Economic and clinical impact of cost-effective kidney-related healthcare interventions to manage the burden of CKD in the UK

Agathangelou G[1], Gofman L[2], Kulkarni R[3], Jaffe JN[1], Farrimond B[1], Sharma S[4]

[1]ZS Associates, London, UK, [2]ZS Associates, Princeton, NJ, USA, [3]ZS Associates, Bethesda, MD, USA, [4]ZS Associates, New Delhi, India.

Background

In the United Kingdom (UK), a total of 7.2 million adults have chronic kidney disease (CKD) (all stages), more than 10% of the entire population.[1] Currently, there are 30,000 people in the UK who rely on dialysis to stay alive,[2] and every year, around 3,000 people receive a kidney transplant.[3] The number of people with end-stage kidney disease (ESKD) requiring kidney replacement therapy (KRT) has been increasing worldwide and is predicted to double by 2030.[4]

Methods

Given the management of CKD is costly and driven by risk factors, ageing, and other health and economic inequalities, the objectives of this research were to determine if population-level interventions including 1) early/improved diagnosis, 2) improved CKD management, 3) use of SGLT-2 inhibitors, and 4) increased rates of transplantation, could be cost-saving or cost-effective.

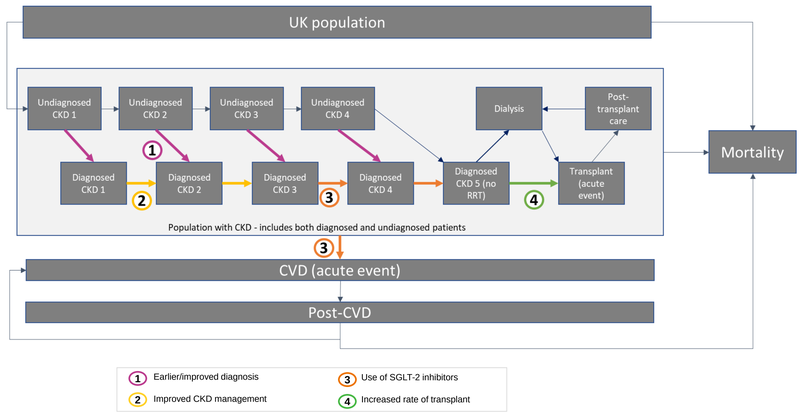
A population-level Markov model was used to estimate the current and future economic burden of CKD across all stages and show the directional impact of four interventions based on costs and outcomes. The model was developed to capture both Payer direct costs and UK economy and productivity costs to understand the progression between undiagnosed and diagnosed people with CKD. The model included additional health states, including; transplantation, post-transplant, cardiovascular disease, and post-CVD. Each cycle length was defined as quarterly (every 3 months) and the time horizon for the model was set to 10 years. The model was set up to allow for each intervention to be assessed individually, or in combination.

Modelling Interventions

The following interventions were applied to the model **(Figure 1)**:

- **Intervention 1. Early/improved diagnosis:** This intervention targets underserved populations through outreach programs to improve screening opportunities and increase early diagnosis and is illustrative of the benefits which can be achieved through well-targeted early/improved diagnosis in general.
- **Intervention 2. Improved CKD management:** This intervention targets eligible patients with CKD who are either untreated or not receiving standard care according to clinical guidelines (e.g., adequate blood pressure management).
- **Intervention 3. Use of SGLT-2 inhibitors:** This intervention aims to increase uptake of new medications such as sodium-glucose transport protein 2 (SGLT-2) inhibitors to reduce cardiovascular events and slow progression to end-stage kidney disease.
- **Intervention 4. Increased rates of transplant:** This intervention models the impact of increased outreach and awareness to increase pre-emptive live donor transplants. It is illustrative of the benefits of improving transplantation rates more generally.

Figure 1. Model Schematic



Results

The model estimated the combined clinical and economic impact of all four interventions. The clinical impact of adopting all four interventions reduced deaths by 10,495 over the 10-year period (Table 1) and would increase the total Quality Adjusted Life Years (QALYs) in the population by 49,574 (Table 2). The model estimates Intervention 3 (use of SGLT-2 inhibitors) is a large contributor to the increase in QALYs gained (Figure 2). The cumulative burden of CKD was £91.0 billion over the 10-year period (Table 2).

The burden of CKD was estimated to be reduced by £64.6 million (0.07% difference). The reduction in indirect costs (£445.7 million) would more than offset the total increase in NHS costs of £381.1 million.

Table 1. Clinical impact of combined interventions[5]

	Prevalence (year 10)			Incidence (year 10)		Total (years 1-10)
Scenario	**CKD 1-2**	**CKD 3-5**	**Dialysis**	**Transplant**	**CVD**	**Death**
Base Case	3,742,425	3,444,060	142,918	11,663	192,970	
Combined interventions	3,743,058	3,467,156	137,453	11,725	190,448	
Difference	633	23,096	(5,465)	62	(2,522)	(10,495)
% change	0.02%	0.7%	-3.8%	0.5%	-1.3%	-0.14%

Table 2. Economic Impact of Combined Interventions

Scenario (Years 1-10)	Direct costs	Indirect costs	Total costs	QALYs
Base Case	70,683,534,208	20,334,744,603	91,018,278,811	71,662,137
Combined interventions	71,064,652,248	19,889,062,335	90,953,714,583	71,711,711
Difference	381,118,041	(445,682,268)	(64,564,228)	49,574
% change	0.5%	-2.2%	-0.1%	0.1%

Figure 2. QALYs gained by intervention

Conclusions

- Approximately 3.25 million adults are living with CKD stages 3-5 and is expected to increase to 3.85 million over the next 10 years.[1]
- Economic modelling suggests that improved implementation of four illustrative healthcare interventions could save more than 10,000 lives by 2033.
- These interventions individually and collectively are shown to be cost-effective or cost-saving where costs to the NHS are offset by QALYs gained.

References

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This study was conducted in collaboration with Kidney Research UK: https://www.kidneyresearchuk.org/about-us/influencing-change/health-economics-repo