

Supplementary information

COVID-19 and kidney disease: insights from epidemiology to inform clinical practice

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Supplementary Table 1 | Barriers to healthcare and potential study biases

Population	Barriers to accessing healthcare pre-pandemic	Barriers to COVID-19 testing	Barriers to accessing healthcare during the COVID-19 pandemic	Biases	Potential design solutions
Dialysis	<p>Out-of-pocket costs to access care.</p> <p>May vary between in-centre haemodialysis patients and home therapy patients.</p>	<p>Universal testing limited by resources, government policy.</p> <p>Variable testing approaches in different phases of the pandemic.</p> <p>Less access to testing for home therapy patients compared to in-centre haemodialysis patients.</p>	<p>AKI burden during the pandemic and shortages of dialysis resources/personnel.</p> <p>Reduction in frequency of dialysis sessions to reduce exposure.</p> <p>Lack of dedicated transport for infected/exposed patients and those with suspected infection (leading to hospitalization for “social reasons”).</p> <p>Pressure to shift to home-based modalities.</p>	<p>Selection bias:</p> <p>Where testing rates low, incidence falsely low; more severe cases likely to be tested so outcomes such as critical care admission and death have falsely high rates.</p>	<p>Investigating dialysis populations which use surveillance testing for infection control purposes (both denominator and SARS-CoV-2 infections systematically assessed in all patients).</p>
Kidney transplant	<p>May vary based on clinical</p>	<p>Reduction in follow-up visits</p>	<p>Reduction in follow-up visits to reduce</p>	<p>Selection bias:</p>	<p>Large prospective cohorts with regular testing to be able to</p>

	<p>characteristics (e.g. more recent recipients or individuals with advanced graft impairment or infectious complications may be seen more frequently than chronic recipients).</p>	<p>to reduce exposure so less likely to be tested, especially early in pandemic and especially when not requiring hospital admission.</p>	<p>exposure; more likely to present late (or not at all) with COVID-19 and non-COVID-19 complications.</p> <p>Well-established relationships with healthcare providers may have meant increased access compared to other groups.</p> <p>Some transplant programmes suspended to minimize exposure of donors and recipients to healthcare settings and to minimize exposure of recipients to immunosuppression.</p>	<p>Incomplete capture of SARS-CoV-2 infection resulting in underestimation of incidence and overestimation of mortality.</p> <p>Biopsy series affected by clinical decision to perform biopsies.</p> <p>Misclassification:</p> <p>Possible reduced SARS-CoV-2 seroconversion or premature antibody waning resulting in underestimation of seroprevalence.</p> <p>Collider bias:</p> <p>Risk factor analyses in hospitalized populations affected by who is hospitalized and why; in several studies, more transplant recipients</p>	<p>estimate incidence of mild and asymptomatic infection.</p> <p>Integration of international/national/regional transplant registries to include biopsy reports, rejection episodes and immunosuppression.</p> <p>Report disaggregated outcomes for each organ.</p> <p>Work with patients to capture symptoms and health needs at home, as opposed to only assessing those in hospital.</p>
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Chronic kidney disease/acute kidney injury	<p>Low rates of testing for albuminuria +/- eGFR resulting in underdiagnosis of CKD.</p> <p>If CKD present, low awareness to diagnose/code CKD in records.</p> <p>Limited healthcare resource.</p> <p>Multiple co-existing conditions such as hypertension, diabetes and</p>	<p>Universal testing in at risk groups limited by resources and government policies.</p> <p>COVID-19 risk varying depending on time and area.</p>	<p>Limited health-care resource.</p> <p>AKI burden during the pandemic with shortages of dialysis/personnel resources.</p> <p>More CKD patients after the pandemic (newly recognized, due to COVID-19) but CKD may be simply not have been detected prior to infection.</p> <p>Reduction in clinic and hospital visits to reduce exposure;</p>	<p>Selection bias:</p> <p>Lack of universal testing.</p> <p>If testing rates low, incidence will be falsely low with more severe cases likely to be tested so outcomes (death, hospitalization, critical care admission etc.) are overestimated.</p> <p>Misclassification:</p> <p>Due to Inaccurate/incomplete coding of CKD.</p> <p>Collider bias:</p>	<p>If using electronic health records, validate captured kidney populations against external/gold standard data (e.g. surveys, registries).</p> <p>Ensure population-based infection surveillance studies are well-represented with patients from known high-risk groups.</p> <p>Work with patients to capture symptoms/health needs, as opposed to only assessing those who are hospitalized.</p>

	cardiovascular disease among patients with CKD.		more likely to present late (or not at all) with COVID-19 and non-COVID-19 diseases.	Those with severe disease more likely to be tested. Inadequate follow-up testing of kidney function in people not considered to be at risk of CKD.	
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