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Making CKD diagnosis more cost-effective and efficient by using a digital solution: a modelling study across six countries

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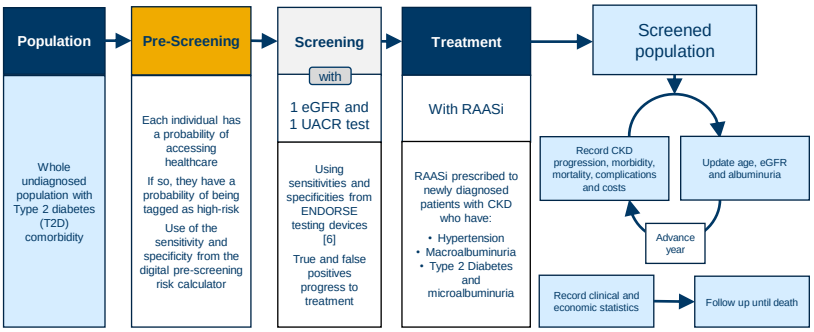
Introduction

- Chronic Kidney Disease (CKD) affects around one in ten people around the world. However, many cases remain undiagnosed [1].
- Annual CKD screening is recommended in high-risk groups but is often underperformed due to limited access to screening resources [2].
- New digital solutions could accelerate diagnosis by identifying high-risk patients earlier [3].
- The objective of this project was to carry out a cost-effectiveness analysis across 6 countries of a CKD screening programme using a globally validated digital pre-screening risk calculator, compared with standard diagnosis and care [4].

Figure 2. Schematic overview of the intervention model structure



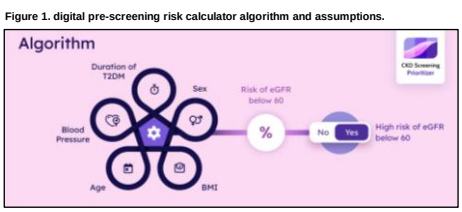
Methods

- Six virtual populations, representative of Australia, Brazil, Mexico, Saudi Arabia, South Korea and the United Arab Emirates (UAE), were generated using the previously validated Inside CKD microsimulation [5].
- Virtual individuals were assigned an age, sex, CKD stage, comorbidity status (type 2 diabetes, hypertension), and probability of being diagnosed. Direct healthcare costs were assigned based on an individual's health status each year.
- An intervention was designed in which "high-risk" type 2 diabetes patients were identified using a validated digital solution and subsequently referred for CKD testing (estimated glomerular filtration rate (eGFR) and urine albumin-to-creatinine ratio) and treatment (renin-angiotensin system blockers, RAASi) if diagnosed. The sensitivity and specificity and the proxies used for these, for each country, can be seen in Table 1.
- The digital solution uses five universal inputs (age, sex, blood pressure, body mass index, and duration of type 2 diabetes) to identify patients at 'high-risk' of having CKD, using an algorithm based on certain assumptions (Fig. 1).
- The health and economic benefits of introducing the digital solution were quantified and these epidemiological, quality of life and cost outputs were compared with the standard diagnosis and care scenario (Fig. 2).

Table 1. Sensitivity and specificity of the digital solution

Country	Proxy used	Sensitivity	Specificity
Australia	Western Pacific	0.835	0.440
Brazil	Americas	0.733	0.670
Mexico	Americas	0.733	0.670
Saudi Arabia	Eastern Mediterranean	0.768	0.464
South Korea	South-East Asia	0.798	0.560
UAE	Eastern Mediterranean	0.768	0.464

Figure 1. digital pre-screening risk calculator algorithm and assumptions.



Results

- Compared with standard diagnosis and care, CKD screening using the validated digital solution followed by treatment was cost-effective in people defined as 'high-risk' in all six countries.
- Cumulative QALYs gained per patient ranged from 0.01 (Saudi Arabia, South Korea) to 0.04 (Brazil) (Table 2).
- For example, in Australia, using a willingness-to-pay threshold of $50,000AUD per additional quality adjusted life year (QALY), the incremental cost-effectiveness ratio was estimated at $6,195AUD/QALY (Table 2).
- Cumulative years of life gained per patient ranged from less than one month (Mexico) to around two months (Brazil) (Table 2).

Table 2 Willingness-to-pay thresholds, incremental cost-effectiveness ratio, quality-adjusted life years gained per person and years of life gained per person under the digital solution scenario

Country	Willingness-to-pay threshold per QALY [a]	ICER (Lifetime Horizon) [b]	Net monetary benefit [c]	Maximum acceptable cost per patient [d]	Cumulative QALYs gained per patient	Cumulative years of life gained per patient
Australia	AU$50,000	AU$6,195	AU$984	AU$1,183.03	0.02246	0.03553
Brazil	R$36,634.75	R$25,060	R$470	R$701.79	0.04063	0.06328
Mexico	Mex$204,893	Mex$42,777	Mex$1,564	Mex$4,469.11	0.00965	0.01476
Saudi Arabia	﷼90,000	﷼32,692	﷼823	﷼1,127.16	0.01436	0.02297
South Korea	₩25,000,000	₩2,991,431	₩320,049	₩400,105	0.01454	0.02217
UAE	د.إ133,255	د.إ35,561	د.إ2,313	د.إ2,313.43	0.02368	0.03693

AU$: Australian dollar; R$: Brazilian Real; Mex$: Mexican Peso; ﷼: Saudi Riyal; ₩ South Korean Won; د.إ United Arab Emirates Dirham; ICER: Incremental cost-effective ratio; QALY: quality-adjusted life year
a) The maximum threshold at which an intervention is considered cost-effective; b) cost per QALY gained; c) the multiplication of QALYs gained by the willingness to pay threshold, subtracting the incremental cost of screening; d) the maximum cost of screening that meets the willingness to pay threshold

Conclusions

- Targeted CKD screening via an easy-to-use digital solution may be a cost-effective way to improve patient outcomes as well as reduce time and cost to healthcare practitioners.
- Demonstration of effectiveness in various real-world, country-specific contexts will be required.

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