

Evidence Glossary on Chronic Kidney Disease



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Nearly 850 million people are affected by Chronic Kidney Disease (CKD) globally, accounting for more than 10% of the world's population.^{1,2} Yet, fewer than 10% of people with CKD are aware of their disease.^{3,4,5}

If left undiagnosed and untreated, CKD can eventually lead to end-stage kidney disease (ESKD) or kidney failure, leaving patients in need of a kidney transplant or long-term dialysis.³ Patients with CKD are also at increased risk of cardiovascular complications, such as heart failure, which share common risk factors like diabetes, obesity and hypertension.^{6,7}

We need to act now to bring the best possible outcomes for patients, health systems, caregivers, the economy, and the planet. However, effective policy action is reliant on robust evidence to understand what needs to change and how to achieve the best outcome. Research highlights the current burden of CKD, outlines the expected burden of CKD if we do not act, and reveals what we can hope for if we are successful in making a change for CKD patients.

AstraZeneca has funded and conducted a comprehensive suite of Real-World Evidence (RWE) and modelling studies focused on CKD to expand the understanding of the prevalence, management and impact of CKD on patients, caregivers, health systems, economies and the environment.

This evidence glossary provides a summary of these studies. Each page outlines the study's aim, methods, involved countries, and key outputs, along with a list of relevant publications from each study to date.

This glossary is focused on currently published information to ensure validity and usability. This document will be updated as new manuscripts and abstracts are published.

All studies included in this glossary are funded by AstraZeneca.

¹Jager, K. J., Kovesdy, C., Langham, R., Rosenberg, M., Jha, V., & Zoccali, C. (2019). A single number for advocacy and communication—worldwide more than 850 million individuals have kidney diseases. *Kidney International*, 96(5), 1048–1050. <https://doi.org/10.1016/j.kint.2019.07.012>

²World Population Review. World Population by Country 2024 (Live). Available from: <https://worldpopulationreview.com> [Last accessed 25 January 2024]










³GBD Chronic Kidney Disease Collaboration (2020). Global, regional, and national burden of chronic kidney disease, 1990–2017: a systematic analysis for the Global Burden of Disease Study 2017. *The Lancet*, 395(10225). [https://doi.org/10.1016/S0140-6736\(20\)30045-3](https://doi.org/10.1016/S0140-6736(20)30045-3)

⁴Mahmoud, M. A., Ibrahim, A., Fadil, H. A., Alalawi, A. M., Alnezary, F. S., Alahmadi, Y., Alolayan, S. O., Althaqfan, S. S., Omer, S., Goresh, H. K., Shoroq, E., & Alghamdi, R. (2023). Assessment of Public Knowledge about Chronic Kidney Disease and Factors Influencing Knowledge Levels: A Cross-Sectional Study. *Medicina*, 59(12), 2072. <https://doi.org/10.3390/medicina59122072>

⁵Cheewala, P. A., Peterson, G. M., Zaidi, S. T. R., Jose, M. D., & Castelino, R. L. (2018). Public knowledge of chronic kidney disease evaluated using a validated questionnaire: A cross-sectional study. *BMC Public Health*, 18(1). <https://doi.org/10.1186/s12889-018-5301-4>

⁶National Kidney Foundation. How your kidneys work. (n.d.). Available at: <https://www.kidney.org/kidneydisease/howkidneyswork> [Last accessed 8 February 2024]

⁷Said, S., & Hernandez, G. T. (2014). The link between chronic kidney disease and cardiovascular disease. *Journal of Nephropathology*, 3(3). <https://doi.org/10.12860/jnp.2014.19>

Study	Focus area(s)	Research themes					
01. Ca/Re/Me	Patients and populations Health systems	Patient characteristics, clinical outcomes, comorbidities, and health care costs.	✓	✓			
02. 	Patients and populations Caregivers Productivity	Carer quality of life, patient health-related quality of life, perceived financial burden, self-reported productivity.	✓		✓	✓	
03. REVEALCKD	Patients and populations	Prevalence of undiagnosed stage 3 CKD, factors associated with undiagnosed stage 3 CKD, time to CKD diagnosis, selected adverse clinical outcomes, and management and monitoring of CKD.	✓				
04. 	Patients and populations Health systems	Patient characteristics, monitoring and management trends, progression of CKD, selected clinical outcomes, healthcare resource utilization, health care costs, quality-of-life	✓	✓			
05. 	Patients and populations Health systems	Projected future prevalence of CKD by disease stage, CKD associated clinical events, comorbid conditions, projected future healthcare resource utilization and projected future healthcare costs.	✓	✓			
06. 	Patients and populations Health systems Caregivers Productivity Environment	Policy impact, projected burden of CKD in 2032, prevalence, clinical events, mortality, healthcare resource usage, healthcare costs, workforce productivity, economic indicators, and environmental measures.	✓	✓	✓	✓	✓
07. ENVIRONMENTAL IMPACT OF CKD	Environment	Carbon emissions, fine particulate matter formation, photochemical ozone formation and freshwater usage.					✓



CaReMe CKD



Patient
characteristics,
clinical outcomes,
comorbidities, and
health care costs.

CaReMe CKD

01. Aim

The CaReMe CKD study aims to provide evidence for the global burden of CKD, specifically on the patient characteristics, prevalence, clinical outcomes and costs to health systems across 11 countries.⁸

02. Design

The CaReMe study collected data from a period of 1 to 5 years on patient care and outcomes directly from health registries. The data collected include patient characteristics, clinical outcomes such as heart failure, stroke or death, and hospital healthcare costs.⁸

03. Countries Involved

Belgium, Canada, Germany, Israel, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom.

04. Key Outcomes

The CaReMe CKD study shows that CKD prevalence is high across the involved countries', but an associated recorded diagnosis of CKD is very low. The study results highlight the need for early action to better identify and diagnose this large cohort of undiagnosed patients with CKD.

- 1 in 10 adults in Europe, Canada, and Israel are likely to have CKD.⁸
- Two thirds of patients with CKD identified by laboratory criteria did not have an official CKD diagnosis in their medical records.⁸
- 42% of patients with CKD, identified through laboratory values, were classified as Stage 3A (mild to moderate loss of function⁹); this was fairly consistent across countries.⁸
- CKD and HF were associated with the accumulation of consistently greater hospital healthcare costs over 5 years compared with other major comorbidities.⁸

⁸Sundström, J., Bodegard, J., Bollmann, A., Vervloet, M. G., Mark, P. B., Karasik, A., Taveira-Gomes, T., Botana, M., Birkeland, K. I., Thuresson, M., Jäger, L., Sood, M. M., VanPottelbergh, G., & Tangri, N. (2022). Prevalence, outcomes, and cost of chronic kidney disease in a contemporary population of 2.4 million patients from 11 countries: The CaReMe CKD study. *The Lancet Regional Health - Europe*, 20. <https://doi.org/10.1016/j.lanepe.2022.100438>

⁹National Kidney Foundation. (n.d.). Stage 3a Chronic Kidney Disease (CKD). Retrieved February 20, 2024, from <https://www.kidney.org/atoz/content/stage-3a-chronic-kidney-disease-ckd>

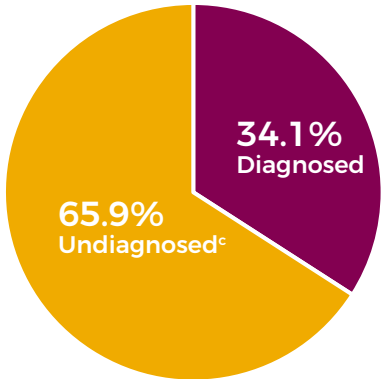
CKD imposes significant economic burden, with renal events and HF being the leading causes of increased costs.

CaReMe CKD uses primary data from digital healthcare systems across 11 countries

Pooled baseline patient characteristics

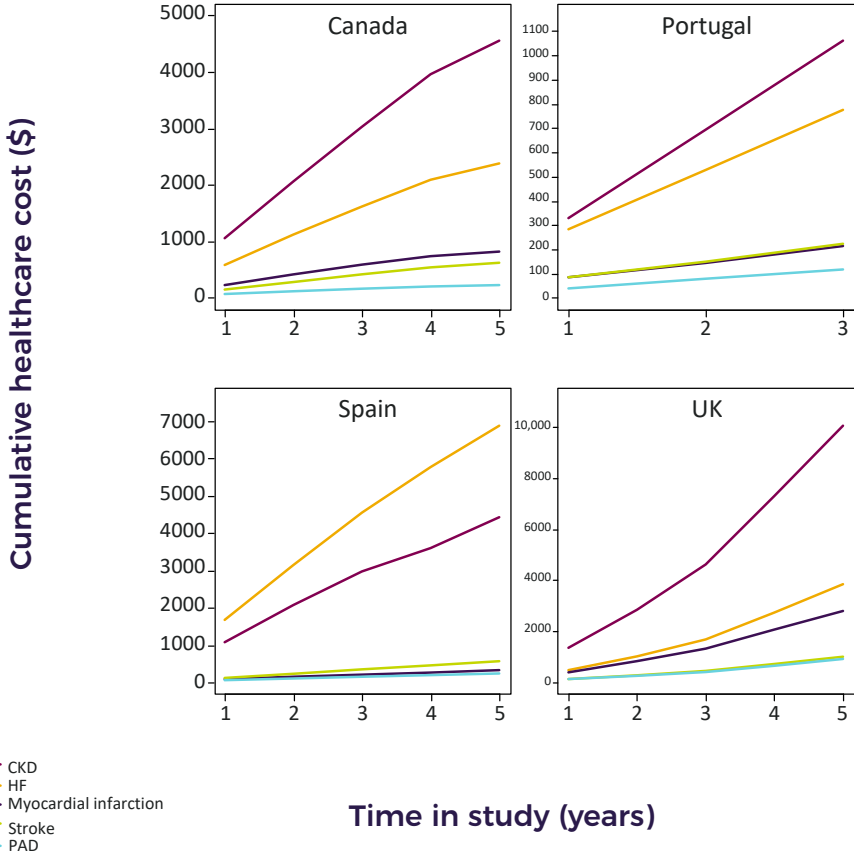
(Measured CKD cohort: N=1,111,836)^b

- Mean age: 74.8 years
- Female: 53.2%
- Diabetes: 38.0%
- Cancer: 23.2%
- CAD: 21.4%
- AF/flutter: 16.5%
- HF: 15.8%
- Stroke: 11.8%
- PAD: 8.3%



Results

CKD and HF were associated with the accumulation of consistently greater healthcare costs over 5 years compared with other major comorbidities.



^aDiagnosis defined as presence of a CKD-specific diagnostic code; ^bDefined by having KDIGO-confirmed CKD; ^cBased on random effects model to calculate pooled existing CKD diagnosis
 AF, atrial fibrillation; CAD, coronary artery disease; CKD, chronic kidney disease; HF, heart failure; KDIGO, Kidney Disease: Improving Global Outcomes; PAD, peripheral artery disease
 Sundström J, et al. Lancet Reg Health Eur 2022;20:100438

CaReMe CKD

05. Relevant publications

a. Sundström, J., Bodegard, J., Bollmann, A., Vervloet, M. G., Mark, P. B., Karasik, A., Taveira-Gomes, T., Botana, M., Birkeland, K. I., Thuresson, M., Jäger, L., Sood, M. M., VanPottelbergh, G., & Tangri, N. (2022). Prevalence, outcomes, and cost of chronic kidney disease in a contemporary population of 2.4 million patients from 11 countries: The CaReMe CKD study. *The Lancet Regional Health - Europe*, 20. <https://doi.org/10.1016/j.lanep.2022.100438>

b. Zhang, R., Mamza, J. B., Gao, H., Lothead, K. C., Milne, N., Jani, B. D., Chess, J. A., Sinha, S., Kanumilli, N., & Mark, P. B. (2023, November 2). Prevalence and Outcomes of CKD in England [Conference presentation abstract]. ASN Kidney Week 2023. <https://www.asn-online.org/education/kidneyweek/2023/program-abstract.aspx?controlId=3939597>

PaCE CKD



Carer quality
of life, patient
health-related quality
of life, perceived
financial burden,
self-reported
productivity.

PaCE CKD

01. Aim

The Patient, Carer, and Economic burden (PaCE) CKD study was developed to assess the relationship between CKD progression and the personal burden felt by the patient and unpaid caregiver populations across 8 countries.

02. Design

The PaCE CKD study used in-depth, semi-structured, qualitative interviews with patients with CKD and unpaid caregivers of patients with CKD, as well as questionnaires to quantify financial and health-related outcomes including financial well-being, work productivity, and quality of life.

03. Countries Involved

Australia, France, Germany, Italy, Mexico, Taiwan, United Kingdom, United States.^{10,15}

04. Key Outcomes

Published results demonstrated that CKD negatively impacted both CKD patients and their caregivers when compared with the general population.

- **Patients with CKD and caregivers of patients with CKD were found to have a lower of quality of life.**^{11,12}
- **Results from US data revealed that respondents with CKD or respondents caring for someone with CKD also highlighted substantial financial and emotional difficulties.**^{13,14}
- **Patients highlighted experiencing emotional distress, reduction in work hours and increased financial burden from CKD.**¹⁵
- **Carers highlighted experiencing increased financial burden, largely driven by a loss of work hours and earnings**¹⁵

¹⁰Garcia Sanchez, J. J., Wu, M. S., Reichel, H., Elsayed, H., Rangaswami, J., Correa-Rotter, R., Hull, R., Esposito, C., Chadban, S., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023). PCR153 PaCE CKD: The Impact of Chronic Kidney Disease and Dialysis on Caregivers Financial Status, and Work Productivity: Results from a Multinational Survey [Conference Poster Presentation]. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ispor.org/docs/default-source/euro2023/isporeurope23garciasanchezpcr153poster129774-pdf.pdf?sfvrsn=e0c18bc4_0

¹¹Correa-Rotter, R., Hull, R., Elsayed, H. M., Rangaswami, J., Esposito, C., Wu, M.-S., Reichel, H., Garcia-Sanchez, J. J., Chadban, S. J., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023, November 2). PaCE-CKD: Health-Related Quality of Life of Caregivers of Individuals with CKD: Results from a Multinational Survey. ASN Kidney Week 2023.

¹²Garcia Sanchez, J. J., Rangaswami, J., Wu, M.-S., Esposito, C., Hull, R., Chadban, S. J., Elsayed, H. M., Reichel, H., Correa-Rotter, R., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023, November 2). Impact of CKD on Patients' Health-Related Quality of Life: Results from PaCE-CKD, a Multinational Survey [Conference Abstract]. ASN Kidney Week 2023.

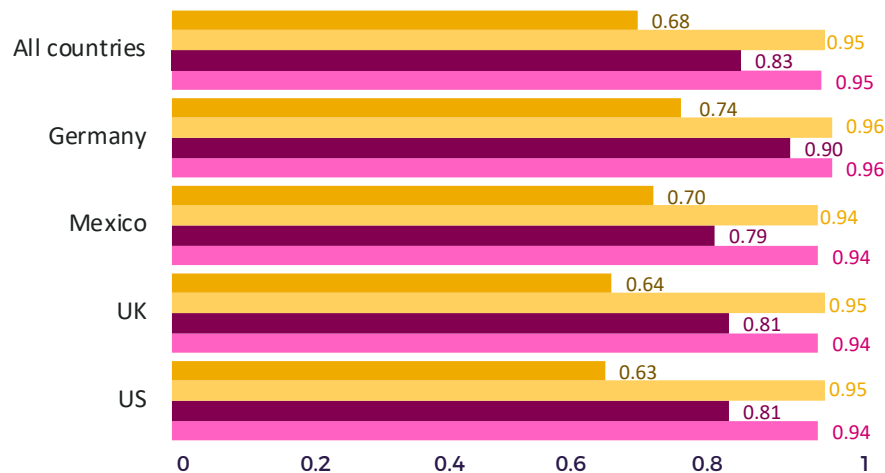
¹³Chadban, S., Esposito, C., Rangaswami, J., Wu, M.-S., Hull, R., Elsayed, H., Reichel, H., Sanchez, J. J. G., Pentakota, S., Kularatne, T., & Fifer, S. (2023). #4529 PACE-CKD: FINANCIAL BURDEN AND WORK PRODUCTIVITY OF PATIENTS WITH CKD AND CAREGIVERS: RESULTS FROM A US SURVEY. Nephrology Dialysis Transplantation, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_4529

¹⁴Esposito, C., Chadban, S., Rangaswami, J., Wu, M.-S., Hull, R., Elsayed, H., Reichel, H., Sanchez, J. J. G., Pentakota, S., Kularatne, T., & Fifer, S. (2023). #3990 PACE-CKD: Health-Related Quality of Life of Patients With CKD And Caregivers: Results From a US Survey. Nephrology Dialysis Transplantation, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_3990

¹⁵Garcia Sanchez, J. J., Kularatne, T., West, B., Rao, N., Wright, J., Hull, R., & Fifer, S. (2022). POS-291 PaCE CKD: Impact of CKD on Patients and Carers – Qualitative Insights From a Series of Multinational Interviews. Kidney International Reports, 7(2). <https://doi.org/10.1016/j.ekir.2022.01.311>

CKD detrimentally affects quality of life and imposes substantial financial and emotional challenges for patients and their carers.

Survey-reported HRQoL in CKD^{1,a}
28% decrease in HRQoL vs general population.



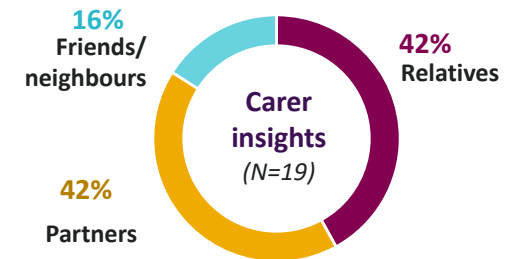
CKD EQ-5D-5L index score; N=1282

- Patients with CKD
- CKD matched general population
- Caregivers
- Caregivers matched general population

Interview-reported impact^{2,b}

Patient experiences (N=20)

- Extreme fatigue
- Depression
- Shock at diagnosis
- Emotional distress
- Anxiety
- Debilitation
- Limited activity
- Help from carers required



Financial burden was associated with:

- Reduced work hours
- Treatment-related travel
- Disease management

Treatment insights

Patients and carers value effectiveness of CKD treatment over other therapy attributes.

^aResults from non-interventional surveys across Germany, Mexico, the UK, and the USA; ^bResults from interviews with patients with CKD and carers in Australia, France, Germany, Italy, the UK, and the USACKD, chronic kidney disease; HRQoL, health-related quality of life.

1. Esposito C, et al. Presented at 60th European Renal Association (ERA) Congress, June 15–18, 2023. Milan, Italy. Poster; 2. Garcia Sanchez JJ, et al. Presented at World Congress of Nephrology (WCN), February 24–27, 2022. Kuala Lumpur, Malaysia. Poster POS-291

05. Relevant Publications

a. Garcia Sanchez, J. J., Kularatne, T., West, B., Rao, N., Wright, J., Hull, R., & Fifer, S. (2022). POS-291 PaCE CKD: Impact of CKD on Patients and Carers – Qualitative Insights From a Series of Multinational Interviews. *Kidney International Reports*, 7(2). <https://doi.org/10.1016/j.ekir.2022.01.311>

b. Esposito, C., Chadban, S., Rangaswami, J., Wu, M.-S., Hull, R., Elsayed, H., Reichel, H., Sanchez, J. J. G., Pentakota, S., Kularatne, T., & Fifer, S. (2023). #3990 PACE-CKD: Health-Related Quality of Life of Patients With CKD And Caregivers: Results From a US Survey. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_3990

c. Chadban, S., Esposito, C., Rangaswami, J., Wu, M.-S., Hull, R., Elsayed, H., Reichel, H., Sanchez, J. J. G., Pentakota, S., Kularatne, T., & Fifer, S. (2023). #4529 PACE-CKD: FINANCIAL BURDEN AND WORK PRODUCTIVITY OF PATIENTS WITH CKD AND CAREGIVERS: RESULTS FROM A US SURVEY. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_4529

d. Correa-Rotter, R., Hull, R., Elsayed, H. M., Rangaswami, J., Esposito, C., Wu, M.-S., Reichel, H., Garcia-Sanchez, J. J., Chadban, S. J., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023, November 2). PaCE-CKD: Health-Related Quality of Life of Caregivers of Individuals with CKD: Results from a Multinational Survey. *ASN Kidney Week 2023*.

e. Garcia Sanchez, J. J., Rangaswami, J., Wu, M.-S., Esposito, C., Hull, R., Chadban, S. J., Elsayed, H. M., Reichel, H., Correa-Rotter, R., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023, November 2). Impact of CKD on Patients' Health-Related Quality of Life: Results from PaCE-CKD, a Multinational Survey [Conference Abstract]. *ASN Kidney Week 2023*.

f. Garcia Sanchez, J. J., Elsayed, H., Esposito, C., Rangaswami, J., Wu, M. S., Hull, R., Chadban, S., Reichel, H., Correa-Rotter, R., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023). PCR208 Pace CKD Financial Burden and Work Productivity Assessment of Chronic Kidney Disease on Patients: Results from an International Survey. *Value in Health*, 26(12), S489. <https://doi.org/10.1016/j.jval.2023.09.2645>

g. Garcia Sanchez, J. J., Wu, M. S., Reichel, H., Elsayed, H., Rangaswami, J., Correa-Rotter, R., Hull, R., Esposito, C., Chadban, S., Pentakota, S., West, B., Mellor, R., Kularatne, T., & Fifer, S. (2023). PCR153 Pace CKD: The Impact of Chronic Kidney Disease and Dialysis on Caregivers Financial Status, and Work Productivity: Results from a Multinational Survey. *Value in Health*, 26(12), S478. <https://doi.org/10.1016/j.jval.2023.09.2591>

REVEAL CKD



Prevalence of undiagnosed stage 3 CKD, factors associated with undiagnosed stage 3 CKD, time to CKD diagnosis, selected adverse clinical outcomes, and management and monitoring of CKD.

REVEAL CKD

01. Aim

REVEAL CKD aims to determine the prevalence and contributing factors associated with undiagnosed stage 3 CKD, where there is a mild to moderate loss of kidney function⁹, and the potential benefits of early CKD diagnosis across 11 countries. The study also assessed differences in the management and monitoring practices and occurrence of clinical outcomes for patients pre- and post-diagnosis.^{16,18}

02. Design

The REVEAL CKD study utilised existing data from electronic medical records and claims databases to identify the prevalence of undiagnosed stage 3 CKD. A patient with undiagnosed CKD was characterised as someone with two consecutive eGFR measurements that met guideline criteria without a corresponding ICD 9/10 diagnostic code any time prior to, or 6 months after, meeting the eGFR criteria.

03. Countries Involved

Australia, Brazil, Canada, China, France, Germany, Italy, Japan, Spain, United Kingdom, United States .

04. Key Outcomes

Published results from the REVEAL CKD study, have thus far demonstrated early-stage CKD is vastly underdiagnosed across the countries evaluated and identified diagnosis as an important first step in improving patient outcomes.

- **The proportion of stage 3 patients undiagnosed ranged from 61.6% to 95.5% in France, Germany, Italy, Japan, and USA.¹⁶**
- **The proportion of undiagnosed stage 3 patients ranged from 84.9% to 97.1% in Spain, Australia, Canada, and Brazil.¹⁷**
- **A diagnosis of stage 3 CKD was associated with improve CKD management, with an observed increase in prescriptions of guideline-directed medical treatment and a delay in disease progression.¹⁸**

⁹National Kidney Foundation. (n.d.). Stage 3a Chronic Kidney Disease (CKD). Retrieved February 20, 2024, from <https://www.kidney.org/atoz/content/stage-3a-chronic-kidney-disease-ckd>

¹⁶Tangri, N., Moriyama, T., Schneider, M. P., Virgitti, J. B., de Nicola, L., Arnold, M., Barone, S., Peach, E., Wittbrodt, E., Chen, H., Järbrink, K., & Kushner, P. (2023). Prevalence of undiagnosed stage 3 chronic kidney disease in France, Germany, Italy, Japan and the USA: Results from the multinational observational REVEAL-CKD study. *BMJ Open*, 13(5). <https://doi.org/10.1136/bmjopen-2022-067386>

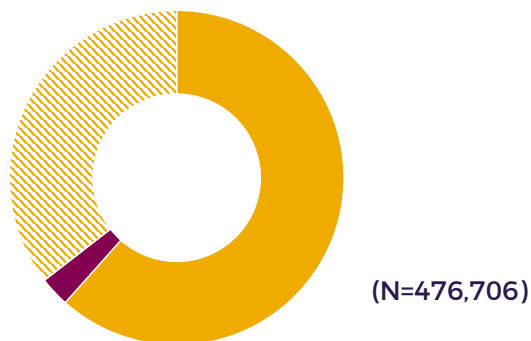
¹⁷Pecoits-Filho, R., de Castro, M. C. R., Cebrian, A., Santamaria, R., Lim, K.-S., Wittbrodt, E., Barone, S., Arnold, M., & Tangri, N. (2023). #3667 REVEAL-CKD: PREVALENCE OF UNDIAGNOSED STAGE 3 CHRONIC KIDNEY DISEASE IN AUSTRALIA, BRAZIL, CANADA AND SPAIN. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_3667

¹⁸Tangri, N., Peach, E. J., Franzén, S., Barone, S., & Kushner, P. R. (2023). Patient Management and Clinical Outcomes Associated with a Recorded Diagnosis of Stage 3 Chronic Kidney Disease: The REVEAL-CKD Study. *Advances in Therapy*, 40(6). <https://doi.org/10.1007/s12325-023-02482-5>






Early diagnosis leads to improved prescription rates and slower kidney function decline, yet diagnosis of patients with CKD remains low.

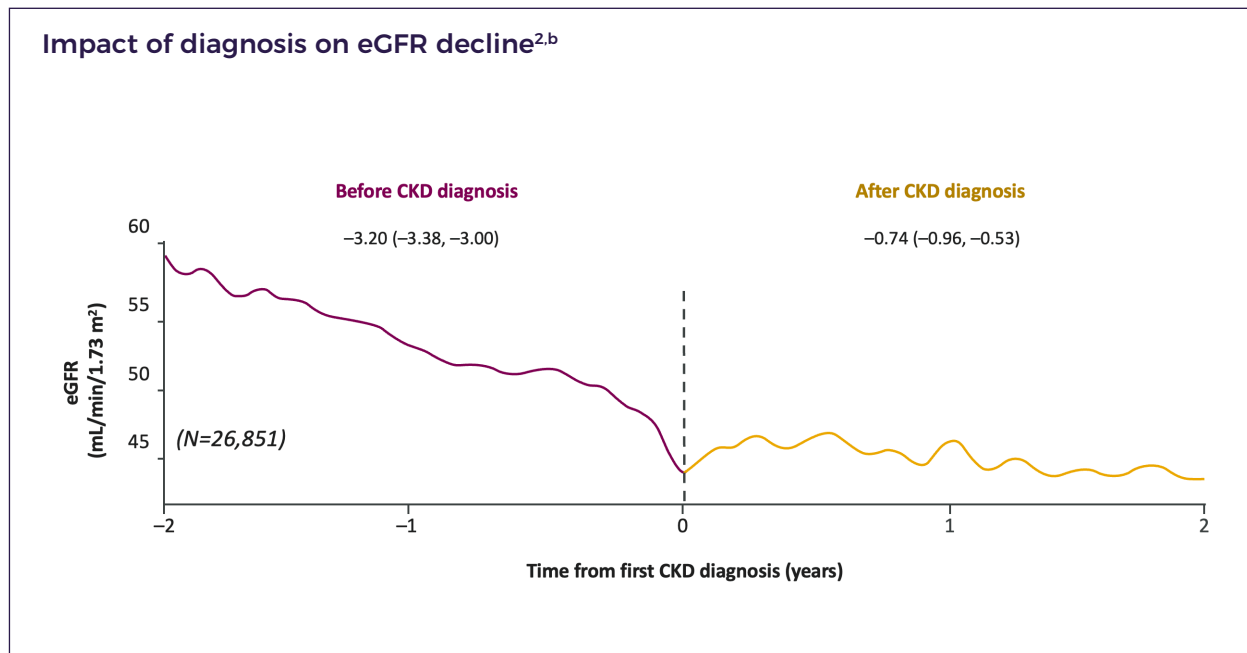
CKD diagnosis^{1,a}

61.6–95.5% of CKD Stage 3 was undiagnosed



Populations least likely to be diagnosed included:

-  Females
-  Earlier CKD stages
-  Fewer comorbidities
-  Age <45 years
-  Fewer medications



Recording a diagnosis of CKD Stage 3 led to a preservation of annual eGFR decline²

^aResults from France, Germany, Italy, Japan, and the USA; ^bResults from the USAACEi, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GDMT, guideline-directed medical therapy
 1. Tangri N, et al. BMJ Open 2023;13:e067386; 2. Tangri N, et al. Adv Ther 2023;40:2869–2885

REVEAL CKD

05. Relevant Publications

a. Tangri, N., Moriyama, T., Schneider, M. P., Virgitti, J. B., de Nicola, L., Arnold, M., Barone, S., Peach, E., Wittbrodt, E., Chen, H., Järbrink, K., & Kushner, P. (2023). Prevalence of undiagnosed stage 3 chronic kidney disease in France, Germany, Italy, Japan and the USA: Results from the multinational observational REVEAL-CKD study. *BMJ Open*, 13(5). <https://doi.org/10.1136/bmjopen-2022-067386>

b. Tangri, N., Peach, E. J., Franzén, S., Barone, S., & Kushner, P. R. (2023). Patient Management and Clinical Outcomes Associated with a Recorded Diagnosis of Stage 3 Chronic Kidney Disease: The REVEAL-CKD Study. *Advances in Therapy*, 40(6). <https://doi.org/10.1007/s12325-023-02482-5>

c. Pecoits-Filho, R., de Castro, M. C. R., Cebrian, A., Santamaria, R., Lim, K.-S., Wittbrodt, E., Barone, S., Arnold, M., & Tangri, N. (2023). #3667 REVEAL-CKD: PREVALENCE OF UNDIAGNOSED STAGE 3 CHRONIC KIDNEY DISEASE IN AUSTRALIA, BRAZIL, CANADA AND SPAIN. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_3667

DISCOVER CKD



Patient characteristics,
monitoring and
management trends,
progression of CKD,
selected clinical
outcomes, healthcare
resource utilization,
health care costs,
quality-of-life.

DISCOVER CKD

01. Aim

The DISCOVER CKD study utilizes data from 6 countries and aims to understand the profiles and experiences of patients with CKD and the practices used in their care, to support efforts to improve management and outcomes in patients with CKD.

02. Design¹⁹

DISCOVER CKD developed a multinational, longitudinal cohort of patients with CKD and is one of the largest multi-country global cohorts to date.

The study includes both retrospective and prospective analysis. The retrospective aspect of the study collects information from established anonymised datasets. This provides a foundation from which to answer descriptive and longitudinal questions on patient characteristics, comorbidities and complications associated with CKD, management of CKD, and the factors influencing clinical decision making.

The prospective aspect of the study recruited individual patients from participating centres in each country to assess quality-of-life and other patient-reported outcomes.

¹⁹Pecoits-Filho, R., James, G., Carrero, J. J., Wittbrodt, E., Fishbane, S., Sultan, A. A., Heerspink, H. J. L., Hedman, K., Kanda, E., Chen, H., Kashihara, N., Sloand, J., Kosiborod, M., Kumar, S., Lainscak, M., Arnold, M., Lam, C. S. P., Holmqvist, B., Pollock, C., ... Wheeler, D. C. (2021). Methods and rationale of the DISCOVER CKD global observational study. *Clinical Kidney Journal*, 14(6). <https://doi.org/10.1093/ckj/sfab046>

²⁰Carrero, J. J., Pollock, C., Kanda, E., Lam, C., Ofori-Asenso, R., Chen, T., Kashihara, N., Fishbane, S., Sanchez, J. J. G., Pentakota, S., Pecoits-Filho, R., & Wheeler, D. C. (2023). #3393 PATIENT-REPORTED OUTCOMES IN EARLY VERSUS ADVANCED CHRONIC KIDNEY DISEASE: EVIDENCE FROM BASELINE DATA IN THE DISCOVER CKD PROSPECTIVE STUDY. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_3393

²¹Pollock, C., James, G., Garcia Sanchez, J. J., Carrero, J. J., Arnold, M., Lam, C. S. P., Chen, H. T., Nolan, S., Pecoits-Filho, R., & Wheeler, D. C. (2022). Healthcare resource utilisation and related costs of patients with CKD from the UK: a report from the DISCOVER CKD retrospective cohort. *Clinical Kidney Journal*, 15(11). <https://doi.org/10.1093/ckj/sfac168>

²²Heerspink, H., James, G., Nolan, S., Carrero, J. J., Arnold, M., Pecoits-Filho, R., Garcia Sanchez, J. J., Lam, C. S. P., Chen, H., Kanda, E., Lainscak, M., Pollock, C., & Wheeler, D. C. (2022). 101 Evaluating Clinical Outcomes in Patients (Pts) With CKD With Rapid and Non-Rapid eGFR Decline: A Report From The DISCOVER CKD Retrospective Cohort. *American Journal of Kidney Diseases*, 79(4), S31. <https://doi.org/10.1053/j.ajkd.2022.01.106>

03. Countries Involved

Italy, Japan, Spain, Sweden, United Kingdom, United States.

04. Key Outcomes

DISCOVER CKD publications have highlighted quality-of-life and healthcare resource utilization differences between early-stage and late-stage CKD patients, revealing worse patient wellbeing outcomes and higher costs for late-stage CKD patients.

- **Patients with late-stage CKD reported lower quality of life, higher symptom severity, and greater impairment in work and activities.²⁰**
- **In the UK, the most severe stage of CKD is associated with annual per-patient costs that are nearly three times greater than the least severe stage, ranging from £4,654-£11,419 per patient.²¹**
- **Rapid eGFR decline is associated with a greater comorbidity and a significantly higher risk of adverse clinical outcomes.²²**

A rich dataset was explored to generate novel and patient-relevant CKD insights applicable to the real-world CKD treatment landscape¹

DISCOVER CKD collects data on clinical management, treatment patterns, and patient experiences and QoL¹

Patient characteristics (Prospective cohort: N=1051)

Mean age: 62.5 years²

Female: 36.9%²

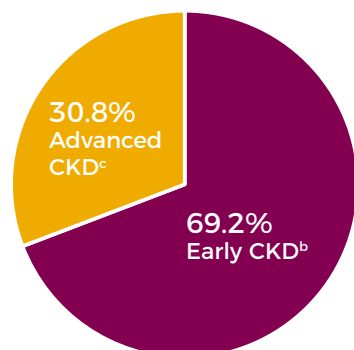
Hypertension: 69.9–71.9%³

Diabetes: 38.0–42.8%³

Hyperlipidemia: 34.3–41.0%³

Heart failure: 6.6–9.3%³

Median UACR (IQR; mg/mmol): 11.8 (1.9–62.0)^{2,a}



Impact on HRQoL²

/ Burden was significant across all patients with CKD.
/ Compared with earlier-stage CKD, patients with advanced-stage CKD reported:



Higher symptom severity



Worse HRQoL



Greater work and activity impairment

aN=267; bEarly CKD = eGFR 30–75 mL/min/1.73 m², advanced CKD = eGFR <15–29 mL/min/1.73 m²; cSelected therapies shown. Other medications used by >20% of patients include treatments for anemia, diuretics, calcium channel blockers, beta blockers, anticoagulants, lipid-lowering therapy, and gastroesophageal reflux therapy. CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HRQoL, health-related quality of life; IQR, interquartile range; UACR, urine albumin:creatinine ratio

1. Pecoito-Filho R, et al. Clin Kidney J 2021;14:1570–1578; 2. Pollock C, et al. Presented at World Congress of Nephrology (WCN), March 30–April 2, 2023. Bangkok, Thailand. Poster WCN21-0671;

2. Carrero J, et al. Presented at 60th European Renal Association (ERA) Congress. June 15–18, 2023. Milan, Italy. Poster

DISCOVER CKD

05. Relevant Publications

a. Carrero, J. J., Pollock, C., Kanda, E., Lam, C., Ofori-Asenso, R., Chen, T., Kashihara, N., Fishbane, S., Sanchez, J. J. G., Pentakota, S., Pecoits-Filho, R., & Wheeler, D. C. (2023). #3393 PATIENT-REPORTED OUTCOMES IN EARLY VERSUS ADVANCED CHRONIC KIDNEY DISEASE: EVIDENCE FROM BASELINE DATA IN THE DISCOVER CKD PROSPECTIVE STUDY. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_3393

b. Pollock, C., James, G., Garcia Sanchez, J. J., Carrero, J. J., Arnold, M., Lam, C. S. P., Chen, H. T., Nolan, S., Pecoits-Filho, R., & Wheeler, D. C. (2022). Healthcare resource utilisation and related costs of patients with CKD from the UK: a report from the DISCOVER CKD retrospective cohort. *Clinical Kidney Journal*, 15(11). <https://doi.org/10.1093/ckj/sfac168>

c. Garcia Sanchez, J. J., James, G., Carrero, J. J., Arnold, M., Lam, C. S. P., Pollock, C., Chen, H. (Tony), Nolan, S., Wheeler, D. C., & Pecoits-Filho, R. (2023). Health Care Resource Utilization and Related Costs of Patients With CKD From the United States: A Report From the DISCOVER CKD Retrospective Cohort. *Kidney International Reports*, 8(4). <https://doi.org/10.1016/j.ekir.2023.01.037>
from the UK: a report from the DISCOVER CKD retrospective cohort. *Clinical Kidney Journal*, 15(11). <https://doi.org/10.1093/ckj/sfac168>

d. Pecoits-Filho, R., James, G., Carrero, J. J., Wittbrodt, E., Fishbane, S., Sultan, A. A., Heerspink, H. J. L., Hedman, K., Kanda, E., Chen, H., Kashihara, N., Sloand, J., Kosiborod, M., Kumar, S., Lainscak, M., Arnold, M., Lam, C. S. P., Holmqvist, B., Pollock, C., ... Wheeler, D. C. (2021). Methods and rationale of the DISCOVER CKD global observational study. *Clinical Kidney Journal*, 14(6). <https://doi.org/10.1093/ckj/sfab046>

e. Heerspink, H., James, G., Nolan, S., Carrero, J. J., Arnold, M., Pecoits-Filho, R., Garcia Sanchez, J. J., Lam, C. S. P., Chen, H., Kanda, E., Lainscak, M., Pollock, C., & Wheeler, D. C. (2022). 101 Evaluating Clinical Outcomes in Patients (Pts) With CKD With Rapid and Non-Rapid eGFR Decline: A Report From The DISCOVER CKD Retrospective Cohort. *American Journal of Kidney Diseases*, 79(4), S31. <https://doi.org/10.1053/j.ajkd.2022.01.106>

f. Abdul Sultan, A., Heerspink, H., Arnold, M., Pollock, C., Garcia Sanchez, J. J., Carrero, J. J., Pecoits-Filho, R., Lam, C., Kashihara, N., Kanda, E., Kosiborod, M., Fishbane, S., Lainscak, M., Stenvinkel, P., & Wheeler, D. C. (2021). POS-503 EVALUATING CHRONIC KIDNEY DISEASE PROGRESSION: A REPORT FROM THE DISCOVER CKD RETROSPECTIVE COHORT. *Kidney International Reports*, 6(4), S218–S219. <https://doi.org/10.1016/j.ekir.2021.03.531>

INSIDE CKD



Projected future prevalence of CKD by disease stage, CKD associated clinical events, comorbid conditions, projected future healthcare resource utilization, projected future healthcare costs, and the impact of changes in screening policies.

INSIDE CKD

01. Aim

The aim of INSIDE CKD is to provide country-specific projections of the growing clinical and economic burden of CKD and inform evidence-based policymaking to support early action and intervention in CKD across 30+ countries.

02. Design

INSIDE CKD utilises a patient-level microsimulation model to project the clinical and economic burden of CKD over a five-year timespan between 2022-2027. The model utilised country- and region-specific inputs to develop a representative population of 20 million for each country or region. Utilising a range of demographic, epidemiological, and clinical input variables, the INSIDE CKD study projects the disease progression and clinical burden in the representative populations.

03. Countries Involved²³

Australia, Brazil, Canada, China, France, Germany, Italy, Japan, Spain, United States, Belgium, India, Israel, Mexico, Philippines, Saudi Arabia, South Korea, Sweden, Taiwan, Thailand, Turkey, Colombia, Denmark, Greece, Hungary, Netherlands, Poland, Romania, Singapore, UAE.

²³Tangri, N., Chadban, S., Cabrera, C., Retat, L., & Sánchez, J. J. G. (2023). Projecting the Epidemiological and Economic Impact of Chronic Kidney Disease Using Patient-Level Microsimulation Modelling: Rationale and Methods of Inside CKD. *Advances in Therapy*, 40(1). <https://doi.org/10.1007/s12325-022-02353-5>

INSIDE CKD

04. Key Outcomes

Inside CKD projections indicate that the prevalence of CKD and RRT will increase over the next 5 years. Clinical and economic needs associated with a rise in CKD will pose a challenge to healthcare systems.

- Results from INSIDE CKD projected an increase in the prevalence of CKD by up to 16% between 2021- 2026 across 10 countries (AUS, BRA, CAN, CHN, FRA, ITA, JPN, ESP, UK, USA).^{24,25}
- The prevalence of renal replacement therapies (dialysis and kidney transplantation) are expected to increase between 1.8% – 23.9% between 2021 – 2026 across 11 countries.²⁶
- Annual costs associated with CKD and RRT are projected to rise between 2021- 2026 by a range of 5.7% to 22.8% across 11 countries.²⁶
- Across 31 countries the mean per patient annual treatment costs range from \$3060 at stage 3a to \$8736 at stage 5.²⁷
- The mean per-patient annual costs for patients with kidney failure are higher, ranging from \$57,334 for haemodialysis to \$49,490 for peritoneal dialysis.²⁷

²⁴Power, A., Garcia Sanchez, J. J., Abdul Sultan, A., Årnlov, J., Cabrera, C., de Nicola, L., Halimi, J. M., Mennini, F. S., Navarro-González, J. F., Nolan, S., Retat, L., Webber, L., & Xu, M. (2021). POS-323 INSIDE CKD: PROJECTING THE FUTURE BURDEN OF CHRONIC KIDNEY DISEASE IN EUROPE USING MICROSIMULATION MODELLING. *Kidney International Reports*, 6(4), S139–S140. <https://doi.org/10.1016/j.ekir.2021.03.339>

²⁵Tangri, N., Garcia Sanchez, J. J., Abdul Sultan, A., Batista, M. C., Cabrera, C., Chadban, S., Chertow, G., Kanda, E., Li, G., Nolan, S., Retat, L., Xin, S., Webber, L., Wish, J., & Xu, M. (2021). POS-322 INSIDE CKD: PROJECTING THE FUTURE BURDEN OF CHRONIC KIDNEY DISEASE IN THE AMERICAS AND THE ASIA-PACIFIC REGION USING MICROSIMULATION MODELLING. *Kidney International Reports*, 6(4), S138–S139. <https://doi.org/10.1016/j.ekir.2021.03.338>

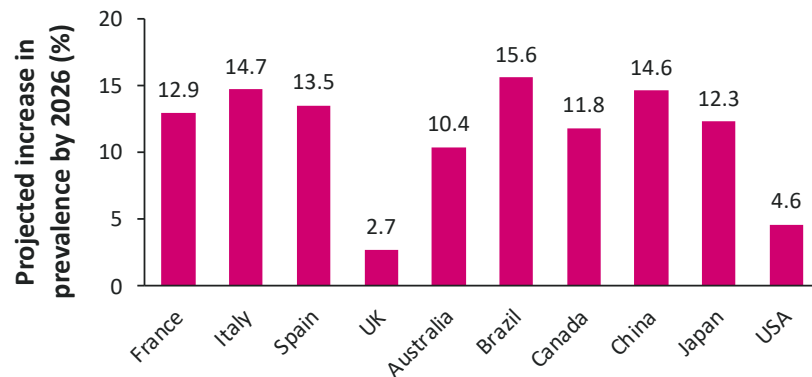
²⁶Mennini, F., Cabrera, C., Card-Gowers, J., Chertow, G., de Nicola, L., Halimi, J., Nolan, S., Power, A., Retat, L., Vesga, J., Webber, L., Wish, J., Xu, M., & Garcia Sanchez, J. (2022). POSB68 Inside CKD: Projecting the Economic Burden of Chronic Kidney Disease Using Patient-Level Microsimulation [Poster Presentation]. *Virtual ISPOR Europe 2021*, S73. [chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.healthlumen.com/wp-content/uploads/2022/06/posb68-inside-ckdispor-eucost-burdenposterrevised-submission-pdf.pdf](https://www.healthlumen.com/wp-content/uploads/2022/06/posb68-inside-ckdispor-eucost-burdenposterrevised-submission-pdf.pdf)

²⁷Jha, V., Al-Ghamdi, S. M. G., Li, G., Wu, M. S., Stafylas, P., Retat, L., Card-Gowers, J., Barone, S., Cabrera, C., & Garcia Sanchez, J. J. (2023). Global Economic Burden Associated with Chronic Kidney Disease: A Pragmatic Review of Medical Costs for the Inside CKD Research Programme. *Advances in Therapy*, 40(10). <https://doi.org/10.1007/s12325-023-02608-9>

The burden of CKD on healthcare systems is growing; eGFR and UACR testing offers a realistic and cost-effective solution to mitigate this impact.

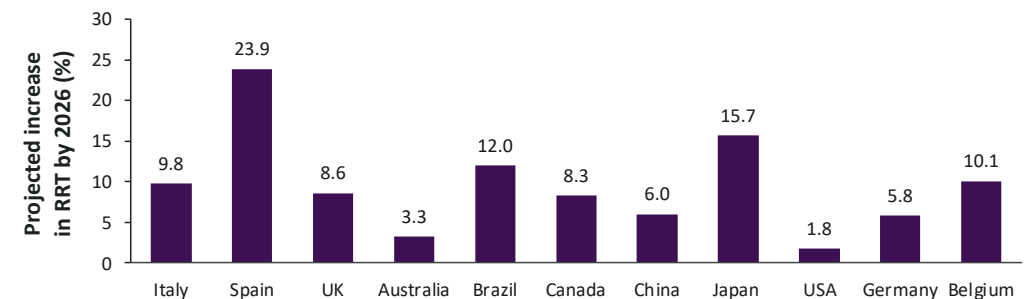
CKD prevalence^{1,2}

Up to 16% increase in prevalence of CKD by 2026



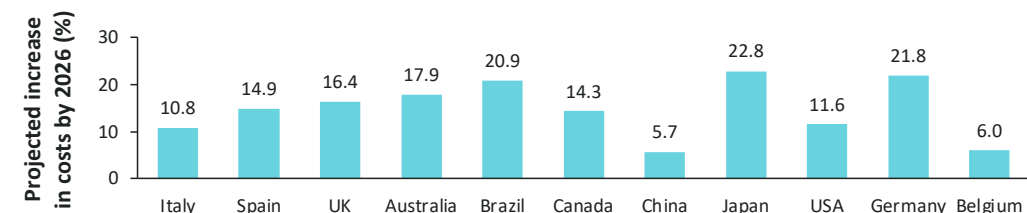
Dialysis and transplantation³

Up to 24% increase in dialysis and kidney transplantation by 2026



Annual costs associated with CKD and RRT³

Up to 23% increase in annual costs associated with CKD and RRT by 2026



/ The profile of CKD is expected to shift towards more advanced stages of CKD over time²

/ Progression of CKD is associated with increased risk of ESKD, CV events, and premature mortality²

/ Screening both UACR and eGFR is cost-effective and facilitates earlier identification and treatment of patients⁴

CKD, chronic kidney disease; CV, cardiovascular; eGFR, estimated glomerular filtration rate; ESKD, end-stage kidney disease; RRT, renal replacement therapy; UACR, urine albumin:creatinine ratio. 1. Power A, et al. Presented at the International Society of Nephrology's World Congress of Nephrology (WCN), April 15–19, 2021. Virtual meeting. Poster WCN21-0657; 2. Tangri N, et al. Presented at the International Society of Nephrology's World Congress of Nephrology (WCN), April 15–19, 2021. Virtual meeting. Poster WCN21-0668; 3. Mennini F, et al. Presented at ISPOR Europe, November 30–December 3, 2021. Virtual meeting. Poster POSB68; 4. Tangri N, et al. [Draft manuscript – Inside CKD: Cost-effectiveness of screening strategies in CKD]

05. Relevant Publications

a. Tangri, N., Chadban, S., Cabrera, C., Retat, L., & Sánchez, J. J. G. (2023). Projecting the Epidemiological and Economic Impact of Chronic Kidney Disease Using Patient-Level Microsimulation Modelling: Rationale and Methods of Inside CKD. *Advances in Therapy*, 40(1).

<https://doi.org/10.1007/s12325-022-02353-5>

b. Jha, V., Al-Ghamdi, S. M. G., Li, G., Wu, M. S., Stafylas, P., Retat, L., Card-Gowers, J., Barone, S., Cabrera, C., & Garcia Sanchez, J. J. (2023). Global Economic Burden Associated with Chronic Kidney Disease: A Pragmatic Review of Medical Costs for the Inside CKD Research Programme. *Advances in Therapy*, 40(10). <https://doi.org/10.1007/s12325-023-02608-9>

c. Mennini, F., Cabrera, C., Card-Gowers, J., Chertow, G., de Nicola, L., Halimi, J., Nolan, S., Power, A., Retat, L., Vesga, J., Webber, L., Wish, J., Xu, M., & Garcia Sanchez, J. (2022). POSB68 Inside CKD: Projecting the Economic Burden of Chronic Kidney Disease Using Patient-Level Microsimulation. *Value in Health*, 25(1), S73. <https://doi.org/10.1016/j.jval.2021.11.341>

d. Garcia Sanchez, J. J., Abdul Sultan, A., Ärnlöv, J., Cabrera, C., Card-Gowers, J., de Nicola, L., Halimi, J.-M., Mennini, F. S., Navarro-González, J. F., Nolan, S., Power, A. J., Retat, L., Webber, L., & Xu, M. (2021). MO498 INSIDE CKD: MODELLING THE CLINICAL AND ECONOMIC IMPACTS OF TARGETED URINARY ALBUMIN-TO-CREATININE RATIO SCREENING IN EUROPEAN COUNTRIES. *Nephrology Dialysis Transplantation*, 36(Supplement_1).

<https://doi.org/10.1093/ndt/gfab087.0018>

e. Abdul Sultan, A., Ärnlöv, J., Cabrera, C., Card-Gowers, J., de Nicola, L., Garcia Sanchez, J. J., Halimi, J.-M., Mennini, F. S., Navarro-González, J. F., Nolan, S., Power, A. J., Retat, L., Webber, L., & Xu, M. (2021). MO494 INSIDE CKD: MODELLING THE ECONOMIC BURDEN OF CHRONIC KIDNEY DISEASE IN EUROPE USING PATIENT-LEVEL MICROSIMULATION. *Nephrology Dialysis Transplantation*, 36(Supplement_1). <https://doi.org/10.1093/ndt/gfab087.0014>

INSIDE CKD



f. Garcia Sanchez, J. J., Abdul Sultan, A., Batista, M. C., Cabrera, C., Card-Gowers, J., Chadban, S., Chertow, G., Kanda, E., Li, G., Nolan, S., Retat, L., Tangri, N., Webber, L., Wish, J., & Xu, M. (2021). MO486 INSIDE CKD: MODELLING THE IMPACT OF IMPROVED SCREENING FOR CHRONIC KIDNEY DISEASE IN THE AMERICAS AND ASIA-PACIFIC REGION. *Nephrology Dialysis Transplantation*, 36(Supplement_1).
<https://doi.org/10.1093/ndt/gfab087.006>

g. Abdul Sultan, A., Batista, M. C., Cabrera, C., Card-Gowers, J., Chadban, S., Chertow, G., Garcia Sanchez, J. J., Kanda, E., Li, G., Nolan, S., Retat, L., Tangri, N., Webber, L., Wish, J., & Xu, M. (2021). MO518 INSIDE CKD: MODELLING THE ECONOMIC BURDEN OF CHRONIC KIDNEY DISEASE IN THE AMERICAS AND THE ASIA-PACIFIC REGION USING PATIENT-LEVEL MICROSIMULATION. *Nephrology Dialysis Transplantation*, 36(Supplement_1).
<https://doi.org/10.1093/ndt/gfab087.0038>

h. Garcia Sanchez, J. J., Tangri, N., Abdul Sultan, A., Batista, M. C., Cabrera, C., Chadban, S., Chertow, G., Kanda, E., Li, G., Nolan, S., Retat, L., Xin, S., Webber, L., Wish, J., & Xu, M. (2021). POS-322 INSIDE CKD: PROJECTING THE FUTURE BURDEN OF CHRONIC KIDNEY DISEASE IN THE AMERICAS AND THE ASIA-PACIFIC REGION USING MICROSIMULATION MODELLING. *Kidney International Reports*, 6(4), S138–S139.
<https://doi.org/10.1016/j.ekir.2021.03.338>

IMPACT CKD



Policy impact,
projected burden
of CKD in 2032,
prevalence, clinical
events, mortality,
healthcare resource
usage, healthcare costs,
workforce productivity,
economic indicators,
and environmental
measures.



IMPACT CKD

01. Aim

The IMPACT CKD study aims to evaluate the multifaceted impact of CKD on patients, healthcare systems, and broader society. By projecting the future implications of CKD through to 2032, the study seeks to illuminate the significant benefits of policy interventions on patient health, healthcare resource allocation, economic stability, workforce productivity, and environmental sustainability. Ultimately, IMPACT CKD aspires to bolster health system evaluations and inform health policy decisions, enhancing awareness and care for individuals afflicted with CKD.²⁸

02. Design

Employing an individual-level microsimulation approach, IMPACT CKD forecasts the clinical, economic, societal, and environmental burden of CKD over a decade (2022-2032). Utilizing both local and surrogate (if local was unavailable) data, the study constructs a demographic of 1 million individuals (diagnosed, undiagnosed, and non-CKD) for each participating country, simulating disease progression and its consequent impact. The findings are then combined and scaled to mirror the entire population of each country involved, providing a comprehensive view of CKD's potential trajectory.

Future publications from IMPACT CKD will project the impact of policies on the burden of disease outcomes from CKD.

03. Countries Involved

Australia, Brazil, China, Germany, Netherlands, Spain, United Kingdom, United States.

²⁸Sanchez, J. J. G., Wheeler, D. C., Brown, S., Priest, S., Guiang, H., Webber, C. J., Wharton, G., Barone, S., & Grima, D. (2023). #4271 THE GROWING BURDEN OF CHRONIC KIDNEY DISEASE IN THE UK: AN IMPACT CKD ANALYSIS. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_4271



IMPACT CKD

04. Key Outcomes

The preliminary findings from the study present the UK segment. The findings highlight a substantial increase in the clinical, economic, societal, and environmental burden of CKD by 2032, drawing attention to the importance of acting now on CKD.

- The population of patients in the UK with CKD is projected to grow from 8.27 million people to 8.61 million people between 2022 – 2032, a projected 4% increase in the total prevalence of CKD.²⁸
- There is projected to be an associated 44% surge (73,365 in 2022 to 105,860 in 2032) in patients undergoing renal replacement therapy (RRT) (dialysis or kidney transplants).²⁸
- There is projected to be a corresponding increase in RRT expenditure from £1.09 billion to £1.85 billion.²⁸

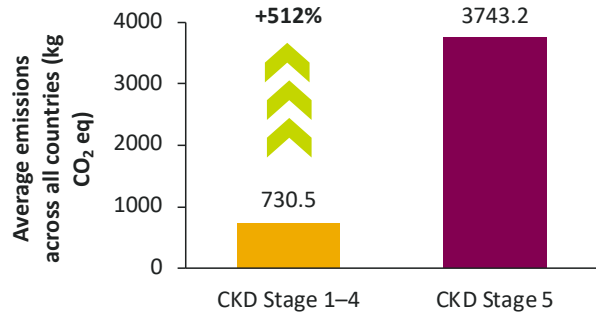
- The growth in in-centre haemodialysis utilization is predicted to lead to an environmental burden of 1.35 million tonnes of CO2 emissions.²⁸

- Between 2022 – 2032, an estimated 81.60 million workdays for patients are anticipated to be lost due to CKD, with an additional 11.89 million lost by caregivers.²⁸

²⁸Sanchez, J. J. G., Wheeler, D. C., Brown, S., Priest, S., Guiang, H., Webber, C. J., Wharton, G., Barone, S., & Grima, D. (2023). #4271 THE GROWING BURDEN OF CHRONIC KIDNEY DISEASE IN THE UK: AN IMPACT CKD ANALYSIS. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_4271

A 360° view of CKD demonstrates the unprecedented socioeconomic and environmental toll of CKD over the next 10 years.

Carbon emissions¹



As CKD progresses, carbon emissions increase^a

The key healthcare drivers for increased emissions are:^a

Hospitalization at early stages

RRT modality at later stages

Clinical	→	Overall prevalence of CKD is projected to remain steady at 12.4 - 12.6% / CKD Stage 3-5 will increase by 21.1% / RRT patients will increase by 30.1%
Economic	→	/ CKD costs over 10 years will increase by 36.3% / RRT costs over 10 years will increase by 29.3%
Societal	→	/ Over 10 years, 362.7 million workdays will be missed / 92% of missed workdays from patients with CKD Stage 3-5
Environmental	→	Predicted growth in the use of fresh water, fossil fuel, and CO ₂ emissions by 2032.

^aUK and USA data used. CKD, chronic kidney disease; RRT, renal replacement therapy.

¹Cases A, et al. Presented at 60th European Renal Association (ERA) Congress, June 15-18, 2023. Milan, Italy. Poster; 2. Garcia Sanchez JJ, et al. Presented at 60th European Renal Association (ERA) Congress; June 15-18, 2023. Milan, Italy. Poster



IMPACT CKD

05. Relevant Publications

a. Sanchez, J. J. G., Wheeler, D. C., Brown, S., Priest, S., Guiang, H., Webber, C. J., Wharton, G., Barone, S., & Grima, D. (2023). #4271 THE GROWING BURDEN OF CHRONIC KIDNEY DISEASE IN THE UK: AN IMPACT CKD ANALYSIS. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_4271

b. Priest, S., Guiang, H. A., Johnston-Webber, C., Rao, N., Chen, J., Bhandary, D., Berria, R., Brown, S., Grima, D., & Skolnik, N. (2023, November 3). IMPACT CKD: Projecting the Growing Environmental Burden of CKD in the United States. *ASN Kidney Week 2023*. <https://www.asn-online.org/education/kidneyweek/2023/program-abstract.aspx?controlId=3945715>

c. Bermudez, I. B., Webber, C. J., Sanchez, J. J. G., Wharton, G., Duncan, N., Fluck, R., Javaid, Y., Roderick, P., Wheeler, D. C., & McGuire, A. (2023). #4167 THE HEALTH, SOCIOECONOMIC AND ENVIRONMENTAL IMPACT OF CKD IN THE UK: BUILDING A CONCEPTUAL FRAMEWORK. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_4167

Environmental impact of chronic kidney disease



Carbon emissions,
fine particulate
matter formation,
photochemical
ozone formation
and freshwater
usage.

Environmental impact of chronic kidney disease

01. Aim

This study provides a comprehensive analysis of the CKD patient care pathway across different stages of CKD to identify areas with high environmental impact and guide policy interventions to mitigate impact at all CKD stages.

02. Design

This study utilised a Life Cycle Assessment (LCA) methodology to investigate the impact of the complete healthcare pathway at each stage of CKD. The LCA methodology generates an environmental profile of the care pathway, utilising local data where possible to illustrate the CKD treatment pathway including healthcare visits, hospitalisations, transport, and kidney replacement treatment modalities.

The study evaluates measures such as fine particulate matter, fossil fuel depletion, and freshwater consumption as a result of the CKD care pathway.

03. Countries Involved

Australia, Belgium, Brazil, Germany, Japan, Italy, Netherlands, Spain, United Kingdom, United States.

04. Key Outcomes

Preliminary findings from this study have revealed the significant environmental burden of in-centre haemodialysis in the UK.

- The carbon footprint from in-centre haemodialysis, evaluated per patient, was estimated to be 3,900 kg CO² equivalents which is roughly equal to the average UK person's annual carbon emissions.²⁹
- 93,600 litres of water and 3,058 kWh electricity was estimated per patient on in-centre haemodialysis annually in the UK.²⁹

05. Relevant Publications

a. Zoccali, C., Barraclough, K., Eckelman, M., Amenos, A. C., Germond-Duret, C., Pecoits-Filho, R., Sanchez, J. J. G., Selvarajah, V., Hubbert, L., & Nicholson, L. (2023). #2695 THE ENVIRONMENTAL IMPACT OF CHRONIC KIDNEY DISEASE INTERNATIONALLY: RESULTS OF A LIFE CYCLE ASSESSMENT. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_2695

²⁹Zoccali, C., Barraclough, K., Eckelman, M., Amenos, A. C., Germond-Duret, C., Pecoits-Filho, R., Sanchez, J. J. G., Selvarajah, V., Hubbert, L., & Nicholson, L. (2023). #2695 THE ENVIRONMENTAL IMPACT OF CHRONIC KIDNEY DISEASE INTERNATIONALLY: RESULTS OF A LIFE CYCLE ASSESSMENT. *Nephrology Dialysis Transplantation*, 38(Supplement_1). https://doi.org/10.1093/ndt/gfad063c_2695

Make *the*
Change
for kidney health

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This campaign is co-created with the Global Patient Alliance for Kidney Health as well as funded and produced by AstraZeneca.

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