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Population-Level Evidence for Expanding Kidney Transplantation Programs Worldwide

Limits: 350 words, 2 tables, and 2 images.

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Globally, the burden of chronic kidney disease (CKD) and need for kidney replacement therapy (KRT - dialysis or transplantation) are increasing. Evidence at the individual patient level identifies kidney transplantation (KT) as the most effective form of KRT, but – in the absence of population-level evidence – countries are prioritizing dialysis services instead. We aimed to assess the population-level relationship between CKD mortality and KRT volume.

We aggregated publicly available, country-level data on World Bank income level, gross domestic product (GDP), age-standardized CKD prevalence and mortality, and KRT volume (dialysis prevalence and KT incidence). We used generalized linear modelling to examine the relationships between GDP and clinical variables, and to model mortality as a function of GDP and KRT volume. Post-hoc, we modeled how many deaths could be averted if each country increased its KT volume to match either (1) the highest KT volume within its income level (conservative scenario) or (2) the highest KT volume overall (optimistic scenario).

Among 203 countries, age-standardized CKD prevalence was 7.78%; data missingness decreased with income level ($p < 0.001$, **Table 1**). Higher GDP was associated with higher KRT volume ($p < 0.001$ for both dialysis and KT) and lower CKD mortality ($p < 0.001$, **Figure 1**). After multivariable adjustment, GDP and KT volume, but not dialysis volume, were independently associated with decreased mortality ($p = 0.018$, 0.007 , and 0.615 , respectively; **Table 2**). Increasing KT volumes globally would avert between 290,000 (conservative) and 1,020,000 (optimistic) CKD deaths annually.

We present the first population-level evidence that countries at all income levels may reduce CKD mortality by increasing KT volume. Dialysis, although an important component of KRT, does not share this mortality benefit. Anticipated global increases in CKD prevalence may deepen existing income-based disparities in data availability, KRT volume, and CKD mortality. Policymakers should leverage domestic resources and global partnerships to

shift resources toward KT expansion, following international guidelines to ensure quality, equity, and patient safety.

Table 1. Chronic kidney disease burden and kidney replacement therapy volumes by income level.

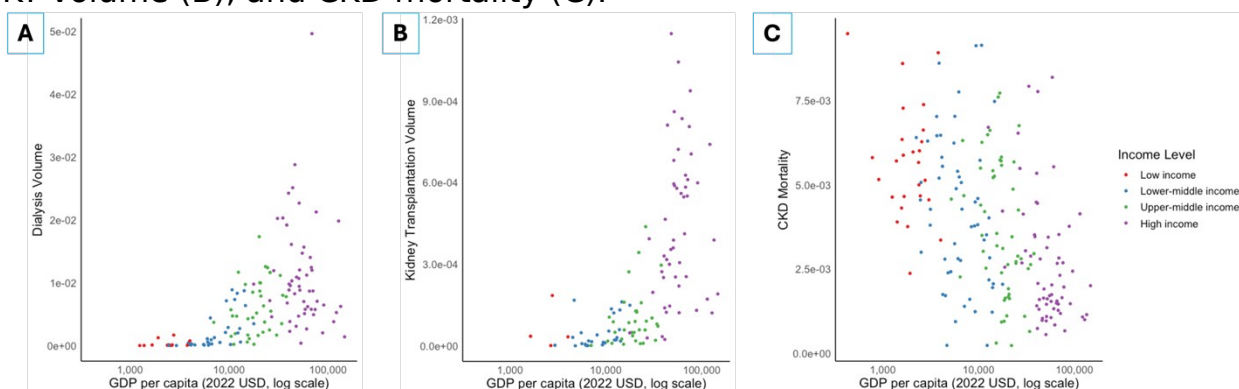
	Overall N = 203	LIC N = 29 (14.3%)	LMIC N = 54 (26.6%)	UMIC N = 53 (26.1%)	HIC N = 67 (33.0%)
GDP per capita	15900	1990	6410	17800	52500
CKD prevalence	7.78%	7.33%	9.19%	9.08%	6.95%
Dialysis volume*	0.508%	0.007%	0.056%	0.494%	0.882%
KT volume*	0.013%	0.003%	0.002%	0.007%	0.039%
CKD mortality*	0.346%	0.571%	0.392%	0.319%	0.200%
Data missingness	9.50%	18.8%	11.8%	8.84%	5.97%

*Variable reported as a proportion of people with CKD.

Cells represent column medians, rounded to three significant digits or three decimal places.

LIC: low-income countries; LMIC: lower-middle income countries; UMIC: upper-middle income countries; HIC: high-income countries; GDP: gross domestic product in 2022 USD, adjusted for purchasing power parity; CKD: chronic kidney disease; KT: kidney transplantation.

Figure 1. The relationship between per capita GDP and dialysis volume (A), KT volume (B), and CKD mortality (C).



GDP: gross domestic product in 2022 USD, adjusted for purchasing power parity; CKD: chronic kidney disease; KT: kidney transplantation; USD: United States dollars.

Table 2. Multivariable model of CKD mortality, with GDP per capita, dialysis volume, and KT volume as predictors.

Outcome: CKD Mortality				
Predictor Variables	Coefficient	2.5% CL	97.5% CL	p-value
	t			
GDP per capita	-5.58E-06	-9.62E-06	-1.19E-06	0.018
Dialysis volume	4.27	-12.6	23.0	0.615
KT volume	-716	-1210	-210	0.007

CKD: chronic kidney disease; GDP: gross domestic product (2022 USD), adjusted for purchasing power parity; KT: kidney transplantation; CL: confidence limit.