

Non-Traditional Barriers to Participation in Chronic Kidney Disease Clinical Trials

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Supplementary methods

National-level variables*:

- Income-group (World Bank Country and Lending Groups).
- ISN Region (ISN).
- Socio-demographic index and group (GBD).
- Current health expenditure (CHE) per capita in US\$ (WHO Global Health Observatory)
- Domestic general government health expenditure (GGHE-D) per capita in US\$ (WHO Global Health Observatory)
- Out-of-Pocket expenditure (OOP) per capita in US\$ (WHO Global Health Observatory)
- Medical doctors (per 10 000 population) (WHO Global Health Observatory)
- Researchers in R&D (per million people) (World Bank Open Data)
- Literacy rate, adult total (% of people ages 15 and above) (World Bank Open Data)
- Unemployment, total (% of total labor force) (national estimate) (World Bank Open Data)
- International migrant stock (% of population) (World Bank Open Data)
- CKD prevalence (GBD)
- Prevalence of treated kidney failure (per million population) (ISN-Global Kidney Health Atlas)

- Annual cost of kidney replacement therapy (KRT), average of the annual cost of hemodialysis (HD) and peritoneal dialysis (PD) (ISN-Global Kidney Health Atlas)
- Nephrologists per million population (ISN-Global Kidney Health Atlas)
- Funding for non-dialysis chronic kidney disease (ISN-Global Kidney Health Atlas)
- Funding for KRT (ISN-Global Kidney Health Atlas)
- Capacity for chronic dialysis, centers per million population. The sum of PD and HD centers (ISN-Global Kidney Health Atlas)

*When unavailable for Hong Kong, SAR data was taken from China.

City-level variables:

- Number of RCTs.
- Number of sites.
- Site names.
- Site zip codes.
- Urban study region area (Global Healthy and Sustainable Cities Observatory)
- Urban study region population estimate (Global Healthy and Sustainable Cities Observatory)
- Population per square kilometer (Global Healthy and Sustainable Cities Observatory)
- Intersection count (Global Healthy and Sustainable Cities Observatory)
- Total emission of CO₂ from the transport sector, using non-short-cycle-organic fuels in 2015 (tonnes per annum) (Global Healthy and Sustainable Cities Observatory)

- Total concentration of PM 2.5 for reference epoch 2014 (micrograms per cubic meter) (Global Healthy and Sustainable Cities Observatory)
- Sample point count (Global Healthy and Sustainable Cities Observatory)
- Percentage of population with access to a fresh food market or supermarket (Global Healthy and Sustainable Cities Observatory)
- Percentage of population with access to a convenience store (Global Healthy and Sustainable Cities Observatory)
- Percentage of population with access to any public open space (Global Healthy and Sustainable Cities Observatory)
- Percentage of population with access to public open space larger than 1.5 hectares (Global Healthy and Sustainable Cities Observatory)
- Percentage of population with access to any public transport stop (OSM or GTFS) (Global Healthy and Sustainable Cities Observatory)
- Percentage of population with access to public transport with regular service (30 mins or better) (Global Healthy and Sustainable Cities Observatory)
- Population-weighted walkable neighborhood population density (Global Healthy and Sustainable Cities Observatory)
- Population-weighted daily living score (Global Healthy and Sustainable Cities Observatory)
- Population-weighted walkability index (Global Healthy and Sustainable Cities Observatory)

Calculated indices:

- Sites per square kilometer:
 - Number of sites recruiting people with CKD for RCTs in the city of interest/city area in square kilometers.
- RCTs per 100,000 population:
 - (Number of RCTs that include the city of interest/city's population) *100,000.
- RCTs per site:
 - Number of RCTs that include the city of interest/number of sites recruiting people with CKD for RCTs in the city of interest
- Estimated nephrologists per city:
 - Nephrologists per million population (GKHA)*city population in millions
- Capacity for chronic dialysis per city, estimated centers:
 - Capacity for chronic dialysis, centers per million population (GKHA)*city population in millions.
- Capacity for chronic dialysis, estimated centers per square kilometer:
 - Capacity for chronic dialysis per city, estimated centers/city area in square kilometers.
- RCTs per estimated nephrologist:
 - Number of RCTs that include the city of interest/estimated nephrologists per city.
- RCTs per estimated dialysis center:
 - Number of RCTs that include the city of interest/capacity for chronic dialysis per city, estimated centers.

- CKD stage 5 RCTs per estimated dialysis center:
 - Number of CKD stage 5 RCTs that include the city of interest/capacity for chronic dialysis per city, estimated centers.
- Estimated nephrologists per CKD prevalence:
 - $(\text{Estimated nephrologists per city} / \text{estimated CKD prevalence}) * 100,000$.
- Estimated research sites per CKD prevalence:
 - $(\text{Number of sites recruiting people with CKD for RCTs in the city of interest} / \text{estimated CKD prevalence}) * 100,000$.
- Capacity for chronic dialysis per city per CKD prevalence:
 - $(\text{Capacity for chronic dialysis per city, estimated centers} / \text{estimated CKD prevalence}) * 100,000$.

Table S1. Included randomized controlled trials.

First author last name	Year	Journal	Funding	Global Observatory of Healthy and Sustainable Cities participating cities	Number of sites in the cities of interest
Barratt	2023	Kidney International	Industry	Adelaide, Gent, Olomouc, Barcelona, Belfast.	7
Johnson	2015	American Journal of Kidney Diseases	Mixed	Adelaide, Melbourne, Sydney.	5
deZeeuw	2013	The New England Journal of Medicine	Industry	Adelaide, Melbourne, Ghent, Mexico City, Barcelona, Valencia, Phoenix.	15
Chertow	2012	The New England Journal of Medicine	Industry	Adelaide, Melbourne, Graz, Ghent, Sao Paulo, Odense, Mexico City, Barcelona, Bern.	13
Roger	2004	Journal of the American Society of Nephrology	Industry	Adelaide, Melbourne.	3
Holdstock	2019	Clinical Kidney Journal	Industry	Adelaide, Odense, Barcelona.	4
HeerspinkHJL	2023	The Lancet	Industry	Adelaide, Sao Paulo, Barcelona, Valencia.	4
Fellström	2009	The New England Journal of Medicine	Industry	Adelaide, Sao Paulo.	2
Lai	2012	Nephrology	Industry	Adelaide.	1
Cervelli	2005	Nephrology	Industry	Adelaide.	1
Tochihara	2008	British Journal of Clinical Pharmacology	Academia	Adelaide.	1
Torres	2012	The New England Journal of Medicine	Industry	Baltimore, Adelaide, Ghent, Belfast.	4
Raggi	2011	Nephrology Dialysis Transplantation	Industry	Baltimore, Phoenix, Adelaide, Melbourne.	4
Chertow	2021	The New England Journal of Medicine	Industry	Baltimore, Sao Paulo, Phoenix, Adelaide, Mexico City, Barcelona, Valencia.	19
Rahman	2013	Hypertension	Mixed	Baltimore.	1
Singh	2006	The New England Journal of Medicine	Industry	Baltimore.	1
Ginzler	2005	The New England Journal of Medicine	Mixed	Baltimore.	1
Nowicki	2011	Diabetes, Obesity and Metabolism	Industry	Baltimore.	1
Pergola	2010	Clinical Journal of the American Society of Nephrology	Industry	Baltimore.	1
Pergola	2009	Clinical Journal of the American Society of Nephrology	Industry	Baltimore.	1
Barr	2008	Critical Care Medicine	Industry	Baltimore.	1
Perrone	2021	Kidney International	Academia	Baltimore.	1
Eckardt	2021	The New England Journal of Medicine	Industry	Baltimore.	1
Toto	2021	Journal of the American Society of Nephrology	Industry	Baltimore.	1
Roger	2011	Nephrology Dialysis Transplantation	Industry	Bangkok, Barcelona.	2
Thimachai	2015	Journal of the Medical Association of Thailand	Academia	Bangkok.	1
Satirapoj	2014	Journal of the Medical Association of Thailand	Industry	Bangkok.	1

Niramitmahapanya	2014	Journal of the Medical Association of Thailand	Academia	Bangkok.	1
Satirapoj	2014	Journal of The Medical Association of Thailand	Academia	Bangkok.	1
Wanner	2014	Clinical Nephrology	Industry	Bangkok.	2
Supasyndh	2013	Clinical Journal of the American Society of Nephrology	Mixed	Bangkok.	1
Phakdeekitcharoen	2012	BMC Nephrology	Academia	Bangkok.	1
Krairittichai	2012	Journal of Medical Association of Thailand	Mixed	Bangkok.	1
Eiam-Ong	2007	Journal of Renal Nutrition	N/A	Bangkok.	2
Tungkasereerak	2006	Journal of the Medical Association of Thailand	Academia	Bangkok.	1
Katavetin	2006	Journal of the Medical Association of Thailand	N/A	Bangkok.	1
Tiranathanagul	2004	Nephrology	N/A	Bangkok.	1
Provenzano	2021	Nephrology Dialysis Transplantation	Industry	Bangkok.	1
Aramwit	2012	Journal of Nephrology	Academia	Bangkok.	4
Kiattisunthorn	2011	Nephrology	N/A	Bangkok.	1
Aramwit	2010	International Journal of Clinical Pharmacology and Therapeutics	Government	Bangkok.	1
Disthabanchong	2010	American Journal of Nephrology	Academia	Bangkok.	1
Aramwit	2009	Clinical Nephrology	Mixed	Bangkok.	1
Spinowitz	2008	American Journal of Nephrology	Industry	Bangkok.	1
Kittiskulnam	2020	American Journal of Nephrology	Academia	Bangkok.	1
Kitrungphaiboon	2019	American Journal of Kidney Diseases	Government	Bangkok.	5
Satirapoj	2018	PLoS One	Academia	Bangkok.	1
Saengpanit	2018	Nephron	Academia	Bangkok.	3
Kamanamool	2018	Lupus	Academia	Bangkok.	4
Susantitaphong	2017	BMC Nephrology	Academia	Bangkok.	1
Pichitporn	2022	American Journal of Kidney Diseases	Academia	Bangkok.	2
Trakarnvanich	2021	Journal of Diabetes Research	Academia	Bangkok.	3
Takkavatakarn	2021	Toxins	Academia	Bangkok.	2
Singhsakul	2019	Journal of Diabetes Research	Academia	Bangkok.	1
Carrera	2010	Nephrology Dialysis Transplantation	Industry	Barcelona, Belfast.	3
Fernández-Juárez	2021	Kidney International	Academia	Barcelona, Valencia.	5
Macdougall	2008	Clinical Journal of the American Society of Nephrology	Industry	Barcelona, Valencia.	2
Espinel	2013	BMC Research Notes	Mixed	Barcelona.	1

FernandezJuarez	2013	American Journal of Kidney Diseases	Mixed	Barcelona.	1
Ramos	2005	Nefrologia	N/A	Barcelona.	1
Praga	2003	Nephrology Dialysis Transplantation	Industry	Barcelona.	3
Shutov	2021	Nephrology Dialysis Transplantation	Industry	Barcelona.	2
Rossing	2021	Nephrology Dialysis Transplantation	Industry	Barcelona.	1
Cruzado	2011	Nephrology Dialysis Transplantation	Industry	Barcelona.	1
Messa	2008	Clinical Journal of the American Society of Nephrology	N/A	Barcelona.	1
Levin	2007	The Lancet	Industry	Barcelona.	1
Dember	2007	The New England Journal of Medicine	Industry	Barcelona.	1
Pérez-Maraver	2005	Diabetes Research and Clinical Practice	Academia	Barcelona.	1
Raggi	2020	Circulation	Industry	Barcelona.	1
Kendrick	2018	Clinical Journal of the American Society of Nephrology	Academia	Bern.	1
Kohan	2014	Kidney International	Industry	Chennai, Mexico City, Barcelona.	5
Sanjay	2008	Nephrology	N/A	Chennai.	1
Walz	2010	The New England Journal of Medicine	Industry	Cologne.	1
Groetzner	2009	Transplantation	Industry	Cologne.	1
Wizemann	2008	Current Medical Research and Opinion	Industry	Cologne.	1
Roger	2014	Nephrology	Industry	Ghent, Lisbon, Barcelona.	3
Guz	2006	Nephrology Dialysis Transplantation	Academia	Ghent.	1
Lins	2004	Clinical Nephrology	Industry	Ghent.	1
Rovin	2023	The Lancet	Industry	Ghent.	1
DeVriese	2020	Journal of the American Society of Nephrology	Industry	Ghent.	1
Braun	2004	Clinical Nephrology	Academia	Graz.	1
Ketteler	2021	Kidney International Reports	Industry	Graz.	1
Bielesz	2021	Clinical Journal of the American Society of Nephrology	Academia	Graz.	1
Besarab	2016	Journal of the American Society Nephrology	Industry	Hong Kong, Bangkok.	2
Barnett	2014	The Lancet Diabetes & Endocrinology	Industry	Hong Kong, Chennai, Lisbon, Barcelona, Valencia.	12
Coyne	2021	Kidney International Reports	Industry	Hong Kong, Melbourne, Bangkok.	3
Wang	2023	Nephrology Dialysis Transplantation	Academia	Hong Kong.	2
Mok	2014	Annals of the Rheumatic Diseases	Academia	Hong Kong.	4
Wang	2014	Journal of the American Society of Nephrology	Industry	Hong Kong.	1

Szeto	2013	PLoS One	Mixed	Hong Kong.	1
Li	2013	American Journal of Medicine	Academia	Hong Kong.	1
McGill	2013	Diabetes Care	Industry	Hong Kong.	1
Yap	2012	Nephrology	Mixed	Hong Kong.	1
Imai	2011	Diabetologia	Academia	Hong Kong.	1
Li	2006	American Journal of Kidney Diseases	Industry	Hong Kong.	2
Siu	2006	American Journal of Kidney Diseases	Academia	Hong Kong.	1
Wong	2005	American Journal of Kidney Diseases	Industry	Hong Kong.	1
Tang	2005	Kidney International	Mixed	Hong Kong.	2
Szeto	2003	Journal of the American Society of Nephrology	Academia	Hong Kong.	1
Wang	2022	Kidney Medicine	Mixed	Hong Kong.	2
Szeto	2021	Clinical Kidney Journal	Academia	Hong Kong.	1
Li	2009	Rheumatology	Industry	Hong Kong.	1
Chan	2007	Nephrology	Mixed	Hong Kong.	2
Feldt-Rasmussen	2007	Journal of the American Society of Nephrology	Industry	Hong Kong.	1
TangSCW	2021	Nephrology Dialysis Transplantation	Mixed	Hong Kong.	2
MaMKM	2020	QJM: An International Journal of Medicine	Academia	Hong Kong.	2
Nakamoto	2020	Therapeutic Apheresis and Dialysis	Industry	Hong Kong , Bangkok.	2
Lv	2022	JAMA	Mixed	Hong Kong , Sydney.	3
Furie	2020	The New England Journal of Medicine	Industry	Hong Kong.	1
Ketteler	2012	Nephrology Dialysis Transplantation	Industry	Lisbon, Barcelona,	2
Galle	2008	Nephrology Dialysis Transplantation	Industry	Lisbon, Barcelona, Valencia.	6
Barratt	2021	Nephrology Dialysis Transplantation	Industry	Lisbon.	1
deFrancisco	2010	Nephrology Dialysis Transplantation	Industry	Lisbon.	1
Ferreira	2008	Journal of the American Society of Nephrology	Industry	Lisbon.	2
Roberts	2016	American Journal of Kidney Diseases	Mixed	Melbourne, Auckland, Sydney.	8
Bakris	2015	JAMA	Industry	Melbourne, Graz, Hong Kong, Lisbon, Barcelona.	7
Packham	2012	Journal of the American Society of Nephrology	Industry	Melbourne, Hong Kong.	6
Ruilope	2014	BMC Nephrology	Industry	Melbourne, Sao Paulo, Hong Kong.	6
McMahon	2010	Nephrology Dialysis Transplantation	Industry	Melbourne, Sydney.	3
Rosenstock	2019	JAMA	Industry	Melbourne, Sydney, Seattle.	3

Roger	2014	International Urology and Nephrology	Industry	Melbourne.	1
Barracough	2012	Nephrology Dialysis Transplantation	Industry	Melbourne.	1
Lewis	2012	Journal of the American Society of Nephrology	Industry	Melbourne.	1
Zoungas	2006	Journal of the American College of Cardiology	Academia	Melbourne.	3
Leikis	2004	Nephrology	Industry	Melbourne.	1
Polkinghorne	2003	Internal Medicine Journal	Academia	Melbourne.	1
Smith	2020	Kidney International Reports	Industry	Melbourne.	1
Lewis	2011	American Journal of Kidney Diseases	Industry	Melbourne.	1
Vogt	2010	Hypertension	Industry	Melbourne.	1
Fassett	2010	Scandinavian Journal of Urology and Nephrology	Academia	Melbourne.	2
Pfeffer	2009	The New England Journal of Medicine	Industry	Melbourne.	1
Kincaid-Smith	2008	Nephrology	N/A	Melbourne.	1
Chrysostomou	2006	Clinical Journal of the American Society of Nephrology	Industry	Melbourne.	1
Roberts	2016	BMC Nephrology	Industry	Melbourne.	2
Rovin	2016	Arthritis & Rheumatology	Industry	Mexico City, Bangkok.	3
Bakris	2007	Kidney International	Industry	Mexico City, Barcelona, Belfast.	3
Provenzano	2007	Clinical Nephrology	Industry	Mexico City, Belfast.	2
Singh	2021	The New England Journal of Medicine	Industry	Mexico City, Sydney, Sao Paulo, Adelaide, Auckland , Chennai, Graz, Odense , Barcelona, Valencia.	13
Singh	2021	The New England Journal of Medicine	Industry	Mexico City, Sydney.	2
HeerspinkHJL	2019	The Lancet	Industry	Mexico City, Sydney.	2
Rovin	2021	The Lancet	Industry	Mexico City, Valencia, Bangkok, Phoenix.	5
Solis-Jimenez	2022	BMC Nephrology	Academia	Mexico City.	1
Rubio-Guerra	2004	Diabetes Care	Industry	Mexico City.	1
Furie	2022	Annals of the Rheumatic Diseases	Industry	Mexico City.	1
HeerspinkHJL	2020	The New England Journal of Medicine	Industry	Mexico City.	1
Ramirez-Sandoval	2019	Journal of Nephrology	Academia	Mexico City.	1
Rovin	2019	Kidney International	Industry	Mexico City , Barcelona, Hong Kong, Bangkok.	5
Meadowcroft	2019	Clinical Kidney Journal	Industry	Odense, Barcelona.	2
Aarup	2006	Nephrology Dialysis Transplantation	Industry	Odense.	1
Bressendorff	2023	Journal of the American Society of Nephrology	Mixed	Odense.	1
Levy-Schousboe	2023	Nephrology Dialysis Transplantation	Mixed	Odense.	1

Bressendorff	2017	Kidney International Reports	Academia	Odense.	1
Hansen	2011	Kidney International	Mixed	Odense.	1
Steffensen	2011	Scandinavian Journal of Urology and Nephrology	Industry	Odense.	1
Svensson	2006	Clinical Journal of the American Society of Nephrology	Mixed	Odense.	1
Ritz	2007	American Journal of Kidney Diseases	Industry	Olomouc, Bangkok, Barcelona, Valencia, Belfast.	5
Drüeke	2006	The New England Journal of Medicine	Industry	Olomouc, Hong Kong, Belfast, Lisbon, Barcelona, Valencia, Bangkok, Belfast.	8
Thadhani	2012	JAMA	Industry	Phoenix, Adelaide, Melbourne, Barcelona.	7
Fried	2013	The New England Journal of Medicine	Industry	Phoenix, Baltimore.	4
Macdougall	2013	The New England Journal of Medicine	Industry	Phoenix, Barcelona.	4
Fishbane	2013	The New England Journal of Medicine	Industry	Phoenix, Barcelona.	4
deZeeuw	2010	The Lancet	Industry	Phoenix, Lisbon.	2
deZeeuw	2015	The Lancet Diabetes & Endocrinology	Industry	Phoenix, Sao Paulo, Mexico City.	3
CherneyDZI	2023	Diabetes, Obesity and Metabolism	Industry	Phoenix, Seattle, Sao Paulo, Barcelona, Valencia.	6
Kothny	2015	Diabetologia	Industry	Phoenix.	1
Sprague	2009	Clinical Nephrology	Industry	Phoenix.	1
Singh	2008	American Journal of Kidney Diseases	Industry	Phoenix.	1
Thadhani	2017	American Journal of Nephrology	Industry	Phoenix.	1
Klinger	2007	American Journal of Kidney Diseases	Industry	Sao Paulo, Bangkok.	3
Coyne	2022	Clinical Journal of the American Society of Nephrology	Industry	Sao Paulo, Barcelona.	2
Marre	2004	Journal of Hypertension	Industry	Sao Paulo, Mexico City.	2
Mogensen	2003	Hypertension	Industry	Sao Paulo, Mexico City, Bern.	3
Meireles	2016	Clinical Nutrition	Mixed	Sao Paulo.	1
Feniman-De-Stefano	2015	Therapeutic Advances in Cardiovascular Disease	Mixed	Sao Paulo.	1
Antunes	2014	International Journal of Artificial Organs	Academia	Sao Paulo.	1
Tzanno-Martins	2014	International Journal of Immunopathology and Pharmacology	Academia	Sao Paulo.	1
Titan	2011	Clinical Nephrology	Government	Sao Paulo.	1
Peck-Radosavljevic	2011	Clinical Gastroenterology and Hepatology	Industry	Sao Paulo.	1
Oliveira	2010	Clinical Journal of the American Society of Nephrology	Industry	Sao Paulo.	1

GueirosAPS	2019	Jornal Brasileiro de Nefrologia	Government	Sao Paulo.	1
Betônico	2019	Clinical Therapeutics	Academia	Sao Paulo.	1
Gobo-Oliveira	2018	European Journal of Dermatology	Industry	Sao Paulo.	1
Vincenti	2017	Kidney International Reports	Industry	Seattle, Barcelona.	2
Bakris	2008	Kidney International	Industry	Seattle, Mexico City, Bangkok.	6
Furie	2014	Arthritis & Rheumatology	Industry	Seattle, Sao Paulo, Hong Kong, Mexico City, Melbourne.	7
Hung	2015	Nephrology Dialysis Transplantation	Academia	Seattle.	1
deBoer	2012	Kidney International	Industry	Seattle.	1
Block	2012	Journal of the American Society of Nephrology	Industry	Seattle.	1
Brockenbrough	2006	American Journal of Kidney Diseases	Mixed	Seattle.	1
Dember	2022	Kidney International	Mixed	Seattle.	1
Jamison	2007	JAMA	Mixed	Seattle.	1
Hanrahan	2020	Clinical Journal of the American Society of Nephrology	Industry	Seattle.	1
Fervenza	2019	The New England Journal of Medicine	Mixed	Seattle.	1
Charytan	2019	Kidney International	Mixed	Seattle.	1
Quarles	2003	Journal of the American Society of Nephrology	Industry	Seattle.	1
Mehrotra	2019	Annals of Internal Medicine	Academia	Seattle.	3
Tuttle	2018	Nephrology Dialysis Transplantation	Industry	Seattle.	1
Baigent	2011	The Lancet	Industry	Sydney, Bangkok.	3
Toussaint	2020	Journal of the American Society of Nephrology	Mixed	Sydney, Melbourne, Adelaide, Hong Kong.	11
Badve	2020	The New England Journal of Medicine	Government	Sydney, Melbourne, Adelaide, Auckland.	7
Groop	2017	Diabetes, Obesity and Metabolism	Academia	Sydney, Melbourne.	2
Irish	2017	JAMA Internal Medicine	Mixed	Sydney, Melbourne, Auckland.	7
Singh	2022	JAMA Internal Medicine	Industry	Sydney, Mexico City.	2
Johansen	2023	Kidney International	Industry	Sydney, Sao Paulo.	7
Yale	2013	Diabetes, Obesity and Metabolism	Industry	Sydney, Sao Paulo.	2
Hewitt	2013	Clinical Journal of the American Society of Nephrology	Industry	Sydney.	1
Fishbane	2022	Journal of the American Society of Nephrology	Industry	Sydney.	1
deZeeuw	2018	The Lancet Diabetes & Endocrinology	Industry	Sydney.	1
Kumar	2017	Journal of the American Society of Nephrology	Government	Sydney.	2
CherneyDZI	2020	The Lancet Diabetes & Endocrinology	Industry	Sydney.	2

Pollock	2019	Lancet Diabetes & Endocrinology	Industry	Sydney.	1
Perkovic	2019	The New England Journal of Medicine	Industry	Sydney.	3
Provenzano	2022	Journal of the American Society of Nephrology	Industry	Valencia.	1
Allegretti	2019	American Journal of Kidney Diseases	Industry	Valencia.	1

Table S2. Country, region, income, and socio-demographic index categorization of the cities included in the Global Observatory of Healthy and Sustainable Cities Open Data.

City	Country	ISN Region*	Income-group**	SDI Group***
Adelaide	Australia	Oceania and South East Asia	High income	High SDI
Auckland	New Zealand	Oceania and South East Asia	High income	High SDI
Baltimore	United States	North America and the Caribbean	High income	High SDI
Bangkok	Thailand	Oceania and South East Asia	Upper-middle income	Middle SDI
Barcelona	Spain	Western Europe	High income	High-middle SDI
Belfast	United Kingdom	Western Europe	High income	High SDI
Bern	Switzerland	Western Europe	High income	High SDI
Chennai	India	South Asia	Lower-middle income	Low-middle SDI
Cologne	Germany	Western Europe	High income	High SDI
Ghent	Belgium	Western Europe	High income	High SDI
Graz	Austria	Western Europe	High income	High SDI
Hong Kong	China (SAR)	North and East Asia	High income	Middle SDI
Lisbon	Portugal	Western Europe	High income	High-middle SDI
Melbourne	Australia	Oceania and South East Asia	High income	High SDI
Mexico City	Mexico	Latin America	Upper-middle income	Middle SDI
Odense	Denmark	Western Europe	High income	High SDI
Olomouc	Czech Republic	Eastern and Central Europe	High income	High SDI
Phoenix	United States	North America and the Caribbean	High income	High SDI
Sao Paulo	Brazil	Latin America	Upper-middle income	Middle SDI
Seattle	United States	North America and the Caribbean	High income	High SDI
Sydney	Australia	Oceania and South East Asia	High income	High SDI
Valencia	Spain	Western Europe	High income	High-middle SDI
Hanoi	Vietnam	Oceania and South East Asia	Lower-middle income	Middle SDI
Maiduguri	Nigeria	Africa	Lower-middle income	Low-middle SDI
Vic	Spain	Western Europe	High income	High-middle SDI

* ISN regions from Bello AK, Okpechi IG, Levin A, et al. ISN–Global Kidney Health Atlas: A report by the International Society of Nephrology: An Assessment of Global Kidney Health Care Status focusing on Capacity, Availability, Accessibility, Affordability and Outcomes of Kidney Disease. Brussels. Belgium: International Society of Nephrology, 2023.

** Income groups from The World Bank. World Bank Country and Lending Groups – World Bank Data Help Desk. Accessed February 2, 2024.

<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519>.

*** SDI groups from Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Socio-Demographic Index (SDI) 1950–2019. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2020. ISN, International Society of Nephrology; SDI, socio-demographic index.

Table S3. Characteristics of the chronic kidney disease randomized controlled trials conducted in the cities included in the Global Healthy and Sustainable City Indicator Study Collaboration.

City	RCT count, n	Sites, n	Primary care sites, n(%)	Secondary care sites, n(%)	Tertiary care sites, n(%)	Industry-funded RCTs, n (%)	Government-funded RCTs, n(%)	Academia-funded RCTs, n(%)	RCTs with mixed funding, n(%)	Local RCTs, n(%)	National RCTs, n(%)	Regional RCTs, n(%)	Global RCTs, n(%)	CKD Stage 5 RCTs, n(%)
Adelaide	18	4	0 (0)	0 (0)	4 (100)	14 (78)	2 (11)	1 (6)	1 (6)	3 (17)	1 (6)	3 (17)	11 (61)	6 (33)
Auckland	4	4	0 (0)	2 (50)	2 (50)	1 (25)	1 (25)	0 (0)	2 (50)	0 (0)	0 (0)	2 (50)	2 (50)	2 (50)
Baltimore	14	4	0 (0)	1 (25)	3 (75)	11 (79)	0 (0)	1 (7)	2 (14)	1 (7)	8 (57)	0 (0)	5 (36)	2 (14)
Bangkok	41	24	2 (8)	10 (42)	12 (50)	16 (39)	2 (5)	16 (39)	3 (7)	21 (51)	5 (12)	1 (2)	14 (34)	19 (46)
Barcelona	40	13	2 (15)	3 (15)	9 (70)	34 (85)	0 (0)	2 (5)	2 (5)	2 (5)	4 (10)	2 (5)	32 (80)	10 (25)
Belfast	8	2	0 (0)	1 (50)	1 (50)	8 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	8 (100)	1 (13)
Bern	3	2	0 (0)	0 (0)	2 (100)	2 (67)	0 (0)	1 (33)	0 (0)	1 (33)	0 (0)	0 (0)	2 (67)	1 (33)
Chennai	4	4	0 (0)	0 (0)	3 (75)	3 (75)	0 (0)	0 (0)	0 (0)	1 (25)	0 (0)	0 (0)	3 (75)	0 (0)
Cologne	3	3	1 (33.3)	1 (33.3)	1 (33.3)	3 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1 (33)	2 (67)	0 (0)	1 (33)
Ghent	9	1	0 (0)	0 (0)	1 (100)	8 (89)	0 (0)	1 (11)	0 (0)	1 (11)	2 (22)	0 (0)	6 (67)	4 (44)
Graz	6	1	0 (0)	0 (0)	1 (100)	4 (67)	0 (0)	2 (33)	0 (0)	0 (0)	1 (17)	2 (33)	3 (50)	4 (67)
Hong Kong	33	11	0 (0)	3 (27)	3 (27)	17 (52)	0 (0)	8 (24)	8 (24)	11 (33)	6 (18)	3 (9)	13 (39)	7 (21)
Lisbon	10	10	2 (20)	1 (10)	5 (50)	10 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1 (10)	1 (10)	8 (80)	3 (30)
Melbourne	32	10	0 (0)	4 (40)	6 (60)	22 (69)	4 (13)	4 (13)	1 (3)	5 (16)	5 (16)	5 (16)	17 (53)	10 (31)
Mexico City	23	15	0 (0)	6 (40)	9 (60)	21 (91)	0 (0)	2 (9)	0 (0)	3 (13)	0 (0)	0 (0)	20 (87)	4 (17)
Odense	11	1	0 (0)	0 (0)	1 (100)	6 (55)	0 (0)	1 (9)	4 (36)	2 (18)	4 (36)	1 (9)	4 (36)	7 (64)
Olomouc	3	1	0 (0)	0 (0)	1 (100)	1 (33)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (100)	0 (0)
Phoenix	15	8	0 (0)	2 (25)	6 (75)	15 (100)	0 (0)	0 (0)	0 (0)	0 (0)	3 (20)	0 (0)	12 (80)	4 (27)
Sao Paulo	25	28	1 (3)	2 (7)	5 (18)	18 (72)	2 (8)	3 (12)	2 (8)	8 (32)	1 (4)	0 (0)	16 (64)	11 (44)
Seattle	17	7	0 (0)	1 (14)	6 (86)	10 (59)	0 (0)	2 (12)	5 (29)	4 (24)	6 (35)	1 (6)	6 (35)	6 (35)
Sydney	23	15	0 (0)	4 (27)	10 (67)	15 (65)	2 (9)	1 (4)	5 (22)	2 (9)	2 (9)	4 (17)	15 (65)	6 (26)
Valencia	14	8	0 (0)	1 (13)	6 (75)	13 (93)	0 (0)	1 (7)	0 (0)	0 (0)	0 (0)	2 (14)	12 (86)	0 (0)
Hanoi	0	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Maiduguri	0	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Vic	0	0	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

CKD, chronic kidney disease; RCT, randomized controlled trial.

Table S4. Novel city-level indicators for chronic kidney disease care and research access.

City	Estimated CKD prevalence (95% CI)*	Estimated nephrologists (total per city) †	Estimated nephrologists per 100,000 people with CKD (95% CI) *†	RCT sites per square kilometer \$	Estimated RCT sites per 100,000 people with CKD (95% CI)*	Estimated dialysis centers †	Dialysis centers per square kilometer †\$	Estimated dialysis centers per 100,000 people with CKD †*
Adelaide	106746 (100240-113448)	22.78	21.34 (20.08-22.72)	0.007	3.75 (3.53-3.99)	5.80	0.011	5.44 (5.12-5.79)
Auckland	136789 (126912-146542)	15.88	11.61 (10.83-12.51)	0.009	2.92 (2.73-3.15)	7.80	0.017	5.72 (5.34-6.17)
Baltimore	178759 (167017-190363)	40.95	22.91 (21.51-24.52)	0.005	2.24 (2.1-2.39)	59.40	0.080	33.21 (31.19-35.55)
Bangkok	1556491 (1448181-1666668)	120.64	7.75 (7.24-8.33)	0.020	1.54 (1.44-1.66)	151.00	0.127	9.7 (9.06-10.43)
Barcelona	336709 (311937-361807)	172.79	51.32 (47.76-55.39)	0.036	3.86 (3.59-4.17)	19.40	0.054	5.75 (5.35-6.21)
Belfast	36346 (33782-38951)	4.86	13.37 (12.48-14.39)	0.020	5.5 (5.13-5.92)	0.80	0.008	2.21 (2.06-2.37)
Bern	18096 (16814-19298)	6.51	35.95 (33.71-38.69)	0.062	11.05 (10.36-11.89)	2.80	0.086	15.41 (14.45-16.59)
Chennai	560575 (518317-604153)	11.88	2.12 (1.97-2.29)	0.009	0.71 (0.66-0.77)	3.30	0.008	0.59 (0.55-0.64)
Cologne	137233 (129404-144950)	30.21	22.01 (20.84-23.34)	0.009	2.19 (2.07-2.32)	12.70	0.037	9.28 (8.79-9.84)
Ghent	19185 (17929-20406)	3.68	19.18 (18.03-20.53)	0.013	5.21 (4.9-5.58)	1.50	0.020	7.67 (7.21-8.21)
Graz	32755 (30377-35048)	9.53	29.09 (27.19-31.37)	0.015	3.05 (2.85-3.29)	1.90	0.028	5.82 (5.44-6.27)
Hong Kong	808744 (745011-873941)	167.1	20.66 (19.12-22.43)	0.030	1.36 (1.26-1.48)	48.30	0.130	5.97 (5.52-6.48)
Lisbon	67552 (62010-73210)	19.93	29.51 (27.23-32.14)	0.118	14.8 (13.66-16.13)	8.70	0.102	12.82 (11.82-13.96)
Melbourne	405201 (380507-430643)	86.47	21.34 (20.08-22.72)	0.006	2.47 (2.32-2.63)	22.00	0.013	5.44 (5.12-5.79)
Mexico City	2791899 (2618037-2961717)	211.26	7.57 (7.13-8.07)	0.006	0.54 (0.51-0.57)	62.70	0.027	2.24 (2.12-2.39)
Odense	16691 (15482-17853)	3.98	23.83 (22.28-25.69)	0.018	5.99 (5.6-6.46)	0.80	0.015	5.08 (4.75-5.48)
Olomouc	11278 (10495-12097)	1.89	16.77 (15.63-18.02)	0.037	8.87 (8.27-9.53)	1.30	0.047	11.3 (10.54-12.15)
Phoenix	170810 (159590-181898)	39.13	22.91 (21.51-24.52)	0.010	4.68 (4.4-5.01)	56.70	0.073	33.21 (31.19-35.55)
Sao Paulo	978456 (915178-1037046)	215.73	22.05 (20.8-23.57)	0.028	2.86 (2.7-3.06)	49.70	0.049	5.08 (4.79-5.43)
Seattle	284593 (265899-303067)	65.19	22.91 (21.51-24.52)	0.004	2.46 (2.31-2.63)	94.50	0.050	33.21 (31.19-35.55)
Sydney	442105 (415163-469865)	94.34	21.34 (20.08-22.72)	0.011	3.39 (3.19-3.61)	24.00	0.018	5.44 (5.12-5.79)
Valencia	70528 (65339-75785)	36.19	51.32 (47.76-55.39)	0.093	11.34 (10.56-12.24)	4.10	0.047	5.75 (5.35-6.21)
Hanoi	637829 (587349-688309)	18.35	2.88 (2.67-3.12)	N/A	N/A	7.40	0.006	1.16 (1.08-1.26)
Maiduguri	42605 (39437-45774)	1.69	3.97 (3.7-4.29)	N/A	N/A	0.90	0.007	2.1 (1.96-2.27)
Vic	4526 (4193-4863)	2.32	51.32 (47.76-55.39)	N/A	N/A	0.30	0.009	5.75 (5.35-6.21)

* Estimated CKD prevalence from GBD Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis for the global burden of disease study 2017. *The Lancet*. 2020;395:709-733.

† Estimated nephrologists and dialysis centers from Bello AK, Okpechi IG, Levin A, et al. ISN–Global Kidney Health Atlas: A report by the International Society of Nephrology: An Assessment of Global Kidney Health Care Status focusing on Capacity, Availability, Accessibility, Affordability and Outcomes of Kidney Disease. Brussels. Belgium: International Society of Nephrology, 2023.

\$ Area was obtained from Higgs C, Liu S, Boeing G, et al. Global Healthy and Sustainable City Indicator study collaboration - 25 Cities Spatial Indicators Datasets. July 25, 2023. Accessed February 2, 2024.
https://rmit.figshare.com/articles/dataset/Global_Healthy_and_Sustainable_City_Indicator_Study_Collaboration_-_25_Cities_spatial_indicators_datasets/15072009.
CKD, chronic kidney disease; RCT, randomized controlled trial; CI, confidence interval; N/A, not available.

Table S5. Income, geographic, and socio-demographic differences in chronic kidney disease research capacity in the cities included in the Global Healthy and Sustainable City Indicator Study Collaboration.

		RCT count	Sites	Estimated nephrologists per 100,000 people with CKD*†	Estimated dialysis centers per 100,000 people with CKD*†	RCTs per 100,000 people with CKD*	Sites per 100,000 people with CKD*	RCTs per site	RCT sites per square kilometer\$	RCTs per estimated nephrologist †	CKD stage 5 RCTs per estimated dialysis center †	Dialysis centers per square kilometer †\$
Income-group**												
	High income	13 (3-40)	4 (1-15)	22.91 (11.61-51.32)	5.82 (2.21-33.21)	13.34 (2.19-65.90)	3.80 (1.36-14.80)	3 (1.0-11.0)	0.01 (0.00-0.12)	0.38 (0.10-2.77)	0.30 (0.00-8.26)	0.04 (0.01-0.13)
	Upper-middle income	25 (23-41)	24 (15-28)	7.75 (7.57-22.05)	5.08 (2.24-9.70)	2.56 (0.82-2.63)	1.54 (0.54-2.86)	1.5 (0.9-1.7)	0.02 (0.01-0.03)	0.12 (0.11-0.34)	0.13 (0.06-0.22)	0.05 (0.03-0.13)
	Lower-middle income	4 (4-4)	4 (4-4)	2.88 (2.12-3.97)	1.16 (0.59-2.10)	0.71 (0.71-0.71)	0.71 (0.71-0.71)	1 (1-1)	0.009 (0.009-0.009)	0.34 (0.34-0.34)	0 (0-0)	0.01 (0.01-0.01)
ISN Region†												
	Africa	0 (0-0)	0 (0-0)	3.97 (3.97-3.97)	2.1 (2.1-2.1)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01 (0.01-0.01)
	Eastern and Central Europe	3 (3-3)	1 (1-1)	16.77 (16.77-16.77)	11.3 (11.3-11.3)	26.6 (26.6-26.6)	8.87 (8.87-8.87)	3 (3-3)	0.03 (0.03-0.03)	1.59 (1.59-1.59)	0 (0-0)	0.04 (0.04-0.04)
	Latin America	24 (23-25)	21.5 (15-28)	14.81 (7.57-22.05)	3.66 (2.24-5.08)	1.69 (0.82-2.56)	1.7 (0.54-2.86)	1.21 (0.89-1.53)	0.01 (0.006-0.02)	0.11 (0.11-0.12)	0.14 (0.06-0.22)	0.03 (0.02-0.04)
	North America and the Caribbean	15 (14-17)	7 (4-8)	22.91 (22.91-22.91)	33.21 (33.21-33.21)	7.83 (5.97-8.78)	2.46 (2.24-4.68)	2.43 (1.88-3.50)	0.54 (0.37-1.03)	0.34 (0.26-0.38)	0.06 (0.03-0.07)	0.07 (0.05-0.08)
	North and East Asia	33 (33-33)	11 (11-11)	20.66 (20.66-20.66)	5.97 (5.97-5.97)	4.08 (4.08-4.08)	1.36 (1.36-1.36)	3.00 (3.00-3.00)	0.02 (0.02-0.02)	0.20 (0.20-0.20)	0.15 (0.15-0.15)	0.13 (0.13-0.13)
	Oceania and South East Asia	23 (4-41)	10 (4-24)	16.47 (2.88-21.34)	5.44 (1.16-9.7)	5.2 (2.63-16.86)	2.92 (1.54-3.75)	1.71 (1.00-4.50)	0.008 (0.006-0.02)	0.34 (0.24-0.79)	0.26 (0.13-1.03)	0.015 (0.006-0.127)
	South Asia	4 (4-4)	4 (4-4)	2.12 (2.12-2.12)	0.59 (0.59-0.59)	0.71 (0.71-0.71)	0.71 (0.71-0.71)	1.00 (1.00-1.00)	0.009 (0.009-0.009)	0.34 (0.34-0.34)	0.00 (0.00-0.00)	0.008 (0.008-0.008)
	Western Europe	9 (3-40)	2 (1-13)	29.3 (13.37-51.32)	5.78 (2.21-15.41)	18.2 (2.19-65.9)	5.5 (2.19-14.8)	3.08 (1-11)	2.03 (0.86-11.77)	0.50 (0.10-2.77)	0.52 (0.00-8.26)	0.03 (0.008-0.10)
SDI Group***												
	High SDI	10(3-32)	3.5(1-15)	21.67(11.61-35.95)	6.74(2.21-33.21)	12.68(2.19-65.90)	3.57(2.19-11.05)	3.10(1-11)	0.01(0.00-0.06)	0.42(0.10-2.77)	0.31(0.00-8.26)	1.08(0.37-6.19)
	High-Middle SDI	14(10-40)	10(8-13)	51.32(29.51-51.32)	5.75(5.75-12.82)	14.80(11.88-19.85)	11.34(3.86-14.80)	1.75(1-3.08)	0.09(0.03-0.11)	0.39(0.23-0.50)	0.35(0.00-0.52)	9.30(3.71-11.77)
	Middle SDI	29(23-41)	19.5(11-28)	7.75(2.88-22.05)	5.08(1.16-9.7)	2.59(0.82-4.08)	1.45(0.54-2.86)	1.62(0.89-3)	0.02(0.00-0.02)	0.16(0.11-0.34)	0.14(0.06-0.22)	2.38(0.64-2.95)
	Low-middle SDI	4(4-4)	4(4-4)	3.04(2.12-3.97)	1.34(0.59-2.1)	0.71(0.71-0.71)	0.71(0.71-0.71)	1(1-1)	0 (0-0)	0.34(0.34-0.34)	0(0-0)	0.94(0.94-0.94)
Research capacity scale category												
	Excellent	33(33-33)	11(11-11)	20.66(20.66-20.66)	5.97(5.97-5.97)	4.08(4.08-4.08)	1.36(1.36-1.36)	3(3-3)	2.95(2.95-2.95)	0.20(0.20-0.20)	0.15(0.15-0.15)	0.13(0.13-0.13)
	Good	10(3-41)	2(1-24)	22.58(7.75-51.32)	5.78(2.21-15.41)	19.08(2.63-65.90)	5.35(1.54-11.34)	3.14(1.50-11)	2.02(0.60-9.3)	0.54(0.23-2.77)	0.48(0.00-8.26)	0.04(0.00-0.12)
	Fair/average	14.33(3-25)	7(3-28)	22.05(11.61-29.51)	9.28(5.08-33.21)	5.97(2.19-16.86)	2.92(2.19-14.80)	1.53(0.89-4.50)	0.86(0.37-11.77)	0.26(0.10-0.79)	0.22(0.03-1.03)	0.04(0.01-0.10)
	Insufficient	13.5 (4-23)	9.5(4-15)	4.84(2.12-7.57)	1.41(0.59-2.24)	0.76(0.71-0.82)	0.62(0.54-0.71)	1.26(1-1.53)	0.79(0.64-0.94)	0.22(0.11-0.34)	0.03(0.00-0.06)	0.01(0.00-0.02)
	Absent	0 (0-0)	0 (0-0)	3.97(2.88-51.32)	2.1(1.16-5.75)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0 (0-0)	0.01(0.01-0.01)

Data is presented as median (range).

* Estimated CKD prevalence from GBD Chronic Kidney Disease Collaboration. Global, regional, and national burden of chronic kidney disease, 1990–2017: A systematic analysis for the global burden of disease study 2017. *The Lancet*. 2020;395:709-733.

† ISN regions, estimated nephrologists and dialysis centers from Bello AK, Okpechi IG, Levin A, et al. ISN–Global Kidney Health Atlas: A report by the International Society of Nephrology: An Assessment of Global Kidney Health Care Status focusing on Capacity, Availability, Accessibility, Affordability and Outcomes of Kidney Disease. Brussels. Belgium: International Society of Nephrology, 2023.

\$ Area was obtained from Higgs C, Liu S, Boeing G, et al. Global Healthy and Sustainable City Indicator study collaboration - 25 Cities Spatial Indicators Datasets. July 25, 2023. Accessed February 2, 2024.

https://rmit.figshare.com/articles/dataset/Global_Healthy_and_Sustainable_City_Indicator_Study_Collaboration_-_25_Cities_spatial_indicators_datasets/15072009.

** Income groups from The World Bank. World Bank Country and Lending Groups – World Bank Data Help Desk. Accessed February 2, 2024.

<https://datahelpdesk.worldbank.org/knowledgebase/articles/906519>.

*** SDI groups from Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Socio-Demographic Index (SDI) 1950–2019. Seattle, United States of America: Institute for Health Metrics and Evaluation (IHME), 2020.

ISN, International Society of Nephrology; SDI, socio-demographic index; RCT, randomized controlled trial; CKD, chronic kidney disease.

Figure S1. Chronic kidney disease research capacity scale categories and financial and socio-demographic indicators. The graph depicts differences in six financial and socio-demographic indicators between groups based on research capacity scale categories. CKD, chronic kidney disease; USD, United States dollars; GGHE-D, domestic general government health expenditure; OOP, out-of-pocket expenditure; SDI, socio-demographic index.

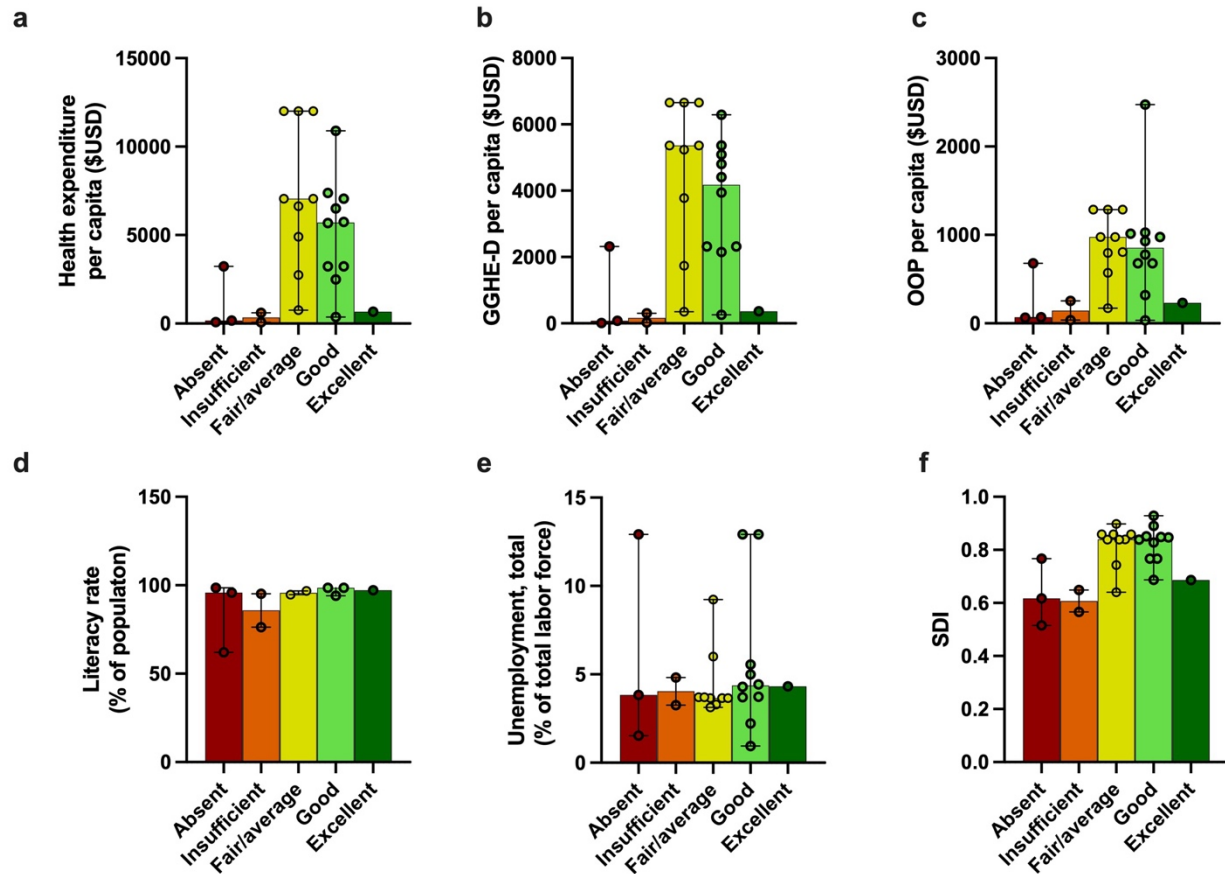


Figure S2. Chronic kidney disease research capacity scale categories and novel nephrology-related indicators. The graph depicts differences in six novel kidney care and research capacity indicators between groups based on research capacity scale categories. CKD, chronic kidney disease; RCTs, randomized controlled trials.

