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COVID-19 and Kidney Disease Disparities in the United States



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Racial, ethnic, socioeconomic, age, and sex-related health disparities in kidney disease are prominent in the United States. The Coronavirus Disease 2019 (COVID-19) pandemic has disproportionately affected marginalized populations. Older adults, people experiencing unstable housing, racial and ethnic minorities, and immigrants are potentially at increased risk for infection and severe complications from COVID-19. The direct and societal effects of the pandemic may increase risk of incident kidney disease and lead to worse outcomes for those with kidney disease. The rapid transition to telemedicine potentially limits access to care for older adults, immigrants, and people experiencing unstable housing. The economic impact of the pandemic has had a disproportionate effect on women, minorities, and immigrants, which may limit their ability to manage kidney disease and lead to complications or kidney disease progression. We describe the impact of COVID-19 on marginalized populations and highlight how the pandemic may exacerbate existing disparities in kidney disease.

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Racial and ethnic minorities experience a disproportionate and complex burden of medical, mental health, and social needs. The Coronavirus Disease 2019 (COVID-19) pandemic has exacerbated critical disparities in marginalized patients with kidney disease. Latinx, blacks, and Native Americans/Pacific Islanders already make up nearly 50% of the population with kidney failure and compared with non-Latinx whites, these groups are also more heavily impacted with COVID-19. Furthermore, many with COVID-19 develop multiorgan failure, including kidney failure, and subsequently require kidney replacement therapy. In the context of the viral pandemic, here we describe many disparities and additional struggles of patient populations with kidney disease, including those faced by the aging and homeless, and among racial and ethnic minorities, immigrants, and refugees. The impacts from COVID-19 on these populations as well as recommendations are summarized in [Table 1](#).

AGING COMMUNITY

Older adults have been disproportionately affected by COVID-19, with greater risk for infection,^{1,2} severe complications,³ and death.^{4,5} Among 393 patients with COVID-19 in New York City, the median age was 62 years, and elderly, compared with younger, patients were more likely to require invasive mechanical ventilation, kidney replacement therapy, and die.⁶ This pattern is consistent worldwide. For example, among 1591 patients with COVID-19 admitted to intensive care units in Italy, the median age was 63 years, and older vs younger patients experienced more severe acute respiratory distress syndrome (SARS) and higher mortality (36% vs 15%).³

Drivers of the variability in infection risk and severity with age are poorly understood and likely multifactorial. Older adults are more likely to have underlying medical conditions such as chronic kidney disease, which have been associated with COVID-19 infection and complications. An estimated 44% of adults older than 70 years have chronic kidney disease, compared with 9.2% of adults aged 40-59 years.⁷ Among 701 hospitalized patients with COVID-19 in Wuhan, older adults were more likely to have elevated creatinine on presentation, which was

associated with 3 times higher risk for in-hospital death.⁸ The relationship between age, immune response to SARS-CoV-2 infection, and chronic diseases remains poorly understood.⁹

The physical environment and limitations in the ability to self-isolate may also impact COVID-19 risks for older adults. Many older adults live in long-term care facilities, which are high-risk settings for COVID-19 outbreaks. A confirmed COVID-19 case was identified on February 28, 2020, at a skilled nursing facility in King County, Washington.¹⁰ By March 18, there were 167 confirmed cases affecting 101 residents, 40 health-care personnel, and 16 visitors linked to the facility.¹⁰ Even if older adults live alone, many rely on visiting caregivers. Many older adults cannot drive and rely on public transportation, which was theorized to be a primary driver in COVID-19 propagation early in the pandemic.¹¹

The impact of COVID-19 on frailty and depression among older adults with kidney disease has not been studied. However, shelter-in-place rules have forced older adults to stay inside and remain inactive, and higher levels of inactivity exacerbate frailty and depression. Frailty has been associated with increased risk of hospitalization

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and mortality among people with chronic kidney disease¹² and kidney failure,¹³ and allograft loss among transplant recipients.¹⁴ A survey of older adults with cognitive impairment found that individuals who live alone were more likely to experience negative feelings.¹⁵ Depression may have long-term effects on medication adherence and treatment engagement, and people with kidney disease have been associated with lower quality of life¹⁶ and higher mortality.¹⁴

While nephrology practices are using telemedicine to limit SARS-CoV-2 transmission in clinical settings, older adults may also not have access to required technology for videoconferencing. Furthermore, hearing loss and low health-literacy may compound the already poor communication during telephone visits or might lead to skipped visits altogether because of the elderly being unable to participate. However, the impact of telemedicine on older adults with kidney disease has not been studied, and research is needed to understand how to effectively deliver telemedicine to this population.

UNSTABLE HOUSING

The impact of COVID-19 is especially prominent among unstably housed populations. Living in shelters and frequent moves makes social distancing impossible and limits the ability to comply with hand washing and other hygiene measures to prevent infection.^{17,18} SARS-CoV-2 transmission in shelters has led to clusters of COVID-19 in large cities.¹⁹ People experiencing homelessness are more likely to have chronic medical conditions than the general population and, if infected, are at increased risk for severe complications.²⁰ Mortality among unsheltered homeless adults is 10 times higher than that in the general population, and whether COVID-19 will inflate relative risks over time is unknown.²⁰

Having kidney disease may intensify risk for COVID-19 infection for people experiencing unstable housing. A study in San Francisco found that patients with chronic kidney disease experiencing homelessness have higher acute care utilization than stably housed counterparts, and greater exposure to hospitals increases COVID-19 exposure.²¹ In Boston, 146 out of 397 asymptomatic people tested at a homeless shelter were positive for COVID-19, indicating high rates of asymptomatic transmission.²² Similarly, homeless patients undergoing dialysis might have increased risk for exposure and infection due to inability to attend dialysis and increased reliance on emergency departments for treatment.^{23,24}

How the COVID-19 pandemic will impact kidney disease outcomes for patients experiencing unstable housing is unknown. Before the COVID-19 pandemic, a study in Baltimore found that patients with chronic kidney disease experiencing housing insecurity were 59% more likely to postpone needed medical care.²⁵ This population may not be able to participate in needed telemedicine visits

because of lack of required technology and be even more likely to postpone needed treatment during COVID-19 than before. Untreated chronic kidney disease and comorbidities may lead to progression and ultimately exacerbate existing socioeconomic disparities in kidney failure.^{26,27}

SEX DIFFERENCES

Clinical and socioeconomic gender-specific consequences of COVID-19 will be likely to have ripple effects across the kidney failure community. Although the prevalence of chronic kidney disease is more common in women, men have higher rates of kidney failure progression and mortality.²⁸ Early COVID-19 data show a similar trend: in New York City, 42.9 men per 100,000 have died, compared with 23.1 per 100,000 women, with almost twice the number of hospitalizations among men compared with women, with²⁹ similar trends observed in China and Italy.^{3,30} A recent meta-analysis of 29 reports representing 206,128 cases demonstrated no differences in cases between men and women but did show an increase in intensive treatment and mortality in men compared with women.³¹ Although the etiology explaining this difference still remained unclear, differences in immune response may play a role. Male patients with kidney failure are thus at a unique disadvantage given the increased risk of morbidity and mortality both from kidney failure and

COVID-19. Further research will be needed to demonstrate sex as a determinant of adverse sequelae from COVID-19.

Conversely, the socioeconomic effects of the COVID-19 pandemic will have an inequitable effect on women. One in 3 jobs held by women

are essential, with the highest proportion in the health-care industry. As such, women account for 73% of US health-care worker COVID-19 infections.³² The employment losses related to social distancing are in predominantly female employment sectors,³³ in addition to the pressing need of child care at home largely falling to women.³⁴ Incidence of domestic abuse cases may rise, as additional time at home means more time around an abusive partner. Furthermore, complications with pregnancy, or unintended pregnancy, may be a consequence of restricted access to care.³⁵ Women with chronic kidney disease are more likely to belong to a racial or ethnic minority group, be a single mother, and have a low income and low-level education,³⁶ placing this community at higher risk of exposure and economic challenges due to lost employment and childcare needs. As such, existing and future community services and social policies should continue to support women throughout the pandemic, especially those in disadvantaged and resource-poor communities.

RACE AND ETHNICITY

The COVID-19 pandemic exposes the systemic interplay of race, social determinants of health, and comorbidities. The incidence of kidney failure is 3.5 times higher for

CLINICAL SUMMARY

- Existing disparities in kidney disease incidence, outcomes, and access to care among older adults, ethnic/racial minorities, people experiencing unstable housing, and immigrant populations may be exacerbated as a result of the COVID-19 pandemic.

Table 1. The Impact of COVID-19 on Existing Disparities in Kidney Disease and Recommendations

Population	Pre-COVID-19 Disparities	Impact of COVID-19 on Existing Disparities	Recommendations and Future Research
Older adults	<ul style="list-style-type: none"> Higher prevalence of CKD and other comorbidities 	<ul style="list-style-type: none"> Higher risk of COVID-19 infection and complications which may exacerbate kidney disease and other conditions Potential worsening of frailty and depression due to shelter-in-place which increase risk for hospitalization, mortality, and allograft loss Potential inability to access telehealth due to cognition, vision/hearing impairment, and lack of required technology may lead to limited access to nephrology care 	<ul style="list-style-type: none"> Increase testing and isolation of positive cases in retirement communities Research is needed to identify effective nephrology telehealth interventions catered to the unique needs of older adults Research is needed to determine the impact of shelter-in-place on frailty, depression, and long-term outcomes among older adults with kidney disease
People experiencing unstable housing	<ul style="list-style-type: none"> Higher prevalence of chronic medical conditions and mortality compared to general population Homeless adults with CKD have higher risk of ESKD and acute care utilization than stably housed counterparts 	<ul style="list-style-type: none"> Higher risk of COVID-19 which may exacerbate kidney disease and other chronic conditions Limited access to telehealth which may exacerbate chronic conditions and further increase reliance on acute care 	<ul style="list-style-type: none"> Increase testing and isolation of positive cases in shelters Investment in housing for symptomatic and positive cases Extend eviction moratorium Research is needed to determine how COVID-19 will impact health outcomes and mortality among those with unstable housing compared to stably housed populations with kidney disease Research is needed to determine how COVID-19 affects access to nephrology care Research is needed to identify effective nephrology telehealth interventions catered to the unique needs of people experiencing unstable housing
Sex and gender	<ul style="list-style-type: none"> Men have higher risk of progression of kidney failure and mortality from kidney failure Women with CKD are more likely to be a minority, to have low education, and low income Higher burden of caregiving on women 	<ul style="list-style-type: none"> Higher morbidity and mortality due to COVID-19 among men Higher socioeconomic and health-care access burden on women 	<ul style="list-style-type: none"> Ensure that protective mechanisms for women and girl victims of violence remain accessible Advocacy for increased resources for community programs and policies that protect women Ensure access to sexual and reproductive health services Research is needed to determine etiology for disparate gender data

(Continued)

Table 1. The Impact of COVID-19 on Existing Disparities in Kidney Disease and Recommendations (*Continued*)

Population	Pre-COVID-19 Disparities	Impact of COVID-19 on Existing Disparities	Recommendations and Future Research
Racial and ethnic minorities	<ul style="list-style-type: none"> • Minorities have higher incidence of renal failure and higher burden of untreated comorbidities than non-Latinx whites • Minorities suffer health disparities stemming from structural racism including poverty, crowded living conditions, inadequate access to healthy foods, discrimination, uncertain legal status, poor access to care, and others 	<ul style="list-style-type: none"> • Minorities are disproportionately affected by COVID-19 which may exacerbate kidney disease and other conditions • Inability to social distance due to essential jobs and crowded living environments • Limited access to telehealth due to language and technology barriers which may exacerbate disparities in access to nephrology care 	<ul style="list-style-type: none"> • Improve data on socioeconomic status alongside data disaggregated by race and ethnicity in COVID-19 to guide efforts to allocate resources and reduce exposure • Provide culture and language congruent outreach and communication by partnering with trusted community-based organizations and faith leaders • Improve contact tracing • Expand access to health care • Prevention and treatment of comorbidities that increase morbidity and mortality such as metabolic conditions and cardiovascular disease.
People who are refugees, immigrants, and undocumented	<ul style="list-style-type: none"> • Limited access to primary and nephrology care, increased reliance on acute care • In most US states, ESKD patients rely on emergency-only dialysis, which is associated with higher morbidity and mortality 	<ul style="list-style-type: none"> • Higher risk of COVID-19 exposure which may exacerbate kidney disease and other conditions • Limited access to telehealth due to language and technology barriers which may exacerbate disparities in access to nephrology care 	<ul style="list-style-type: none"> • Suspension of the Public Charge Rule • Suspension of immigration enforcement • Improve disaster relief assistance for immigrants who are ineligible for most forms of pandemic assistance • Expand access to COVID-19 care by modifying the Emergency Medicaid definition • Expand access to kidney replacement therapy by modifying the Emergency Medicaid definition • Research is needed to determine how COVID-19 will affect outcomes among those receiving emergency-only dialysis • Research is needed to determine how COVID-19 will impact access to nephrology care for this population • Research is needed to identify effective nephrology telehealth interventions that are culturally responsive and language congruent

Abbreviations: CKD, chronic kidney disease; COVID-19, Coronavirus Disease 2019; ESKD, end-stage kidney disease.

blacks and 1.5 times greater for Latinx, with higher rates of progression to kidney failure observed in both communities.^{37,38} The etiology for this disturbing finding is multifactorial in the setting of structural racism and individual factors, including undertreated metabolic conditions and cardiovascular disease, as well as poor access to care, and socioeconomic factors such as living conditions, education, and health literacy.³⁹

Notably, these same factors are exposed in the COVID-19 pandemic. Although data collection by race and ethnicity on the COVID-19 pandemic is sparse and incomplete, limited data show black, Latinx, and Native Americans make up a disproportionate number of COVID-19 related deaths and cases across the United States.^{40,41,42} In New York City, the age-adjusted mortality rate from COVID-19 for blacks is double that of white and Asian residents, and age-adjusted case rate is highest in the Latinx and black community.⁴³ In the Navajo nation, the infection rate has surpassed that of the state of New York.⁴⁴

Health disparities are primarily driven by structural racism, defined as “the ways in which historical and contemporary racial inequities in outcomes are perpetuated by social, economic, and political systems, including mutually reinforcing systems of health care, education, housing, employment, the media, and criminal justice.”⁴⁵ Racial and ethnic minorities, for example, are more likely to live in crowded living conditions such as densely populated urban areas and multigenerational households. They are overrepresented in homeless shelters and prisons and are more likely to live in poverty.³⁹ Blacks make up a majority of those living in poverty in urban areas.³⁹ Furthermore, racial and ethnic minorities are disproportionately essential workers: 25% of Latinx or black workers are employed in service industry jobs, compared with 16% of whites.⁴⁶ Furthermore, access to care may be out of reach in states that have not expanded Medicaid; it should be of no surprise these areas are associated with higher mortality and lower life expectancies.⁴⁷ In the COVID-19 era, there will likely be further evidence of racial disparities in health-care access due to loss of insurance, poor quality of care, and disproportionate distribution of testing and resources. Moreover, language barriers in some minority communities limit contact tracing and preventative outreach.⁴⁸

Thus, the aggregate of kidney failure and COVID-19 in minorities portends a potentially lethal combination. In the wave of the pandemic, myriad health disparities will disproportionately affect minorities with kidney failure and therefore must be fully considered when evaluating actionable prevention strategies.

REFUGEES, IMMIGRANTS, AND UNDOCUMENTED

The impact of COVID-19 on immigrant populations has been profound. Undocumented immigrants are disproportionately essential workers, risking daily exposure to COVID-19.⁴⁹ Many immigrants work low-wage jobs in the service and hotel industries and are among the millions in America out of work.⁵⁰ The \$1 trillion economic relief package will not reach the undocumented population as they face unemployment and mounting financial resource

strain.⁵¹ Many support large families and will have little to spend on medications, healthy food, and other health-related social needs.⁵¹ Increasing financial resource strain increases risk for incident albuminuria and rapid kidney function decline, and the economic impact of COVID-19 alone may result in a higher prevalence of kidney disease and kidney disease progression in this population.⁵²

Undocumented immigrants are not eligible for the Affordable Care Act, and there are an estimated 7.1 million without health insurance.⁵³ Without insurance, undocumented immigrants do not have consistent access to primary care, and undiagnosed or poorly controlled chronic conditions increase their risk for severe complications from COVID-19 if infected. Without primary care, undocumented immigrants do not have a place to call for guidance or testing if they experience symptoms and many rely instead on emergency services.⁵¹ Increased reliance on acute care increases their chances for exposure to COVID-19 and unnecessarily contributes to overwhelmed hospital systems if they could otherwise be managed at home.⁵¹

The rapid transition to telemedicine during COVID-19 has potentially increased the number of immigrants without nephrology care and led to suboptimal care for those connected to nephrology. Undocumented immigrants may not seek care or testing because of fear of the public charge rule and repercussions from the U.S. Immigration and Customs Enforcement Agency. This rule, which went into effect in February 2020, states that “aliens are inadmissible if they are unable to care for themselves” and discourages them from seeking assistance.⁵¹ This population often faces fear and mistrust from the medical system, which might be worse if they cannot see the clinical staff or environment.^{51,54} For those who do seek care, the technology needed for telemedicine visits complicates clinical encounters that are already threatened by low health literacy and language barriers. Undocumented immigrants attempting to establish care might not know where to call or if they will be understood when they call.

In addition, providers are forced to have nuanced discussions over the phone, with translators and without assistance from facial cues, about complex kidney management issues and dialysis planning. Predialysis nephrology care is an established predictor of early mortality among incident dialysis patients.⁵⁵ There are 57.5 million Latinx in the United States as of 2017, and that number is expected to double in the next 20 years.⁵⁶ The prevalence of kidney failure among Latinx populations is 2-fold higher than among whites.⁵⁷ Research is needed to determine whether the lack of, or flawed, nephrology encounters during COVID-19 will exacerbate existing disparities in kidney failure among Latinx populations.

There are an estimated 5500-8857 uninsured immigrants with kidney failure in the United States.⁵⁸ In most states, this population relies on hospitals for emergency-only dialysis.⁵⁸ The Emergency Medical Treatment and Active Labor Act requires hospitals to treat anyone who enters with an emergency medical condition. These individuals do not have funding for outpatient dialysis, and Emergency Medical Treatment and Active Labor Act enables

them to receive treatment when they present with emergency indications for dialysis.⁵⁹ Emergency-only dialysis is associated with worse morbidity⁵⁴ and mortality^{60,61} for patients, promotes burnout and emotional exhaustion for providers,⁶² and is extremely costly to the medical system.⁶³

Individuals who receive emergency-only dialysis have high acute care utilization and spend less time in the outpatient setting than those who receive standard dialysis. In 1 study, patients receiving emergency-only dialysis presented to the emergency room 6 times in a 30-day period, on average.⁶⁰ This population is at increased risk for severe complications and death if they are infected with SARS-CoV-2, but they repeatedly risk exposure for themselves and their families every time they present for dialysis. Fear of exposure to COVID-19 may also promote waiting longer to present for dialysis and increase risk of out-of-hospital death. They are also unnecessarily using emergency, inpatient, and dialysis resources that could otherwise be used for patients with COVID-19 during a time when resources are limited.

CONCLUSION

The COVID-19 pandemic is re-exposing an underlying and long-standing set of critical weaknesses in our nation's health-care system, especially relevant to the stark burdens already faced by many underserved populations. Numerous complications and struggles with kidney disease have unfortunately intensified in patient groups and have risen to the forefront during a time of great patient need and distress. The risk for the elderly, the homeless, differences between sexes, and overwhelming threats to racial, ethnic, and underserved minorities and immigrants are compounding. All together, the broad and complex set of interconnected disparities, both nationally and globally, will require a similarly broad and complex set of solutions. As the nation pulls together during these times of great uncertainty, it will be our continued responsibility to move the needle forward on the inequities faced by marginalized populations that have been unheeded far too long.

REFERENCES

- Gudbjartsson DF, Helgason A, Jonsson H, et al. Spread of SARS-CoV-2 in the Icelandic population. *N Engl J Med*. 2020;382:2302-2315.
- Li Q, Guan X, Wu P, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. *N Engl J Med*. 2020;382(13):1199-1207.
- Grasselli G, Zangrillo A, Zanella A, et al. Baseline characteristics and outcomes of 1591 patients infected with SARS-CoV-2 admitted to ICUs of the lombardy region, Italy. *JAMA*. 2020;323(16):1574-1581.
- Xie J, Tong Z, Guan X, Du B, Qiu H. Clinical characteristics of patients who died of coronavirus disease 2019 in China. *JAMA Netw Open*. 2020;3(4):e205619.
- Aronson L. Age, complexity, and crisis - a prescription for progress in pandemic. *N Engl J Med*. 2020.
- Goyal P, Choi JJ, Pinheiro LC, et al. Clinical characteristics of Covid-19 in New York city. *N Engl J Med*. 2020;382:2372-2374.
- Centers for Disease Control and Prevention. Chronic Kidney Disease Surveillance System. 2020. Available at: <https://www.cdc.gov/kidneydisease/index.html>. Accessed August 9, 2020.
- Cheng Y, Luo R, Wang K, et al. Kidney disease is associated with in-hospital death of patients with COVID-19. *Kidney Int*. 2020;97:829-838.
- Koff WC, Williams MA. Covid-19 and immunity in aging populations - a New research Agenda. *N Engl J Med*. 2020.
- McMichael TM, Currie DW, Clark S, et al. Epidemiology of Covid-19 in a long-term care facility in king county, Washington. *N Engl J Med*. 2020;382:2005-2011.
- Harris J. *The subways seeded the massive coronavirus epidemic in New York city: working paper 27021*. Cambridge, Massachusetts: National Bureau of Economic Research; 2020.
- Chowdhury R, Peel NM, Krosch M, Hubbard RE. Frailty and chronic kidney disease: a systematic review. *Arch Gerontol Geriatr*. 2017;68:135-142.
- Sy J, Johansen KL. The impact of frailty on outcomes in dialysis. *Curr Opin Nephrol Hypertens*. 2017;26(6):537-542.
- Konel JM, Warsame F, Ying H, et al. Depressive symptoms, frailty, and adverse outcomes among kidney transplant recipients. *Clin Transpl*. 2018;32(10):e13391.
- Goodman-Casanova JM, Dura-Perez E, Guzman-Parra J, Cuesta-Vargas A, Mayoral-Cleries F. Telehealth home support during COVID-19 confinement for community-dwelling older adults with mild cognitive impairment or mild dementia: survey study. *J Med Internet Res*. 2020;22(5):e19434.
- Teles F, Amorim de Albuquerque AL, Freitas Guedes Lins IK, Carvalho Medrado P, Falcão Pedrosa Costa A. Quality of life and depression in haemodialysis patients. *Psychol Health Med*. 2018;23(9):1069-1078.
- Wood LJ, Davies AP, Khan Z. COVID-19 precautions: easier said than done when patients are homeless. *Med J Aust*. 2020;212:384-384.e1.
- Tsai J, Wilson M. COVID-19: a potential public health problem for homeless populations. *Lancet Public Health*. 2020;5(4):e186-e187.
- Mosites E, Parker EM, Clark K, et al. Assessment of SARS-CoV-2 infection prevalence in homeless shelters — four U.S. Cities, March 27–April 15, 2020. *MMWR Morb Mortal Wkly RepePub*. 2020.
- Roncarati JS, Baggett TP, O'Connell JJ, et al. Mortality among unsheltered homeless adults in Boston, Massachusetts, 2000-2009. *JAMA Intern Med*. 2018;178:1242-1248.
- Hall YN, Choi AI, Xu P, Smith NL, Boyko EJ. Predictors of end-stage renal disease in the urban poor. *J Health Care Poor Underserved*. 2013;24(4):1686-1700.
- Karedes D. CDC reviewing 'stunning' universal testing results from Boston homeless shelter. *Boston 25 News*. Updated April 15, 2020. Available at: <https://www.boston25news.com/news/cdc-reviewing-stunning-universal-testing-results-boston-homeless-shelter/Z253TFB06RG4HCUAARBO4YW064/>.
- Novick TK, Gadegbeku CA, Crews DC. Dialysis for patients with end-stage renal disease who are homeless. *JAMA Intern Med*. 2018;178(12):1581-1582.
- Chan KE, Thadhani RI, Maddux FW. Adherence barriers to chronic dialysis in the United States. *J Am Soc Nephrol*. 2014;25(11):2642-2648.
- Novick T, Han D, Tout D, et al. Housing instability and healthcare engagement among people with CKD. *Kidney Med*. 2020;2(3):367-368.
- Kimmel PL, Fwu CW, Eggers PW. Segregation, income disparities, and survival in hemodialysis patients. *J Am Soc Nephrol*. 2013;24(2):293-301.
- Young EW, Mauger EA, Jiang KH, Port FK, Wolfe RA. Socioeconomic status and end-stage renal disease in the United States. *Kidney Int*. 1994;45(3):907-911.
- Cobo G, Hecking M, Port FK, et al. Sex and gender differences in chronic kidney disease: progression to end-stage renal disease and hemodialysis. *Clin Sci*. 2016;130:1147-1163.
- Rabin RC. In N.Y.C., the coronavirus is killing men at twice the rate of women. *The New York Times*. April 7, 2020.

30. Zhang Y. *The epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19) – China*. China CDC Weekly; 2020.
31. Peckham H, Gruijter N, Raine C, Radziszewska A, Ciurtin C, Wedderburn L, et al. Sex-bias in COVID-19: a meta-analysis and review of sex differences in disease and immunity. *Infect Dis Epidemiol*. 2020. Preprint.
32. Robertson C, Gebeloff R. How millions of women became the most essential workers in America. *The New York Times*. April 18, 2020.
33. Gupta AH. Why this economic crisis differs from the last one for women. *The New York Times*. March 31, 2020.
34. Medina J, Lerer L. When Mom's Zoom meeting is the one that has to wait. *The New York Times*. Published April 22, 2020. Updated April 23, 2020.
35. Gausman J, Langer A. Sex and gender disparities in the COVID-19 pandemic. *J Women's Health (Larchmt)*. 2020;29(4):465-466.
36. Ricardo AC, Yang WSD, Appel L, et al. Sex-related disparities in CKD progression. *JASN*. 2019;130:137-146.
37. Trivedi AN, Sommers BD. The affordable care act, medicaid expansion, and disparities in kidney disease. *Clin J Am Soc Nephrol*. 2018;13:480-482.
38. Desai N, Lora CM, Lash JP, Ricardo AC. CKD and ESRD in US hispanics. *AJKD*. 2018;73(1):102-111.
39. Patzer RE, McClellan WM. Influence of race, ethnicity and socioeconomic status on kidney disease. *Nat Rev Nephrol*. 2012;8(9):533-541.
40. Yancy CW. COVID-19 and African Americans. *JAMA*. 2020.
41. Dorn AV, Cooney RE, Sabin ML. COVID-19 exacerbating inequalities in the US. *Lancet*. 2020;395(10232):1243-1244.
42. Richardson S, Hirsch JS, Narasimhan M, et al. Presenting characteristics, comorbidities, and outcomes among 5700 patients hospitalized with COVID-19 in the New York city area. *JAMA*. 2020;323:2052-2059.
43. COVID-19: data. City of New York. Available at: <https://www1.nyc.gov/site/doh/covid/covid-19-data.page>. Accessed April 30, 2020.
44. Lakhani N. The Guardian: why Native Americans took COVID-19 seriously: 'It's our reality'. Available at: <https://www.theguardian.com/us-news/2020/may/26/native-americans-coronavirus-impact>. Accessed June 12, 2020.
45. Pallok K, De Maio F, Ansell DA. Structural racism - a 60-year-old black woman with breast cancer. *N Engl J Med*. 2019;380(16):1489-1493.
46. Welles CC, Cervantes L. Hemodialysis care for undocumented immigrants with end-stage renal disease in the United States. *Curr Opin Nephrol Hypertens*. 2019;28(6):615-620.
47. Blow CM. The racial time bomb in the COVID-19 crisis. *The New York Times*. April 1, 2020.
48. Martin M, Fernandez A, Bibbins-Domingo K. Who lies beneath the flattened curve: LatinX and COVID-19. *San Francisco Examiner*. April 9, 2020.
49. Jordan M. Farmworkers, mostly undocumented, become 'essential' during pandemic. *New York Times*. Published April 2, 2020. Updated April 10, 2020.
50. Jordan M, Dickerson C. 'Plz cancel our cleaning': virus leads many to cast aside household help. *The New York Times*. March 25, 2020.
51. Page KR, Venkataramani M, Beyrer C, Polk S. Undocumented U.S. Immigrants and Covid-19. *N Engl J Med*. 2020;382:e62.
52. Novick T, Omenyi C, Han D, et al. Housing insecurity and risk of adverse kidney outcomes. *Kidney360*. 2020;1(4):241-247.
53. Cheng YJ, Kanaya AM, Araneta MRG, et al. Prevalence of Diabetes by race and ethnicity in the United States, 2011-2016. *JAMA*. 2019;322(24):2389-2398.
54. Cervantes L, Jones J, Linas S, Fischer S. Qualitative interviews exploring palliative care perspectives of latinos on dialysis. *Clin J Am Soc Nephrol*. 2017;12(5):788-798.
55. Bradbury BD, Fissell RB, Albert JM, et al. Predictors of early mortality among incident US hemodialysis patients in the Dialysis Outcomes and Practice Patterns Study (DOPPS). *Clin J Am Soc Nephrol*. 2007;2(1):89-99.
56. US Census Bureau. *Hispanic Heritage Month 2017*. 2017.
57. Ricardo AC, Flessner MF, Eckfeldt JH, et al. Prevalence and correlates of CKD in hispanics/latinos in the United States. *Clin J Am Soc Nephrol*. 2015;10(10):1757-1766.
58. Rodriguez R, Cervantes L, Raghavan R. Estimating the prevalence of undocumented immigrants with end-stage renal disease in the United States. *Clin Nephrol*. 2019;93:108-112.
59. Cervantes L, Mundo W, Powe NR. The status of provision of standard outpatient dialysis for US undocumented immigrants with ESKD. *Clin J Am Soc Nephrol*. 2019;14(8):1258-1260.
60. Cervantes L, Tuot D, Raghavan R, et al. Association of emergency-only vs standard hemodialysis with mortality and health care use among undocumented immigrants with end-stage renal disease. *JAMA Intern Med*. 2018;178(2):188-195.
61. Nguyen OK, Makam AN. Comparison of scheduled vs emergency-only dialysis in undocumented immigrants with end-stage renal disease-reply. *JAMA Intern Med*. 2019;179(5):728-729.
62. Cervantes L, Richardson S, Raghavan R, et al. Clinicians' perspectives on providing emergency-only hemodialysis to undocumented immigrants: a qualitative study. *Ann Intern Med*. 2018;169(2):78-86.
63. Nguyen OK, Vazquez MA, Charles L, et al. Association of scheduled vs emergency-only dialysis with health outcomes and costs in undocumented immigrants with end-stage renal disease. *JAMA Intern Med*. 2019;179(2):175-183.