, graft survival worsened when both the donor and recipient had diabetes, but there was no difference in rejection; only a slight reduction in renal function was observed with diabetic donors (Orsillo et al., 2025). In addition, mortality rates from renal failure decreased after coronary revascularization therapy and after kidney transplantation (KRT) (H. Wu et al., 2021). Finally, TCM (Traditional Chinese Medicine), such as acupuncture, which helps control glucose in diabetes care, is associated with a reduced risk of developing renal failure (Hsu et al., 2014), and similarly, probiotics (such as Lactobacillus rhamnosus) could delay kidney damage, improve metabolism, and reduce inflammation in patients (Dai et al., 2022), along with allopurinol, which effectively reduced SUA (serum uric acid levels in blood or urine) (Luo et al., 2022).

Dapagliflozin

The treatment that prevents the progression of kidney damage is SGLT2 (sodium-glucose cotransporter) dapagliflozin, which reduces the risk of mortality, cardiovascular events, and kidney complications (Kaze et al., 2022). It acts in the kidney by increasing urine output and altering its concentration to prevent the reabsorption of glucose and sodium (S. Liu et al., 2025). However, in severe patients, it reduces diuretic use and increases the need for blood pressure medications (Zampieri et al., 2025). On the other hand, it is safe in hospitalized diabetic patients with COVID-19 (Rahmanian et al., 2024b) and is more effective than placebo at preserving renal function (Holmen et al., 2026). It protects the heart against heart attack in patients with diabetes and acute coronary syndrome (Zhao et al., 2025).

iSGLT2

SGLT2 drugs block the sodium-glucose transporter in the kidney to improve life expectancy and clinical outcomes (Chitpim et al., 2025). They are one of the treatments for type 2 diabetes mellitus, heart failure, chronic kidney disease, and hypertension, and they reduce major cardiovascular events (Campos et al., 2025). They also have renal benefits, reducing mortality alongside RAS inhibitors in survival therapies (Hong et al., 2025), and help control proteinuria in patients with IgA (immunoglobulin A) nephropathy due to their effects on kidney pressure and inflammation (Serna-Trejos et al., 2024). However, when included in osmotic diuresis and vasoconstriction, they can cause dehydration and acute kidney injury (Feitosa et al., 2023).

Coronary revascularization

Coronary revascularization is a renal replacement therapy associated with decreased mortality from renal failure (H. Wu et al., 2021) and with improved risk stratification in diabetic patients with more diffuse and progressive disease (Aker et al., 2025). Likewise, their risk increases after percutaneous coronary intervention (PCI), specifically when comparing those with and without diabetes (van Vliet et al., 2025). On the other hand, in patients with three affected vessels, coronary bypass offers better results than angioplasty (Fialka et al., 2025). Chronic kidney disease also predicts adverse outcomes in coronary patients who undergo surgery (Takahashi et al., 2025). However, the effectiveness of revascularization in chronically obstructed coronary arteries is low in patients with renal disease undergoing dialysis (Tsai et al., 2025).

Complications

Diabetic retinopathy is a strong predictor of kidney disease progression, increasing the risk with severity (Gupta et al., 2022). Similarly, the combination of DM and CKD is associated with worse outcomes, with CKD being an independent predictor of HF (Lawson et al., 2023), just as the worst prognosis in AMI (Acute Myocardial Infarction) is an increase in MACE (Major Adverse Cardiovascular Events) (Kim et al., 2011). Finally, in this context, rapid deterioration of renal function predicts renal and cardiac failure and death globally (Sandholm et al., 2023).

Acute myocardial infarction

The worst prognosis in AMI (Acute Myocardial Infarction) is an increase in MACE (Major Adverse Cardiovascular Events) (Kim et al., 2011). This risk is higher the higher the Glycated Hemoglobin Index (Keller et al., 2026), especially in people over 70 years of age with hyperlipidemia, lung disease, or cancer. Likewise, for its treatment, percutaneous coronary intervention (PCI) reduces rehospitalization by lowering heart rate (Gao & Wang, 2025), and SGLT2 inhibitors offer additional cardiac protection by reducing inflammation and post-infarction myocardial damage (Martínez-Montoro et al., 2025).

HF (Heart Failure)

The combination of diabetes mellitus (DM) and chronic kidney disease (CKD) is associated with worse outcomes, being an independent risk predictor even without heart failure (HF) (Lawson et al., 2023). Furthermore, the severity of diabetic retinopathy, as assessed by retinal photography, is an independent indicator of disease status (Huang et al., 2025). However, there is a limitation in knowledge about long-term renal progression in patients who already have heart failure and type 2 diabetes (Julián et al., 2025). On the other hand, the combination of diabetes and CKD increases cardiovascular risk in acute HF. This comorbidity does not affect the efficacy or safety of eplerenone treatment (Kobayashi et al., 2025). Finally, in the management of these patients, topical corticosteroids have been shown to reduce mortality in those with heart failure with reduced ejection fraction (HFrEF) (Svanström et al., 2026).

MACE (Major Adverse Cardiovascular Events)

The worst prognosis in acute myocardial infarction (AMI) is an increase in major adverse cardiovascular events (MACE) (Kim et al., 2011). This risk is higher in patients with weakened heart function, higher blood sugar and fat levels, and lower kidney function (Jiang et al., 2025), which can be predicted using a machine learning model that primarily considers kidney impairment, advanced age, and inflammation levels (Kwiendacz et al., 2025). In addition, fatty liver acts as an aggravating factor that worsens cardiovascular risk in people with prediabetes, increasing the likelihood of MACE (Lyu et al., 2025). In patients undergoing transcatheter aortic valve replacement (TAVR), there is an imbalance between vascular volume and myocardial mass (V/M ratio), which is identified as the strongest predictor of MACE (W. Li et al., 2025). Given this scenario, treatment with IVL (sound waves) reduces the risk of MACE in patients with and without kidney problems (Phagu et al., 2025).

This research has certain limitations, notably a marked geographical bias in the available literature, with an overrepresentation of studies conducted in high-income countries, which limits the applicability of the results to regions with less developed health systems. In addition, the selection of articles may have been influenced by limited access to regional databases and the predominance of observational designs and systematic reviews. For this reason, future research should conduct broader searches that include locally accessible academic archives and work in conjunction with researchers from underrepresented countries. Finally, methodological heterogeneity in the definition of key variables, such as clinical conditions and socioeconomic levels, made it difficult to compare studies and perform more robust aggregate analyses directly.

CONCLUSION

Diabetic nephropathy is caused by hypertension, hyperlipidemia, and smoking, due to excess insulin linked to cholesteryl ester. Its diagnosis focuses on distinguishing kidney damage from diabetic nephropathy or another disease, using the AOPEP gene (aminopeptidase protein) and the miR-27b-3p molecule (reduction of endothelial cells). Hypertension causes damage to the kidneys due to renalase, dopamine, and norepinephrine, which increases the risk of dementia along with a poor diet. For diagnosis, the albuminuria test does not apply to women and hypertensive patients with chronic kidney disease. uEGF (urinary epidermal growth factor) is a biomarker that predicts acute kidney injury, chronic kidney disease, nephropathy, and diabetes. As a globular protein, it detects diabetic nephropathy in children and adolescents and enhances the predictive value of other biomarkers for the progression of kidney disease. MAFLD (fatty liver) is prevalent in patients with diabetes who are at risk of cardiovascular and renal disease. It is a common and growing condition in type 2 diabetes. It acts as an independent predictor of chronic kidney disease, together with abdominal fat, which is a better predictor than BMI. Early detection should therefore be used to reduce mortality and the risk of hospitalization for heart failure.

Dapagliflozin is an SGLT2 inhibitor that protects the kidney and heart, is more effective than placebo, and is safe in people with diabetes with COVID-19; however, in severe cases, it may require adjustment of diuretics and blood pressure medications. iSGLT2 inhibitors block the renal sodium-glucose transporter, improving life expectancy in patients with diabetes, heart failure, and chronic kidney disease, reducing cardiovascular events and offering renal benefits, although with risks of dehydration and acute kidney injury. Coronary revascularization improves renal survival but increases the risk of PCI (percutaneous coronary intervention) in diabetics, with bypass being superior to angioplasty in three-vessel disease (meaning that the three main

arteries of the heart are blocked or severely narrowed). At the same time, chronic nephropathy worsens the prognosis, although revascularization remains effective in renal patients.

The worst prognosis after an AMI is linked to a higher risk of MACE, a risk that increases with high levels of glycated hemoglobin, particularly in people over 70 with comorbidities, and whose treatment with percutaneous coronary intervention reduces rehospitalization, while SGLT2 inhibitors offer cardiac protection. In the context of heart failure, the combination of DM and CKD leads to worse outcomes and increased cardiovascular risk. However, treatment with eplerenone remains effective, and topical corticosteroids reduce mortality. The risk of MACE after a heart attack is heightened in patients with impaired cardiac function and renal involvement, fatty liver, and myocardial volume/mass imbalance; however, sound wave therapy (IVL) manages to equalize this risk between patients with and without kidney disease.

REFERENCES

Abaj, F., Mirzababaei, A., Gholizadeh, M., Aali, Y., Jadidi, P., Amiri Khosroshahi, R., Clark, C. C. T., & Mirzaei, K. (2025). Associations of dietary insulin load and dietary insulin index with diabetic nephropathy and reduced kidney function among women: a case–control study. Journal of Health, Population and Nutrition, 44(1). https://doi.org/10.1186/s41043-025-00895-2

Aker, A., Halon, D., Avidan, Y., Yahav, A., Makhoul, S., & Zafrir, B. (2025). The long-term prognostic value of CT coronary artery calcium score in asymptomatic patients with type 2 diabetes. IJC Heart and Vasculature, 61. https://doi.org/10.1016/j.ijcha.2025.101799

Benlloch, S., Moncho, F., & Górriz, J. L. (2024). Targeting metabolic-associated fatty liver disease in diabetic kidney disease: A call to action. In Nefrologia 44(2), 129–138). Elsevier Espana S.L.U. https://doi.org/10.1016/j.nefro.2023.08.005

Campos, R. N., Moreira, D. A. R., & da Fonseca, G. M. (2025). Effect of dapagliflozin, a sodium-glucose co-transporter 2 inhibitor, on ventricular repolarization electrocardiographic parameters in type 2 diabetes patients: DAPA - ECG study. Frontiers in Clinical Diabetes and Healthcare, 6. https://doi.org/10.3389/fcdhc.2025.1537005

Chen, T. K., Knicely, D. H., & Grams, M. E. (2019). Chronic Kidney Disease Diagnosis and Management: A Review. In JAMA - Journal of the American Medical Association 322(13), 1294–1304. American Medical Association. https://doi.org/10.1001/jama.2019.14745

Chen, Y. Y., Chen, Y. H., Fang, Y. W., Wang, J. T., & Tsai, M. H. (2025). The protective effects of insulin on the developing of dementia in chronic kidney disease patients with hypertension and diabetes: a population-based nationwide study. BMC Nephrology, 26(1). https://doi.org/10.1186/s12882-025-04145-9

Cheng, A. Y. Y., Mottl, A., & Magwire, M. (2025). Pillar Risk-Based Treatment for Chronic Kidney Disease in People With Type 2 Diabetes: A Narrative Review. In Diabetes Therapy. Adis. https://doi.org/10.1007/s13300-025-01796-7

Chitpim, N., Leelahavarong, P., Prawjaeng, J., Ittiphisit, S., Srinonprasert, V., & Kongmalai, T. (2025). A cost-utility analysis of adding SGLT2 inhibitors for the management of type 2 diabetes with chronic kidney disease in Thailand. Scientific Reports, 15(1). https://doi.

org/10.1038/s41598-024-81747-7

Conserva, F., Pesce, F., Cinefra, C., Marvulli, T. M., Bari, I. Di, Stasi, A., Faienza, M. F., Rossini, M., Montinaro, A., Squiccimarro, E., Sclavo, G., Schirinzi, A., Serio, F. Di, Nair, V., Fermin, D., Menon, R., Otto, E., Sallustio, F., Gallone, A., … Pontrelli, P. (2025). A renal biopsy-anchored multi-marker signature involving AOPEP SNP-driven splicing, miR-27b-3p and glycated albumin for stratifying renal damage in type 2 diabetes. Diabetes Research and Clinical Practice, 229. https://doi.org/10.1016/j.diabres.2025.112460

Cortvrindt, C., Speeckaert, R., Delanghe, J. R., & Speeckaert, M. M. (2022). Urinary Epidermal Growth Factor: A Promising "Next Generation" Biomarker in Kidney Disease. In American Journal of Nephrology 53(5), 372–387. S. Karger AG. https://doi.org/10.1159/000524586

Dai, Y., Quan, J., Xiong, L., Luo, Y., & Yi, B. (2022). Probiotics improve renal function, glucose, lipids, inflammation and oxidative stress in diabetic kidney disease: a systematic review and meta-analysis. Renal Failure, 44(1), 862–880. https://doi.org/10.1080/0886022X.2022.2079522

Daidone, M., Di Chiara, T., Del Cuore, A., Casuccio, A., Salamone, G., Di Raimondo, D., & Tuttolomondo, A. (2025). Mediterranean diet and hypertension: relationship between adherence to a Mediterranean diet and arterial hypertension. BMC Nutrition, 11(1). https://doi.org/10.1186/s40795-025-01025-1

Diaz, G. E., Mostacero, G. H., Huamaní, B., Gutierrez-Rodriguez, R., Rivera-Lozada, O., Yangali-Vicente, J., & Barboza, J. J. (2025). Finerenone Versus Placebo on Renal Outcomes in Patients with Chronic Kidney Disease and Type 2 Diabetes: A Systematic Review and Meta-Analysis. In Journal of Clinical Medicine 14(18). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/jcm14186355

Faghir Ganji, M., Ansari-Moghaddam, A., Amanollahi, A., Fallahi, R., & Abdolmohammadi, N. (2024). The prevalence of kidney failure in diabetic patients with and without anemia: A systematic review and meta-analysis. In Clinical Epidemiology and Global Health 28. Elsevier B.V. https://doi.org/10.1016/j.cegh.2024.101641

Feitosa, M. P. M., Lima, E. G., Abizaid, A. A. C., Mehran, R., Lopes, N. H. M., de Assis Fischer Ramos, T., Hideo-Kajita, A., Filho, R. K., & Junior, C. V. S. (2023). The safety of SGLT-2 inhibitors in diabetic patients submitted to elective percutaneous coronary intervention regarding kidney function: SAFE-PCI pilot study. Diabetology and Metabolic Syndrome, 15(1). https://doi.org/10.1186/s13098-023-01107-9

Fialka, N., EL-Andari, R., Kang, J., Hong, Y., McAlister, F. A., Nagendran, J., & Nagendran, J. (2025). Myocardial Revascularization in Patients With 3 Vessel Coronary Artery Disease and Chronic Kidney Disease: Coronary Artery Bypass Grafting Versus Percutaneous Coronary Intervention. American Journal of Cardiology, 243, 8–14. https://doi.org/10.1016/j.amjcard.2025.02.004

Fu, Y., & Chen, Y. (2025). Comprehensive Mendelian randomization analysis of inflammatory networks in diabetic nephropathy and pituitary adenoma: unveiling complex causal relationships. Discover Oncology, 16(1). https://doi.org/10.1007/s12672-025-03291-8

Gao, D., & Wang, A. (2025). Association between hemoglobin glycation index and myocardial infarction in critically ill patients with diabetes mellitus: a retrospective study based on MIMIC-IV. BMC Cardiovascular Disorders, 25(1). https://doi.org/10.1186/s12872-025-04742-4

Gupta, M., Rao, I. R., Nagaraju, S. P., Bhandary, S. V., Gupta, J., & Babu, G. T. C. (2022). Diabetic Retinopathy Is a Predictor of Progression of Diabetic Kidney Disease: A Systematic Review and Meta-Analysis. In International Journal of Nephrology, 2022. Hindawi Limited. https://doi.org/10.1155/2022/3922398

Heryć, R., Cecerska-Heryć, E., Serwin, N., Stodolak, P., Goszka, M., Polikowska, A., Ciechanowski, K., & Wiśniewska, M. (2025). Renalase, dopamine, and norepinephrine as markers for the development of hypertension in CKD patients. BMC Nephrology, 26(1). https://doi.org/10.1186/s12882-025-04114-2

Holmen, S., Manintveld, O., Damman, K., Braun, O., Löfman, I. H., Szymanski, M., Ravnestad, H., Gude, E., Bjørkelund, E., Andreassen, A. K., Gullestad, L., & Broch, K. (2026). DAPAgliflozin for renal protection in heart transplant recipients. Rationale and design of the randomized controlled DAPARHT trial. American Heart Journal, 291, 128–135. https://doi.org/10.1016/j.ahj.2025.08.010

Hong, S., Han, K., Kim, K. S., & Park, C. Y. (2025). Effects of RAS and SGLT2 inhibitors alone or in combination on end-stage kidney disease and/or all-cause death in patients with both diabetes and hypertension: a nationwide cohort study. Cardiovascular Diabetology, 24(1). https://doi.org/10.1186/s12933-025-02846-x

Hsu, P. C., Tsai, Y. T., Lai, J. N., Wu, C. T., Lin, S. K., & Huang, C. Y. (2014). Integrating traditional Chinese medicine healthcare into diabetes care by reducing the risk of developing kidney failure among type 2 diabetic patients: A population-based case control study. Journal of Ethnopharmacology, 156, 358–364. https://doi.org/10.1016/j.jep.2014.08.029

Huang, Y. C., Shen, F. C., Liu, P. K., Su, W. C., Huang, T. H., Lin, M. Y., Kuo, M. C., Chiu, Y. W., Hwang, S. J., Lin, Y. T., & Wu, P. H. (2025). Dissecting the relationship between heart failure and diabetic retinopathy severity in patients with diabetes and chronic kidney disease: an observational cohort study. Scientific Reports, 15(1). https://doi.org/10.1038/s41598-025-04523-1

Ingwiller, M., Delautre, A., Tivollier, J. M., Edet, S., Florens, N., Couchoud, C., & Hannedouche, T. (2025). Kidney Biopsy-Proven Diabetic and Non-Diabetic Kidney Diseases and Outcomes in Patients With Type 2 Diabetes Receiving Dialysis: The REIN Registry. Kidney Medicine, 7(2). https://doi.org/10.1016/j.xkme.2024.100944

Jiang, R., Li, Y., Cheng, L., Ni, W., Ni, Q., Zhu, J., Lin, K., Ke, J., Gao, Z., & Zhou, H. (2025). Stress hyperglycemia ratio and its correlation with long-term prognosis in ACS patients with chronic kidney disease: a retrospective study. BMC Cardiovascular Disorders, 25(1). https://doi.org/10.1186/s12872-025-04907-1

Julián, M. T., Codina, P., Lupón, J., Zamora, E., Pérez-Montes de Oca, A., Domingo, M., Santiago-Vacas, E., Borrellas, A., Ruiz-Cueto, M., González-Gallego, C., Troya, M., Romero-González,

G. A., Alonso, N., & Bayes-Genis, A. (2025). Long-term trajectory of estimated glomerular filtration rate in ambulatory patients with type 2 diabetes and heart failure: clinical insights and prognostic implications. Cardiovascular Diabetology, 24(1). https://doi.org/10.1186/s12933-025-02632-9

Kaur, A., Sharma, G. S., & Kumbala, D. R. (2023). Acute kidney injury in diabetic patients: A narrative review. In Medicine (United States) 102(21). Lippincott Williams and Wilkins. https://doi.org/10.1097/MD.0000000000033888

Kaze, A. D., Ndumele, C. E., Jaar, B. G., Santhanam, P., Yeneneh, B. T., Mookadam, F., Tung, R., Fonarow, G. C., Crews, D. C., & Echouffo-Tcheugui, J. B. (2025). Estimated Glomerular Filtration Rate Variability and Incident Heart Failure in Adults With Type 2 Diabetes. JACC: Advances, 4(8). https://doi.org/10.1016/j.jacadv.2025.101903

Kaze, A. D., Zhuo, M., Kim, S. C., Patorno, E., & Paik, J. M. (2022a). Association of SGLT2 inhibitors with cardiovascular, kidney, and safety outcomes among patients with diabetic kidney disease: a meta-analysis. Cardiovascular Diabetology, 21(1). https://doi.org/10.1186/s12933-022-01476-x

Keller, K., Schmitt, V. H., Hobohm, L., & Espinola-Klein, C. (2026). Risk factors for myocardial infarction in patients with peripheral artery disease. International Journal of Cardiology, 442. https://doi.org/10.1016/j.ijcard.2025.133898

Kim, C. S., Choi, J. S., Park, J. W., Bae, E. H., Ma, S. K., Jeong, M. H., Kim, Y. J., Cho, M. C., Kim, C. J., & Kim, S. W. (2011). Concomitant renal insufficiency and diabetes mellitus as prognostic factors for acute myocardial infarction. Cardiovascular Diabetology, 10. https://doi.org/10.1186/1475-2840-10-95

Kobayashi, M., Yamashina, A., Satomi, K., Watanabe, M., Takagi, R., Tezuka, A., Ito, S., Asakura, M., & Kitakaze, M. (2025). Eplerenone, diabetes, and chronic kidney disease in patients hospitalized for acute heart failure: findings from the EARLIER trial. Cardiovascular Diabetology, 24(1). https://doi.org/10.1186/s12933-025-02659-y

Krisanapan, P., Sanpawithayakul, K., Pattharanitima, P., Thongprayoon, C., Miao, J., Mao, M. A., Suppadungsuk, S., Tangpanithandee, S., Craici, I. M., & Cheungpasitporn, W. (2024). Safety and Efficacy of GLP-1 Receptor Agonists in Type 2 Diabetes Mellitus with Advanced and End-Stage Kidney Disease: A Systematic Review and Meta-Analysis. In Diseases, 12(1). Multidisciplinary Digital Publishing Institute (MDPI). https://doi.org/10.3390/diseases12010014

Kunutsor, S. K., Seidu, B. S., & Seidu, S. (2024). Cardiovascular effectiveness of newer glucose-lowering agents, with and without baseline lipid-lowering therapy in type 2 diabetes: A systematic meta-analysis of cardiovascular outcome trials and real-world evidence. In Primary Care Diabetes 18(6), 589–598. Elsevier Ltd. https://doi.org/10.1016/j.pcd.2024.09.007

Kwiendacz, H., Huang, B., Chen, Y., Janota, O., Irlik, K., Liu, Y., Mantovani, M., Zheng, Y., Hendel, M., Piaśnik, J., Wójcik, W., Alam, U., Gumprecht, J., Lip, G. Y. H., & Nabrdalik, K. (2025). Predicting major adverse cardiac events in diabetes and chronic kidney disease: a machine learning study from the Silesia Diabetes-Heart Project. Cardiovascular Diabetology, 24(1). https://doi.org/10.1186/s12933-025-02615-w

Lawson, C. A., Seidu, S., Zaccardi, F., McCann, G., Kadam, U. T., Davies, M. J., Lam, C. S., Heerspink, H. L., & Khunti, K. (2021). Outcome trends in people with heart failure, type 2 diabetes mellitus and chronic kidney disease in the UK over twenty years: Clinical Practice Research Datalink cohort study. EClinicalMedicine, 32. https://doi.org/10.1016/j.eclinm.2021.100739

Lawson, C. A., Tay, W. T., Bernhardt, L., Richards, A. M., Zaccardi, F., Tromp, J., Katherine Teng, T. H., Hung, C. L., Chandramouli, C., Wander, G. S., Ouwerkerk, W., Seidu, S., Khunti, K., & Lam, C. S. P. (2023). Association Between Diabetes, Chronic Kidney Disease, and Outcomes in People With Heart Failure From Asia. JACC: Asia, 3(4), 611–621. https://doi.org/10.1016/j.jacasi.2023.03.005

Ledeganck, K. J., den Brinker, M., Peeters, E., Verschueren, A., De Winter, B. Y., France, A., Dotremont, H., & Trouet, D. (2021). The next generation: Urinary epidermal growth factor is associated with an early decline in kidney function in children and adolescents with type 1 diabetes mellitus. Diabetes Research and Clinical Practice, 178. https://doi.org/10.1016/j.diabres.2021.108945

Lee, S. E., Yoo, J., Kim, B. S., Choi, H. S., Han, K., & Kim, K. A. (2023). The effect of metabolic dysfunction-associated fatty liver disease and diabetic kidney disease on the risk of hospitalization of heart failure in type 2 diabetes: a retrospective cohort study. Diabetology and Metabolic Syndrome, 15(1). https://doi.org/10.1186/s13098-023-01006-z

Li, G., Zhao, Z., Yu, Z., Liao, J., & Zhang, M. (2025). Machine learning for risk prediction of acute kidney injury in patients with diabetes mellitus combined with heart failure during hospitalization. Scientific Reports, 15(1). https://doi.org/10.1038/s41598-025-87268-1

Li, W., Ren, R., Zhao, Q., Qi, C., Chen, Z., & Zhang, Y. (2025). Computed tomography-based coronary lumen volume to myocardial mass ratio in patients undergoing transcatheter aortic valve replacement: a novel method for risk assessment. BMC Cardiovascular Disorders, 25(1). https://doi.org/10.1186/s12872-025-04705-9

Liu, S., Chen, W., Zhao, Y., Ma, S., Shi, B., & Guo, H. (2025). SGLT2 inhibitor in a type 2 diabetes mellitus patient coexisted with central diabetes insipidus following hyperosmolar hyperglycemic state. BMC Endocrine Disorders, 25(1). https://doi.org/10.1186/s12902-025-01924-1

Liu, W., & Sun, X. (2024). Does metabolic dysfunction-associated fatty liver disease increase the risk of chronic kidney disease? A meta-analysis of cohort studies. BMC Nephrology, 25(1). https://doi.org/10.1186/s12882-024-03910-6

Lu, N. L., Lam, H. T., & Vo, T. D. (2025). Prevalence of metabolic dysfunction-associated fatty liver disease among health check-up attendees: A retrospective study conducted in Vietnam. World Journal of Gastroenterology, 31(37). https://doi.org/10.3748/wjg.v31.i37.110797

Luo, Q., Cai, Y., Zhao, Q., Tian, L., Liu, Y., & Liu, W. jing. (2022). Effects of allopurinol on renal function in patients with diabetes: a systematic review and meta-analysis. Renal Failure, 44(1), 806–814. https://doi.org/10.1080/0886022X.2022.2068443

Lyu, Y. S., Park, M., Kim, H. K., Park, S., Park, J. Y., Hong, A. R., Yoon, J. H., Jeong, S., Yoon, Y., Kim, J. H., Kim, S. Y., Kang, H. C., & Choi, W. (2025). Combined impact of prediabetes and fatty liver index on cardiometabolic outcomes and mortality in middle aged adults: a nationwide cohort study. Cardiovascular Diabetology, 24(1). https://doi.org/10.1186/s12933-025-02793-7

Martínez-Montoro, J. I., Aparicio-Sánchez, J. J., Pimentel, B., Juárez-Campo, M., Alamillo, M. L., & Fernández-García, J. C. (2025). Screening, prevalence, and burden of chronic kidney disease in people with type 2 diabetes managed by endocrinologists: A nationwide cross-sectional study. Diabetes Research and Clinical Practice, 226. https://doi.org/10.1016/j.diabres.2025.112326

Nardi, E., Prastaro, M., Santoro, C., Gallo, L., Simeoli, L., Fontanarosa, S., Paolillo, S., Gargiulo, P., Esposito, G., & Filardi, P. P. (2025). Therapeutic tailored approach in patients with diabetes, cardiovascular and renal comorbidities: A cardiologist's view. In Nutrition, Metabolism and Cardiovascular Diseases 35(9). Elsevier B.V. https://doi.org/10.1016/j.numecd.2025.104033

Norvik, J. V., Harskamp, L. R., Nair, V., Shedden, K., Solbu, M. D., Eriksen, B. O., Kretzler, M., Gansevoort, R. T., Ju, W., & Melsom, T. (2021). Urinary excretion of epidermal growth factor and rapid loss of kidney function. Nephrology Dialysis Transplantation, 36(10), 1882–1892. https://doi.org/10.1093/ndt/gfaa208

Orsillo, A., Kholmurodova, F., Clayton, P. A., Chadban, S., Weightman, A., & Irish, G. L. (2025). The Impact of Donor and Recipient Diabetes on Patient and Graft Survival in Kidney Transplant Recipients. Kidney International Reports. https://doi.org/10.1016/j.ekir.2025.08.013

Persson, F., Borg, R., & Rossing, P. (2021). A narrative review of new treatment options for chronic kidney disease in type 2 diabetes. Annals of Translational Medicine, 9(8), 716–716. https://doi.org/10.21037/atm-20-4841

Phagu, A. A. S., van Oort, M. J. H., Oliveri, F., Bingen, B. O., Paradies, V., Mincione, G., Claessen, B. E. P. M., Dimitriu-Leen, A. C., Vossenberg, T. N., Kefer, J., Mandurino-Mirizzi, A., van der Kley, F., Jukema, J. W., Amri, I. Al, & Montero-Cabezas, J. M. (2025). Procedural and Clinical Outcomes of Coronary Intravascular Lithotripsy in Patients With Impaired Renal Function: A Multicenter Retrospective Study. American Journal of Cardiology, 256, 72–80. https://doi.org/10.1016/j.amjcard.2025.07.023

Poulsen, C. G., Jesse, K., Carstensen, B., Frimodt-Møller, M., Hansen, T. W., Persson, F., Vistisen, D., & Rossing, P. (2024). Prognosis for Type 1 Diabetes with Diabetic Nephropathy between 2000 and 2020 - Changes in Kidney Function Decline Over Time and Development of Cardiovascular Disease, Kidney Failure, and Mortality. Kidney International Reports, 9(12), 3403–3413. https://doi.org/10.1016/j.ekir.2024.09.010

Pratley, R. E., Tuttle, K. R., Rossing, P., Rasmussen, S., Perkovic, V., Nielsen, O. W., Mann, J. F. E., MacIsaac, R. J., Kosiborod, M. N., Kamenov, Z., Idorn, T., Hansen, M. B., Hadjadj, S., Bakris, G., Baeres, F. M. M., & Mahaffey, K. W. (2024). Effects of Semaglutide on Heart Failure Outcomes in Diabetes and Chronic Kidney Disease in the FLOW Trial. Journal of the American College of Cardiology, 84(17), 1615–1628. https://doi.org/10.1016/j.jacc.2024.08.004

Qin, C., Wu, Y., Zou, Y., Zhao, Y., Kang, D., & Liu, F. (2025). Associations between depressive and anxiety symptoms and incident kidney failure in patients with diabetic nephropathy. BMC Nephrology, 26(1). https://doi.org/10.1186/s12882-025-03983-x

Rahmanian, M., Deravi, N., Poudineh, M., Poopak, A., Mirmohammadali, S. N., Fekrvand, S., Tadbir, K., Ebrahimian, S., Zargarzadeh, N., Pirzadeh, M., Abdi, A., Firouzabadi, F. D., & Mechanick, J. I. (2024a). Prevalence of metabolic dysfunction–associated fatty liver disease among patients with diabetic kidney disease: a systematic review and meta-analysis. In Egyptian Liver Journal 14(1). Springer Science and Business Media Deutschland GmbH. https://doi.org/10.1186/s43066-024-00393-w

Ríos-Silva, M., Huerta, M., Mendoza-Cano, O., Murillo-Zamora, E., Cárdenas, Y., Bricio-Barrios, J. A., Diaz, Y., Ibarra, I., & Trujillo, X. (2023). Urinary epidermal growth factor in kidney disease: A systematic review. In Nefrologia 43(4), 413–426). Elsevier España S.L.U. https://doi.org/10.1016/j.nefro.2022.10.003

Sandholm, N., Valo, E., Tuomilehto, J., Harjutsalo, V., & Groop, P. H. (2023). Rate of Kidney Function Decline is Associated With Kidney and Heart Failure in Individuals With Type 1 Diabetes. Kidney International Reports, 8(10), 2043–2055. https://doi.org/10.1016/j.ekir.2023.07.026

Serna-Trejos, J. S., Neira-Ruiz, L. C., Bermúdez-Moyano, S. G., & González-Sánchez, D. A. (2024). Clinical findings of iSGLT-2 use in non-diabetic IgA nephropathy patients: A case series. Revista Colombiana de Nefrologia, 11(2). https://doi.org/10.22265/acnef.11.2.789

She, R., Newman, S. P., Kang, A., Choo, J. C. J., Khoo, E., Nandakumar, M., & Griva, K. (2025). Prognostication of Mental Health Risk Clusters on Hospitalization and Mortality in Patients With Coexisting Diabetes and Kidney Failure: The Hidden Burden of Loneliness. https://doi.org/10.1016/j

Svanström, H., Mkoma, G. F., Hviid, A., & Pasternak, B. (2026). Angiotensin Receptor-Neprilysin Inhibitors and Mortality Among Patients With HFrEF. American Journal of Cardiology, 258, 158–164. https://doi.org/10.1016/j.amjcard.2025.08.063

Takahashi, T., Watanabe, T., Toyoshima, M., Katawaki, W., Toshima, T., Kumagai, Y., Yamanaka, T., & Watanabe, M. (2025). Prognostic Impact of Chronic Kidney Disease After Percutaneous Coronary Intervention with Drug-Coated Balloons. Journal of Clinical Medicine, 14(7). https://doi.org/10.3390/jcm14072317

Thipsawat, S. (2021). Early detection of diabetic nephropathy in patient with type 2 diabetes mellitus: A review of the literature. In Diabetes and Vascular Disease Research 18(6). SAGE Publications Ltd. https://doi.org/10.1177/14791641211058856

Tsai, C. T., Lu, Y. W., Huang, W. C., Huang, S. S., Teng, H. I., Tsai, Y. L., Lee, W. L., & Lu, T. M. (2025). Revascularization of coronary chronic total occlusion in patients with end stage renal disease. Scientific Reports, 15(1). https://doi.org/10.1038/s41598-025-91447-5

van Vliet, D., Pinxterhuis, T. H., Ploumen, E. H., Kok, M. M., Buiten, R. A., Zocca, P., Roguin, A., Schotborgh, C. E., Anthonio, R. L., Danse, P. W., Benit, E., Aminian, A., Doggen, C. J. M., &

von Birgelen, C. (2025). Impact of diabetes on three-year outcome after coronary stenting in patients with polyvascular atherosclerotic disease – a secondary analysis of the randomized TWENTE trials. IJC Heart and Vasculature, 59. https://doi.org/10.1016/j.ijcha.2025.101741

Walker, H., Khan, S., Padmanabhan, S., Pell, J. P., Lewsey, J., Mackay, D., Dundas, R., Friday, J. M., Tran, T. Q. B., Brown, D., Ho, F., Hastie, C. E., Fleming, M., Geue, C., Stevenson, A., Du Toit, C., Jani, B. D., Gallacher, K., Mark, P. B., & Sullivan, M. K. (2025). Analysis of the kidney failure risk equation implementation in routine clinical practice and health inequalities in chronic kidney disease care: a retrospective cohort study. BMC Nephrology, 26(1). https://doi.org/10.1186/s12882-025-04043-0

Wu, H., Lau, E. S. H., Yang, A., Szeto, C. C., Ma, R. C. W., Kong, A. P. S., Chow, E., So, W. Y., Chan, J. C. N., & Luk, A. O. Y. (2021). Trends in kidney failure and kidney replacement therapy in people with diabetes in Hong Kong, 2002-2015: A retrospective cohort study. The Lancet Regional Health - Western Pacific, 11. https://doi.org/10.1016/j.lanwpc.2021.100165

Wu, L., Li, X. Q., Chang, D. Y., Zhang, H., Li, J. J., Wu, S. L., Zhang, L. X., Chen, M., & Zhao, M. H. (2020). Associations of urinary epidermal growth factor and monocyte chemotactic protein-1 with kidney involvement in patients with diabetic kidney disease. Nephrology Dialysis Transplantation, 35(2), 291–297. https://doi.org/10.1093/ndt/gfy314

Yahya Ahmed, H., & Hashim Abd Ali, A. (2020). The Relationship between Diabetes Mellitus and Renal Failure in Babylon Province. In Systematic Reviews in Pharmacy 11(8).

Yasuma, T., Fujimoto, H., D'Alessandro-Gabazza, C. N., Toda, M., Uemura, M., Nishihama, K., Takeshita, A., Fridman D'Alessandro, V., Okano, T., Okano, Y., Tomaru, A., Anoh, T., Inoue, C., Alhawsawi, M. A. B., Abdel-Hamid, A. M., Leistikow, K., King, M. R., Ono, R., Nosaka, T., … Gabazza, E. C. (2025). Microbiota-derived corisin accelerates kidney fibrosis by promoting cellular aging. Nature Communications, 16(1). https://doi.org/10.1038/s41467-025-61847-2

Yirga, G. kassaw, Aytenew, T. M., Kassaw, A., Hiruy, E. G., Shiferaw, K., Baye, A. A., Kerebeh, G., Mekonnen, G. B., Ewunetu, M., Amare, A. T., Birlie, T. A., Wassie, F. D., Diress, T., Abeje, G., Eshetie, Y., Abere, Y., & Bantie, B. (2025). Chronic kidney disease among patients with hypertension in sub-Saharan Africa: a systematic review and meta-analysis. BMC Public Health, 25(1). https://doi.org/10.1186/s12889-025-22828-8

Younis, K., McCaffrey, G., King Shier, K., Bouchal, S. R., & Quinn, R. R. (2025). Barriers to, and Facilitators of, Diabetes Self-management in the Dialysis Population: A Narrative Review and Implications for Research. In Canadian Journal of Kidney Health and Disease 12. SAGE Publications Ltd. https://doi.org/10.1177/20543581251359734

Zampieri, F. G., Azevedo, L. C. P., Neto, A. S., Rea-Neto, Á., David-João, P. G., Amendola, C. P., Kozesinski-Nakatani, A. C., Filiponi, T. C., Almeida, G. M. B., Bergo, R. R., Figueiredo, R. C., Schuler, C. J., Westphal, G. A., Biondi, R. S., Pereira, A. J., Correa, T. D., Berwanger, O., Bagshaw, S. M., Bellomo, R., & Tavares, C. A. M. (2025). Effects of dapagliflozin on urinary output, fluid balance, and biochemistry in critically ill patients: a post-hoc secondary analysis of the DEFENDER trial. Critical Care, 29(1). https://doi.org/10.1186/s13054-025-05534-0

Zhang, F., & Li, W. (2025). Association of Life's Essential 8 Score with All-Cause and Cardiovascular Mortality in Patients with Diabetic Nephropathy: A NHANES-Based Cohort Study. Journal of Multidisciplinary Healthcare, 18, 4795–4808. https://doi.org/10.2147/JMDH.S533760

Zhang, J. W., Zhao, Q., Li, Z., Liu, Q., Zang, S. S., & Liu, S. (2025). The effect of saffron supplementation on liver and kidney function, blood glucose and pressure in patients with diabetes and prediabetes: A grade assessed systematic review and meta-analysis of randomized controlled trials. In Prostaglandins and Other Lipid Mediators 177. Elsevier Inc. https://doi.org/10.1016/j.prostaglandins.2025.106949

Zhao, Z., Zheng, N., Zhang, T., Zhang, C., Li, Y., Lan, M., Zhang, N., Li, H., Ai, H., & Liu, D. (2025). Cardiorenal protection with dapagliflozin in patients with type 2 diabetes mellitus and chronic coronary syndrome undergoing percutaneous coronary intervention: a registry cross-sectional study. Cardiovascular Diabetology, 24(1). https://doi.org/10.1186/s12933-025-02678-9