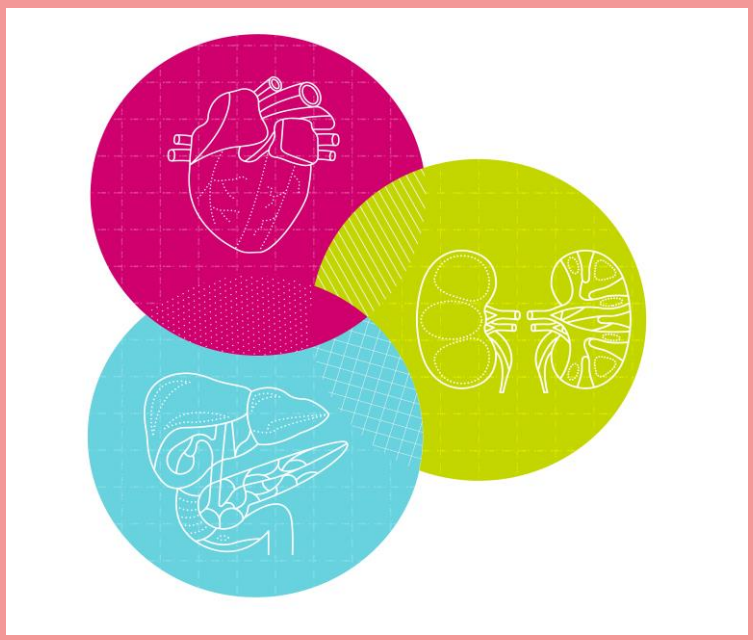
Environmental Impact of the Care Pathway for Chronic Kidney Disease in the UK

Care Pathway Case Study



AstraZeneca

Sustainable Healthcare Coalition

Environmental Impact of the Care pathway for Chronic Kidney Disease in the UK

Title	Care Pathway for Chronic Kidney Disease in the UK
Organisation	AstraZeneca
Company website	www.astrazeneca.com/
Contact details	Nigel Budgen (Nigel.Budgen@astrazeneca.com)
Completion date	June 2022
Assurance	Internal assurance
Supporting information	ERM LCA and Care Pathway Assessment Reports
Conformance with Care Pathways: Guidance on Appraising Sustainability ("the Guidance")	Adheres to the principles of the Guidance
Care pathway description	Care Pathway for Chronic Kidney Disease (CKD)
Environmental issues appraised	Global warming potential (IPCC, CO_2 eq, 100-year)

Globally, it is recognised that health and care systems are undergoing transformative change to adapt to the needs of patients and communities, with increasing pressure to be financially, socially and environmentally sustainable. Appraising the sustainability of care pathways is seen as a crucial step to enabling a more sustainable health system[1].

Conclusions

This study estimates the greenhouse gas (GHG) emissions associated with the treatment of Chronic Kidney Disease (CKD) and appraises the use of sodium-glucose cotransporter-2 (SGLT-2) inhibitors to control the progression of the disease[2]. It is estimated that the average CKD case in the UK has a global warming impact of **0.392 kg CO2 eq per patient day** [2]. Stage 3 and 5d are shown to make the largest overall GHG contribution to the care pathway[2]. Considering the size of the CKD population in the UK, this study shows treating CKD in the UK has a substantial GHG footprint, estimated to be in the region of **250,000 tonnes CO_2 eq per year** [2,3]. The size of the CKD population in the UK is projected to grow by over 13.5% by 2027 from 2.8 million people in 2020, against a backdrop to control GHG emissions from healthcare[3]. Alongside the acknowledged significant human and financial cost on patients and NHS care providers, this study draws attention to the environmental cost of CKD.

This analysis illustrates that decreasing incidence in the most impactful stages of disease by control of disease progression can reduce the GHG impact of CKD care in the UK by reducing the need for intensive primary and secondary care interventions.

Learnings

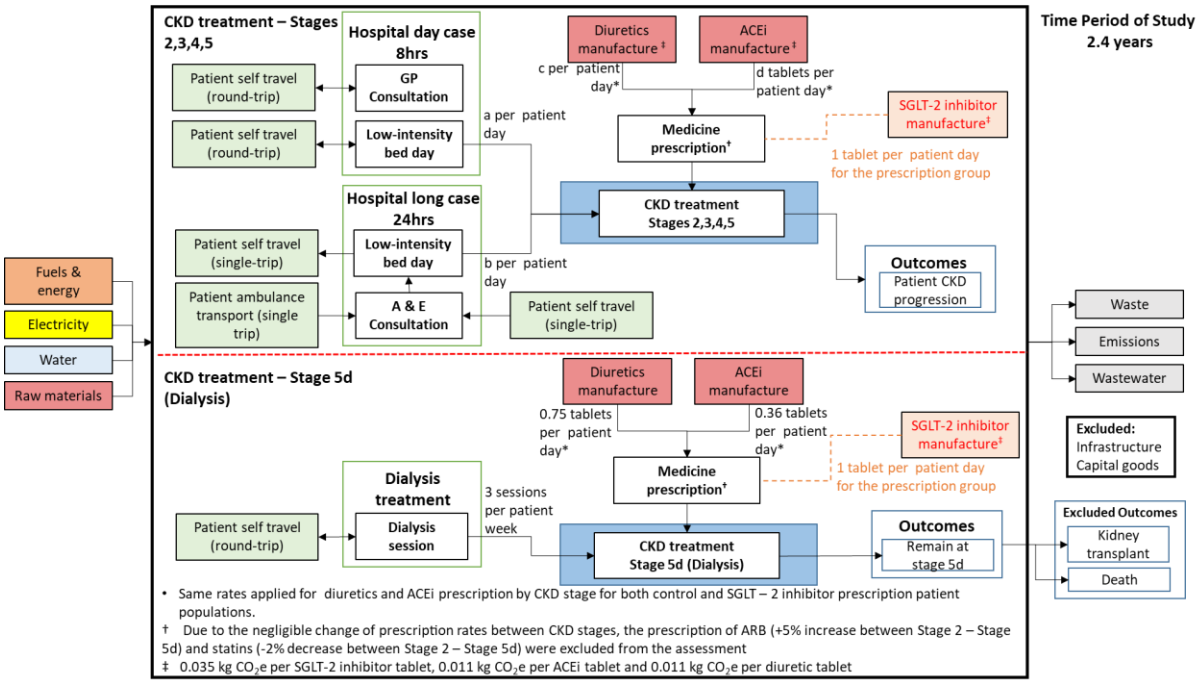
This study has demonstrated the value of appraising the sustainability of care pathways. The assessment has identified the environmental hotspots in the care of a patient with CKD and how they are affected by treatments. The relative impact reduction estimated in this study is based on reliable published peer reviewed data[3-7]. The assessment is therefore well founded and is not reliant on derived factors. However, environmental impact values are calculated using a number of generic emission factors. This introduces a degree of uncertainty with the final absolute footprint value estimates given here. A more in depth assessment of the environmental impact of standard procedures that are specifically deployed to control CKD stages 1-5, similar to that undertaken for stage 5d[7], would be needed to provide a definitive measure of the absolute values.

Scope

This appraisal addresses the environmental impact of the care of a patient with CKD. The unit of analysis for this appraisal is:

"The care of a patient with CKD of any age in the UK"

CKD is a disease that causes progressive extensive damage to patients' kidneys over a prolonged period, inhibiting normal blood filtration and allowing the accumulation of waste within the body. In this study we appraised the carbon footprint of CKD, focussing on the impact per patient day spent in each stage of the disease. Using the SHC Care Pathway Guidance[1], clinical trial data[4] and environmental impact data from AstraZeneca's life cycle assessment (LCA)[8] and published sources, the overall GHG emissions were estimated. The progression of patients diagnosed with CKD is stratified into stages 1 – 5d and is indicated by the key metric of estimated glomerular filtration rate (eGFR), expressed in ml/min/1.73m^3. The incidence of hospitalisation, medicines prescribed and treatments provided to each patient changes over time as CKD progresses stage-wise from stage 1 (eGFR 90+) to stage 5d (eGFR <15), where dialysis treatment is required. By establishing the pathway, the GHG impact of the prescription of a SGLT-2 inhibitor was modelled to illustrate the potential carbon savings offered to a patient population. The process flow of this pathway is shown in the diagram below.



Data

The care pathway GHG footprint for the treatment of CKD has been calculated using secondary data in the literature, supplemented by estimates and assumptions. The carbon impact per patient day in each CKD stage was calculated with the following inclusions: hospital day cases, hospital long stay cases, dialysis treatment, GP consultation, patient self-travel, prescribed medicines and patient travel to A&E department[1-8].

A table summarising these data is shown at the top of page 4.

1 Coalition for Sustainable Pharmaceuticals and Medical Devices, Care Pathways: Guidance on Appraising Sustainability. (CSPM). 2015.
2 Internal AstraZeneca Report CKD Care Pathway Assessment 2022 ERM Project No.: 0590599
3 Retat L, Xu M, Webber L, Cabrera C, Sörstadius E, Abdul Sultan A, Nolan S, Garcia Sanchez JJ, Estimating the future burden of chronic kidney disease through microsimulation Kidney Week; American Society of Nephrology, Oct 19-21 2020 Virtual Congress. Methods
4 Heerspink H.J.L., Stefánsson B. V., Correa-Rotter R., Chertow G. M., Greene T., Hou F.F., M.D., Mann J F. E., McMurray J. J.V., Lindberg M, Rossing P., Sjöström C.D., Toto R.D, Langkilde A.M., and Wheeler D.C, Dapagliflozin in Patients with Chronic Kidney Disease N Engl. J Med 2020;383:1436-46.
5 NHS England Ambulance Quality Indicators 2022, https://www.england.nhs.uk/statistics/statistical-work-areas/ambulance-quality-indicators/ (accessed 4 February 2022)
6 NHS England Chronic Kidney Disease in England: The Human and Financial Cost, 2022, https://www.england.nhs.uk/improvement-hub/publication/chronic-kidney-disease-in-england-the-human-and-financial-cost/ (accessed 4 February 2022)
7 Sustainable Healthcare Coalition, A Care Pathway Environmental Assessment of In-Centre Haemodialysis at The Newcastle upon Tyne Hospitals NHS Foundation Trust (2022); https://shcoalition.org/wp-content/uploads/2022/06/ICHD_CarePathway_-220610.pdf
8 Internal AstraZeneca Report, Life Cycle Assessment of SGLT-2 inhibitor. ERM Project No: 0599882 Sept 2021.

Results

The potential carbon impacts per patient per day across each of the modelled CKD stages, shown in the table below, are used to estimate the total UK CKD patient impact.

	Stage 2 (eGFR 90-60)	Stage 3 (eGFR 60-30)	Stage 4 (eGFR 30-15)	Stage 5 (eGFR <15)	Stage 5d (Dialysis)	Unit
Hospital day cases[a]	0.232	0.240	0.260	0.260	0.000	per patient per year
Hospital long cases[b]	0.000	0.074	0.252	0.252	0.000	per patient per year
ACEi prescription[d]	0.52	0.43	0.36	0.36	0.36	tablets per patient day
Diuretics prescription[c]	0.52	0.57	0.75	0.75	0.75	tablets per patient day
ARB prescription	0.84	0.85	0.89	0.89	0.89	tablets per patient day
Statins prescription	0.66	0.66	0.65	0.65	0.65	tablets per patient day

The CKD average impact per patient day has been estimated as 0.392 kg CO_2 eq. The impact of dialysis treatment (Stage 5d) is shown to make the largest contribution.

In this study we also appraised the carbon footprint of CKD in each stage with and without the use of a SGLT-2 inhibitor, to determine the potential carbon savings offered by treatment to control disease progression.

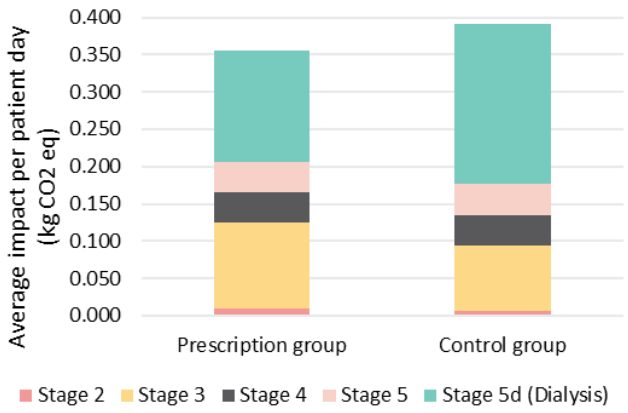
As shown in the results breakdown graph, below, the largest contribution to both the control (55%) and SGLT-2 inhibitor-prescribed populations (42%) per patient day comes from Stage 5d (Dialysis). Stage 5d is the most carbon-intense stage of CKD treatment.

This analysis shows the prescription of a SGLT-2 inhibitor could offer a 9% reduction in the carbon impact of a CKD patient population. When SGLT-2 inhibitor is prescribed, the percentage of the trial patient population on an average day requiring dialysis treatment is reduced from 2.3% to 1.6%, which reduces the impact for Stage 5d per average patient from 0.215 kg CO2 eq to 0.149 kg CO2 eq, a reduction of 31%. This reduction in stage 5d outweighs the increase for stage 3 from 0.087 to 0.115 kg CO2 eq per average patient.

The reduction in the number of patients in a population requiring carbon-intense dialysis treatment is highlighted as the key stage for influencing the carbon impact and for achieving carbon reductions.

Understanding and apprising the GHG impact associated with the management and treatment of CKD are important steps towards a more sustainable treatment paradigm for this debilitating condition. The incidence of CKD in the UK is anticipated to significantly increase over the next decade against urgent actions to control climate change. Further work is needed to model the potential impact.

CKD Stage	GHG Impact per Control Patient Day in Stage (kg CO_2 eq)	UK CKD Population	UK CKD Patient GHG Impact (tonnes CO_2 eq/year)
Stage 2 (eGFR 90-60)	0.064	210,000	5,000
Stage 3 (eGFR 60-30)	0.140	2,430,000	124,000
Stage 4 (eGFR 30-15)	0.325	120,000	14,000
Stage 5 (eGFR <15)	0.325	38,000	5,000
Stage 5d (Dialysis)	9.39	30,000	103,000



Acknowledgements

This document has been developed collaboratively through the Sustainable Healthcare Coalition, which comprises a range of organisations within the healthcare sector including pharmaceutical and medical device companies, trade bodies, procurement, government organisations and other stakeholders. The Sustainable Healthcare Coalition operates with the aim of facilitating the journey towards good health and wellbeing on a finite planet, through open-minded collaboration across public and private healthcare. AstraZeneca funded the study; was involved in the study design, development, analysis; and was given the opportunity to review the manuscript before submission.