# Chronic Kidney Disease in Minnesotans: A Rising Trend or Increased Screening?

## Introduction

Chronic kidney disease (CKD) has emerged as a serious public health concern in Minnesota and across the United States. This silent epidemic is closely related to heart health, as CKD is associated with Type 2 diabetes, high blood pressure, and other chronic conditions, and puts people at much higher risk for heart disease, stroke, and death.[1]

The relationship between CKD and heart disease deaths is particularly concerning. Patients with CKD are at risk of increased rates of artery disease, heart failure, arrhythmias, and sudden cardiac death.[2] Heart disease is the leading cause of death for people with CKD, with heart disease deaths accounting for approximately 40% to 50% of all deaths in patients with advanced CKD compared with only 26% in those with normal kidney function.[2] The chance of having a stroke is five to thirty times higher in patients with CKD, especially those on dialysis.[3] Among CKD patients with heart failure, heart disease related deaths were at 10.2% compared with 0.9% in CKD patients without heart failure over a one year time span.[4]

More people are getting sick with CKD, while at the same time there are improved detection and awareness efforts. Globally, the amount of CKD has risen dramatically, with the number of newly diagnosed people increasing from 7.8 million in 1990 to 19 million in 2019.[5] In the United States, the amount of people with CKD stages 1-4 increased from 11.8% in 1988-1994 to 14.2% in 2015-2016.[6] However, determining if these numbers represent a true increase in the amount of people getting sick, improved detection, or both remains challenging, as it is often hard to know if someone has CKD until the late-stages of disease.[7]

Screening initiatives have improved over the past three decades. Current guidelines recommend targeted screening in high-risk populations, including those with diabetes, hypertension, and cardiovascular disease.[8] However, recommendations are rarely followed, with only an estimated 10% of people living with CKD aware of their diagnosis. Recent studies indicate that screening all US residents over age 35 for chronic kidney disease would increase life expectancy, reduce the number of people requiring dialysis or transplant, and provide good value in health care spending.[7]

## Data source

The Minnesota Department of Health collects data on all deaths through the Minnesota Vital Statistics System (MVSS). This analysis includes all recorded deaths of Minnesota residents occurring in Minnesota between 2000 and 2023, using the International Classification of Disease version 10 (ICD-10) medical coding to determine both direct and contributing causes of death. These death data are based on death certificates, which capture causes and location of death, demographic information, and the place of residence of the deceased.

For this report, deaths attributed to chronic kidney disease (CKD), heart disease, stroke, and diabetes were identified using ICD-10 codes recorded on death certificates. Data presented includes trends in CKD, heart disease and stroke mortality over time, as well as differences by age, race, and education level.

This report focuses on mortality outcomes related to CKD, heart disease, stroke, and diabetes. Deaths where CKD, heart disease, stroke, or diabetes were listed as either the direct cause, or a contributing cause of death were included.

Definitions and coding criteria for CKD and heart disease are detailed in the appendix. The results presented are based on official Minnesota Department of Health mortality data.

## Analysis

This report shares the percentage of Minnesota deaths that have CKD as a direct or contributing cause of death from 2000 through 2023. A direct cause of death can be thought of as the illness or event that caused the death of the individual, whereas a contributing cause of death played a role but was not the ultimate cause of death. There is only one direct cause of death while there may be up to twenty contributing causes of death on a death certificate. This analysis is stratified by individual characteristics, including race, age group, and education, as well as conditions where the individual lived by looking at the social vulnerability index (SVI), a way of measuring social, economic, and demographic characteristics of a community.[9] Additionally, this report analyzes trends in the proportion of heart disease, stroke, or diabetes deaths that have CKD as a contributing cause of death.

The race category was classified using the National Center for Health Statistics bridged race categories, allowing for consistency across the years of the dataset. As the causes of death we focus on in this report are rare for those under age 18, they were excluded from the analysis. Age groups are stratified 18 – 44, 45 – 64, and 65 years or older. Education level is grouped into the following categories by highest level of education attained: Less than a high school degree, high school degree, college degree, and advanced degree.

## Key findings

An estimated 1 in 7 (642,000) Minnesota adults have chronic kidney disease, with nearly all (90%) unaware they have it.[1] The demographic characteristics of Minnesota resident deaths analyzed in this report can be found in Table 1 of the appendix. Statewide, the percent of deaths that were classified as directly or indirectly related to CKD have dramatically increased from 3.8% in 2000-2004 to 14.4% in 2020-2023. CKD as a direct or contributing cause is most common among those over 65 (16.6% of all deaths) compared to those aged 18 – 44 (2.5%). When comparing racial groups, Native Hawaiians and Pacific Islander and Asian Minnesotans have the highest proportion of deaths with CKD as a direct or contributing cause at 22.4% and 19.6%, respectively.

## Chart 1: CKD as a direct or contributing cause of death has increased from 2000 through 2023

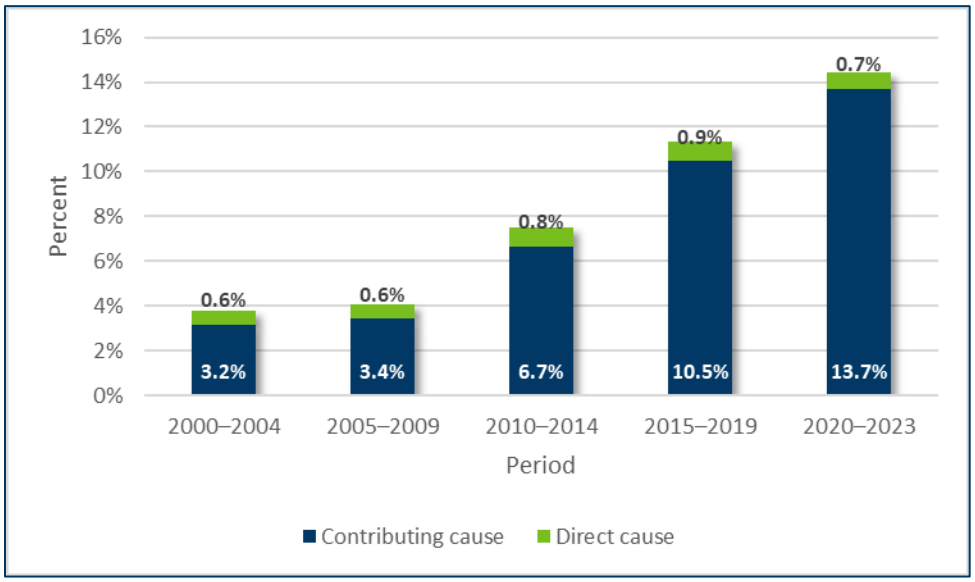
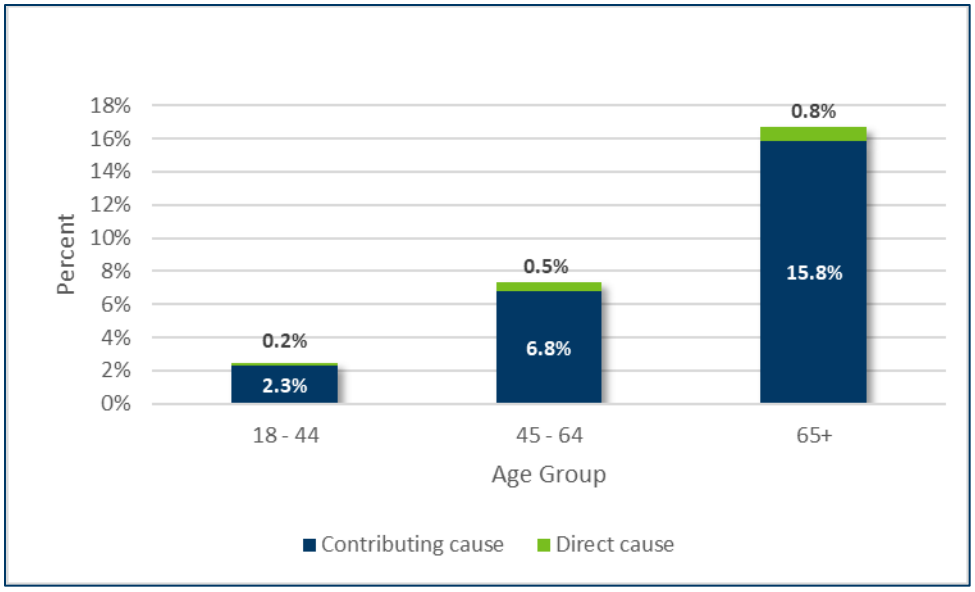



Chart 1 shows that the proportion of deaths with CKD as a direct cause has generally trended higher, with a slight dip in the 2020 – 2023 period that may be due to the COVID-19 pandemic. During this time, COVID-19 became a leading cause of death and lowered the percentage of deaths caused by other conditions. COVID-19 is particularly dangerous for individuals with chronic illness. CKD has as a contributing cause of death has risen even more dramatically, much more so than as a direct cause.

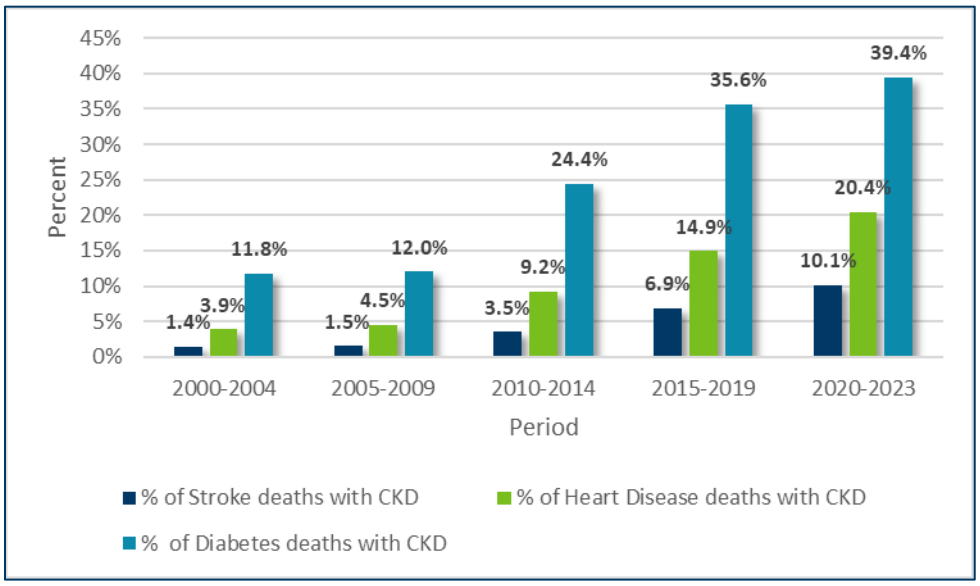
## Chart 2: CKD as a direct or contributing cause of death is much higher in older individuals for 2020 -- 2023




CKD as a cause of death increases as age increases, which aligns with the trend of chronic disease increasing with age. CKD prevalence is approximately 6% in adults aged 18 – 44, 12% in those aged 45 – 64 and 34% in those 65 and older. In Chart 2, this pattern is apparent, with the

oldest group aged 65+ having the most deaths related to CKD. This finding was consistent for all time periods analyzed.[10] After 40, kidney filtration declines by about 1% per year, leading to structural changes that make the kidneys more vulnerable.[11]

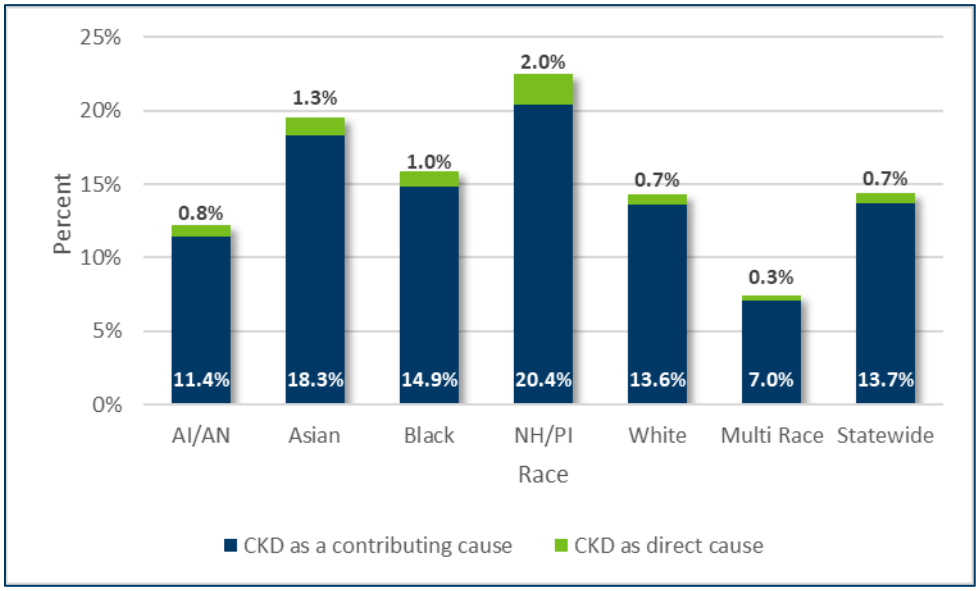
## Chart 3: CKD as a contributing cause where stroke, heart disease, or diabetes is the direct cause of death is increasing over time




When looking at the total deaths with heart disease, stroke, or diabetes as the direct cause there has been a strong, consistent increase in the presence of CKD as a contributing cause for all these conditions since 2000, visualized in Chart 3. Research has shown that CKD can be a contributor to heart disease, stroke and diabetes deaths. CKD and heart disease are known as silent killers, meaning that they lack symptoms until it is too late to reverse negative health outcomes. Individuals often do not know they will have a stroke until it occurs, and diabetes is often not discovered until symptoms occur. The data suggests that providers should look for CKD when treating people for heart disease and diabetes, and messaging around heart disease, diabetes, stroke and CKD should be packaged together as cardiometabolic disease.

The question remains – is CKD truly having such a stark impact on mortality, or have screening and mortality coding methods increased to the point where it is simply being captured more?

## Chart 4: Unequal impact of CKD as direct or contributing cause of death by race from 2020 – 2023



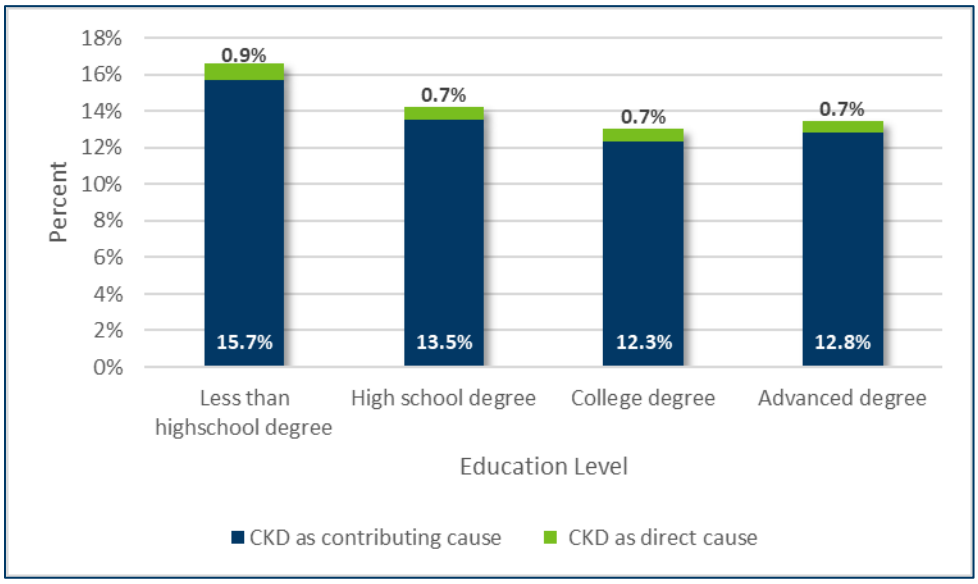

When looking at CKD as both a direct and contributing cause of death, it is important to recognize that Asian, Black and Native Hawaiian/ Pacific Islander Minnesotans experience a disproportionate number of deaths when compared to other racial groups. These differences are shown in Chart 4 for the 2020-2023 period. The development of CKD is complex and includes health conditions like diabetes and high blood pressure as well as genetic, dietary, socioeconomic and social determinants of health factors.

Access to quality food, quality health care and opportunities for exercise can be limited in neighborhoods with less resources, which may affect some Asian, Black, and Native Hawaiian and Pacific Islander populations in Minnesota more than others. Being unable to easily access healthy food, get work that pays well enough, and inequalities that exist within our systems all contribute to conditions that increase the risk for developing CKD. Other factors such as having a good understanding of your health, not having adequate insurance, and experiencing discrimination within a health care setting also play a role in the development of CKD.

Foods that are more common in certain cultural diets can contribute to increased risks of diabetes, hypertension and obesity, all of which are risk factors for CKD. However, dietary habits are diverse within and across communities, and many families also incorporate nutrient-rich vegetables, legumes, and lean proteins. It is also important to note that these dietary patterns are shaped by a range of factors, including historical context, accessibility, and affordability constraints.

There are also genetic factors that play a role in the development of CKD. An example of this are certain genetic variations that lead to insulin deficiency in some Asian populations, even when people have healthy body weights. There are also some genetic variations among the Black population that have been associated with increased risk of kidney diseases.

## Chart 5: Higher Education level means less CKD as a direct and contributing cause of death from 2020 - 2023

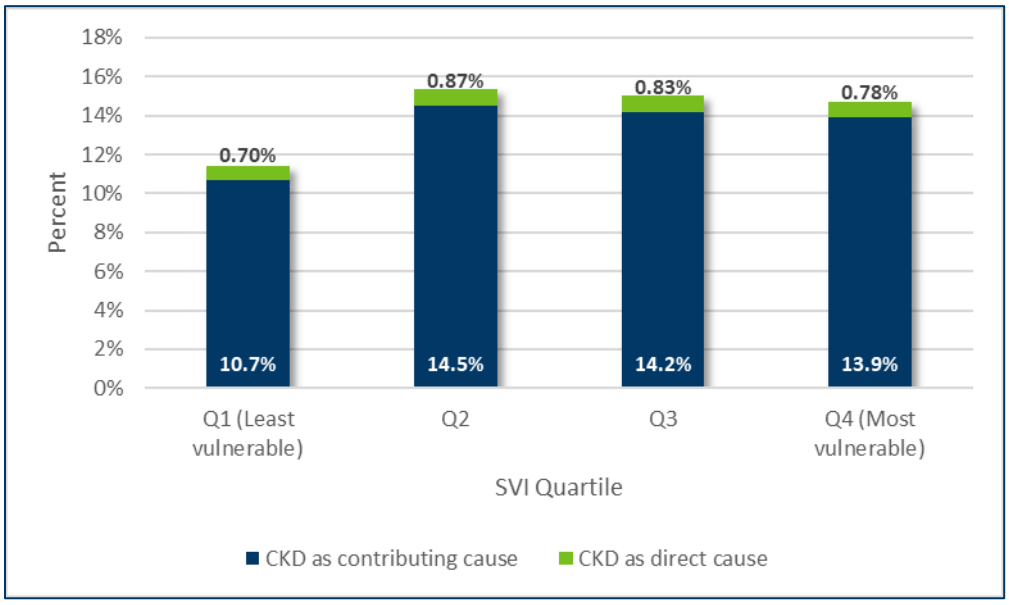



Education level has been shown through multiple large scale studies to be inversely linked to the development of CKD, with those with lower education having a 21 – 25% higher risk of developing CKD compared to individuals with higher education.[12,13] Chart 5 highlights these differences during the 2020-2023 period. This trend is persistent even when accounting for age, sex and baseline kidney function and is thought to largely be related to socioeconomic and health behavior factors.[14] In addition to lower education being associated with higher risk for CKD, it is also associated with high rates of complications such as end stage renal disease and cardiovascular events, and faster progression of CKD.[13,15]

The association between CKD and education level can be explained in part by increased prevalence of CKD risk factors among those with less education, fewer opportunities to engage in healthy activities such as exercise and smoking cessation, and reduced access to health care.[13,16] A factor influencing the association between education level and development of CKD may be a proxy for health literacy. Health literacy can be thought of as the ability to obtain, understand and use health information to make the best health related decisions, and is thought to be important in managing chronic disease such as CKD. Education level is one of the most important factors impacting health literacy, with many studies showing that the more educated someone is, the better their health literacy.[17]

The results of this report and body of research highlight the need for increased outreach on the risk of CKD development for those with lower education levels.

### Chart 6: Higher Social Vulnerability Index score is linked to worse health outcomes in 2022




Characteristics of the community environments where people live, work, and play may also be associated with health outcomes, including deaths due to CKD. In this report, SVI scores were linked to death data using zip codes. A lower SVI score means an individual lived in an area with less vulnerability, with higher SVI scores indicating more vulnerability.

Chart 6 shows the differences in the presence of CKD on death certificates by a community's social vulnerability. Only those communities who are least socially vulnerable have lower CKD deaths. This may be a result of having increased access to health care, healthy food and opportunities to exercise. What this graph shows most clearly however, is that no matter your SVI score, CKD is a serious contributing factor for death. Vulnerable or not, many Minnesotans are impacted by this disease.

## Improvements in CKD screening

There have been vast improvements in CKD screening over the past 20 years, which may account for part of the drastic increase seen in this report. The main CKD test used to be a simple blood test which could tell how well kidneys were functioning. Today's screening guidelines are more advanced, requiring both blood and urine tests to confirm a CKD diagnosis. Obtaining both blood and urine from patients can be challenging.

With increased screening of people at high risk and the implementation of new guidelines and testing, the number of CKD diagnoses have increased consistently over the past 20 years.[18]With an increase in diagnoses comes an increase in people making lifestyle choices that may improve their health outcomes. With earlier treatment, medication and lifestyle choices, individuals with CKD are likely living longer with their disease, increasing the odds that it may be a contributing factor to the direct cause of their death.

# Conclusion

Despite advances in health care, CKD remains substantially underdiagnosed and under-recognized. Many people have lived with CKD for years without symptoms, and screening rates remain low, especially among populations at highest risk. This widespread lack of early detection means that countless Minnesotans are unaware of their condition until they progress to advanced stages, when effective treatments are limited. The problem is far-reaching: nationally and locally, underdiagnosis contributes to preventable illness, higher health care costs, and premature death.

CKD and its impact on the health of Minnesotans reflect persistent inequities that lead to different health outcomes for different populations. This report reveals that CKD does not affect all Minnesotans equally, with disparities by race, educational attainment, and age underscoring the need for a more balanced and equitable approach to prevention, diagnosis, and care.

Social and economic factors such as access to quality health care, healthy food and safe accessible environments play a central role in the development of CKD and the associated health outcomes. Individuals from historically marginalized communities face heightened barriers such as limited access to specialists, underinsurance and systemic bias that reside within health care systems.

These issues were recognized and explored during the Minnesota Ending Disparities in CKD Leadership Summit that occurred in July of 2024. This statewide gathering of health care providers, public health leaders, and community advocates was designed to support new ideas to address CKD and the unequal outcomes faced by our communities. A key product from this summit is a roadmap that includes multiple avenues for change. [19] The summit highlighted the serious need for targeted education for groups of people at higher risk of getting sick with CKD, with this education including doctors and their staff. The roadmap also highlights early detection efforts and culturally appropriate ways to reach people at risk of CKD. The health care workforce that works with individuals at higher risk of CKD should also aim to be more diverse to help increase trusting relationships between communities and the health care system.

The recommendations that came from the summit highlight the need for a multi-pronged approach to tackling CKD and the unequal outcomes this report highlights. Between early detection, education developed for specific communities, and engaging with those communities in a meaningful and respectful way, Minnesotans can meet the challenge of improving CKD outcomes.[19]

# Limitations

The main limitation is that death is inherently messy. There may be inaccurate or incomplete death certificates, misclassifications, or general missed information. In a high paced hospital setting, when someone dies there, full analysis of all the causes of death cannot always be done. There may also be differences in how deaths are recorded across different health care systems. Classifying what ultimately was the underlying cause of death can be subjective, especially when there are many contributing factors. Early stages of CKD that may not have clinical symptoms are more likely to have been missed on a death certificate.

Another limitation of this report is that the different stages of CKD were not differentiated, as any ICD-10 code that involved a stage of CKD was coded as CKD.

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# Appendix

## Table 1: Demographic characteristics of Minnesotans who died from 2000 to 2023

| Demographic or socioeconomic characteristic | Minnesotans who died 2000 – 2023 | Minnesotans who died 2000 – 2023 with CKD as a direct cause | Minnesotans who died 2000 – 2023 with CKD as a contributing cause |
|---|---|---|---|
| **Age** | | | |
| 18-44 | 45,415 | 91 (0.20%) | 802 (1.8%) |
| 45-64 | 151,318 | 686 (0.45%) | 6,350 (4.2%) |
| 65+ | 751,351 | 6,315 (0.84%) | 65,807 (8.6%) |
| **Race** | | | |
| American Indian/Alaskan Native | 11,346 | 107 (0.94%) | 1,054 (9.2%) |
| Asian | 9,564 | 157 (1.6%) | 1,498 (15.7%) |
| Black | 26,172 | 354 (1.3%) | 3,095 (11.8%) |
| Native Hawaiian/ Pacific Islander | 383 | 4 (1.1%) | 20 (5.2%) |
| White | 887,155 | 6,328 (0.71%) | 66,333 (7.4%) |
| **Education** | | | |
| Did not graduate high school | 204,835 | 1,019 (0.50%) | 8,032 (3.9%) |
| Graduated high school | 487,024 | 1,870 (0.38%) | 20,923 (4.3%) |
| Graduated college | 197,297 | 496 (0.25%) | 6,718 (3.4%) |
| Advanced degree | 41,303 | 196 (0.47%) | 2,150 (5.2%) |

## Table 2: CKD as a direct or contributing cause of death has increased from 2000 through 2023

| Time Period | Total Deaths | CKD Direct Deaths | CKD Contributing Deaths |
|---|---|---|---|
| 2000 - 2004 | 176,714 | 1,070 (0.61%) | 5,592 (3.2%) |
| 2005 - 2009 | 176,156 | 1,135 (0.64%) | 6,048 (3.4%) |
| 2010 - 2014 | 190,812 | 1,609 (0.84%) | 12,713 (6.7%) |
| 2015 - 2019 | 209,818 | 1,841 (0.88%) | 21,960 (10.5%) |
| 2020 - 2023 | 194,584 | 1,437 (0.74%) | 26,646 (13.7%) |

## Table 3: CKD as a contributing cause where stroke, heart disease, or diabetes is the direct cause of death is increasing over time

| Time Period | Stroke Deaths with CKD | Heart Disease Deaths with CKD | Diabetes Deaths with CKD |
|---|---|---|---|
| 2000 - 2004 | 175 (1.4%) | 2,538 (3.9%) | 560 (11.8%) |
| 2005 - 2009 | 155 (1.5%) | 2,199 (4.5%) | 654 (12.0%) |
| 2010 - 2014 | 357 (3.5%) | 4,354 (9.2%) | 1,369 (24.4%) |
| 2015 - 2019 | 741 (6.9%) | 7,622 (14.9%) | 2,273 (35.6%) |
| 2020 - 2023 | 907 (10.1%) | 9,135 (20.4%) | 2,316 (39.4%) |

## Table 4: CKD as a direct or contributing cause of death by race for 2020 – 2023

| Race | Total Deaths | CKD Direct Deaths | CKD Contributing Deaths |
|---|---|---|---|
| American Indian/ Alaskan Native | 3,555 | 29 (0.82%) | 405 (11.4%) |
| Asian | 4,055 | 52 (1.3%) | 741 (18.3%) |
| Black | 8,037 | 83 (1.0%) | 1,194 (14.9%) |
| Native Hawaiian/ Pacific Islander | 49 | 1 (2.0%) | 10 (20.4%) |
| White | 177,322 | 1,264 (0.73%) | 24,145 (13.7%) |

## Table 5: Higher Education level means lower CKD as a direct or contributing cause of death from 2020 – 2023

| Education Level | Total Deaths | CKD Direct Deaths | CKD Contributing Deaths |
|---|---|---|---|
| Did not graduate high school | 24,079 | 217 (0.90%) | 3,788 (15.7%) |
| Graduated high school | 109,240 | 794 (0.73%) | 15,210 (13.9%) |
| Graduated college | 46,594 | 327 (0.71%) | 5,767 (12.4%) |
| Advanced degree | 12,713 | 75 (0.59%) | 1,606 (12.6%) |

## Table 6: Higher Social Vulnerability Index score is linked to worse health outcomes in 2022

| SVI Quartile | Total Deaths | CKD Direct Deaths | CKD Contributing Deaths |
|---|---|---|---|
| Q1 (Least vulnerable) | 2,146 | 15 (0.70%) | 230 (10.7%) |
| Q2 | 7,108 | 62 (0.87%) | 1,030 (14.4%) |
| Q3 | 12,454 | 103 (0.83%) | 1,723 (14.2%) |
| Q4 (Most vulnerable) | 26,791 | 209 (0.78%) | 1,704 (14.1%) |