Leukemia Mortality in the United States and Wisconsin from 1999-2016

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Abstract:

Background: Leukemia is the tenth most common cancer in the United States, and there were 22,840 leukemia-related deaths in 2019.

Methods: We examined differences and trends in leukemia mortality by age, gender, race, and ethnicity in Wisconsin from 1999-2016 using CDC WONDER.

Results: Overall mortality is slowly decreasing. Higher mortality rates were seen in men compared to women. Mortality increased with age. Whites had a higher mortality rate among racial groups. Mortality was higher in non-Hispanic or Latinx compared to those who identify as Hispanic or Latinx.

Discussion: The differences we found in mortality align with previous literature. Further study on leukemia might focus on survival or upstream factors rather than mortality due to leukemia having few modifiable risk factors.

Introduction

Leukemia is a broad term for cancers that affect the blood and bone marrow. Risk factors for leukemia include previous cancer treatment, genetic disorders, exposure to chemicals such as benzene, smoking, and a family history of leukemia.[1] Leukemia is the tenth most common cancer in the United States and represents 3.5% of all new cases of cancer.[2] In 2019, there were 61,780 new cases of leukemia and 22,840 leukemia-related deaths.[2] Over the last ten years, incidence rates for leukemia have remained stable. Mortality rates for leukemia decreased by 1.6% each year from 2007-2016. The five-year survival rate of leukemia has been gradually increasing since 1975.[2]

While leukemia is one of the most common childhood cancers, it occurs most often in older adults. The most frequently diagnosed age is between 65-74 years. Age-specific mortality rates occur most commonly in people ages 75-84. Men have a higher risk of leukemia compared to women. Among racial groups, White individuals have the highest risk of new leukemia cases and deaths followed by Blacks and Hispanics.[2] From 2013-2017, the highest death rates of leukemia occurred in North Dakota, South Dakota, Wisconsin, Missouri, Arkansas, Kansas, Oklahoma, Indiana, Kentucky, and West Virginia.[2] The objective of this study was to evaluate trends and racial and gender differences in leukemia mortality in Wisconsin from 1999-2016.

Methods

Data on leukemia mortality (ICD-10 codes C91-C95) in Wisconsin from 1999-2016 was obtained from the Centers for Disease Control and Prevention Wide-ranging Online Data for Epidemiologic Research (CDC WONDER).[3] To provide an overview of the epidemiology of leukemia in Wisconsin from 1999-2016, the number of deaths and age-adjusted mortality rates per 100,000 people were calculated using CDC WONDER. Leukemia mortality was further

stratified by age (<45, 45-64, and 65+ years), race (White, Black, Native American/Alaskan Native (NA/AN), and Asian/Pacific Islander (A/PI)), ethnicity (Hispanic/Latinx or not), and gender (male or female). When comparing rates, relative risk ratios and 95% confidence intervals were calculated to show differences between groups and determine statistical significance.

Results

According to CDC WONDER, Wisconsin has one of the highest age-adjusted leukemia mortality rates (≥7.5/100,000) compared to other states in the U.S. (**Figure 1**). In Wisconsin, the age-adjusted leukemia mortality rate decreased from 8.5/100,000 in 1999 to 6.9/100,000 in 2016. This decrease wasn't steady as the mortality rate fluctuated between increasing and decreasing during this time period. Compared to the overall age-adjusted leukemia mortality rate in the U.S., Wisconsin continues to have slightly higher rates over time (**Figure 2**). Males had a statistically significant higher age-adjusted leukemia mortality rate than females (males 95%CI: 10.2-10.7; females 95%CI: 5.7-6.1) and were 1.78 times as likely to die from leukemia as females were (**Table 1**). Leukemia mortality increased with age, with the greatest mortality rate among those 65 years or older. The relative risk was 5.5 times higher for people ages 45-64 years compared to those less than 45, and 47.2 times higher for people 65 or older compared to those less than 45.

Table 1 provides a breakdown of mortality rates among racial and ethnic groups. Native Americans/Alaskan Natives (NA/AN) appeared to have the highest age-adjusted mortality rate with a rate of 8.6/100,000 (95%CI: 6.1-11.7). But compared to the White rate of 7.9/100,000 (95%CI: 7.7-8.1), this difference was not statistically significant. The NA/AN population only makes up a small subset of the Wisconsin population, so this result could be due to the

differences in population size. Whites had a statistically significant greater age-adjusted mortality rate for leukemia than Blacks (6.4/100,000, 95%CI: 5.5-7.2) and A/PI (4.2/100,000, 95%CI: 2.9-5.7) populations. Those who identified as Hispanic or Latinx (4.3/100,000, 95%CI: 3.2-5.3) had a statistically significantly lower age-adjusted mortality than those who did not (7.9/100,000, 95%CI: 7.7-8.0).

Discussion

From 1999-2016, leukemia mortality rates have been declining throughout the U.S. and in Wisconsin. Data from the Surveillance Epidemiology, and End Results Program (SEER) showed a similar finding of decreasing age-adjusted leukemia mortality from 7.7/100,000 in 1999 to 6.2/100,000 in 2017 in the U.S.[2] This decline can be attributed in part to new therapies and treatments that are extending the lives of individuals living with leukemia. In 2001, the FDA approved tyrosine kinase inhibitor imatinib methylate as a first line treatment for chronic myeloid leukemia (CML), a leukemia that primarily affects older individuals. This new treatment raised the five-year survival rate of CML to almost 90% compared to 30% prior to this therapy.[4]

There are gender differences in leukemia mortality in Wisconsin. Men have a higher risk of leukemia mortality compared to women irrespective of race. Data from SEER also shows that the age-adjusted leukemia mortality rate per 100,000 in the U.S. is 8.6 for males and 4.8 for females, and this difference was consistent across all races.[2] In a review of gender differences in cancer susceptibility, Dorak et al. found that hematologic malignancies are more common among males and hypothesized that this could be due to differences in immunity, hormones, and genetic factors related to gender.[5] Furthermore, there are gender-related confounders such as smoking and occupational exposure that contribute to leukemia risk.[6]

In our study, we found racial and ethnic differences in leukemia mortality in Wisconsin. The non-Hispanic, White population is at highest risk for leukemia mortality compared to Hispanic, African American, A/PI, and NA/AN populations. This finding may be attributed to differences in incidence. Data from SEER show that White and Non-Hispanic male populations have the highest age-adjusted incidence rate per 100,000 at 19.2 and 18.6 respectively compared to other races and ethnicities. Age-adjusted leukemia mortality is subsequently higher in these two populations as well based on data from SEER.[2]

A strength of using CDC WONDER is that it provided mortality data across the U.S. and Wisconsin throughout the time period, allowing for direct comparisons. This data was accessible to the public free of charge, so data was collected with ease and in a timely manner. A strength of the data collected is that it supports the work in progress of research and development in decreasing mortality rates for a disease that currently has no cure. Another strength is the ability to analyze and stratify data of mortality rates by person, place, and time to identify population differences and trends. Using the SEER database provided access to a broader time period of data (before 1999 and after 2016) and for comparisons of incidence and prevalence to mortality.

Although leukemia is one of the more common types of cancer, it is still a relatively rare disease. A limitation of data collection for leukemia is that its annual mortality rate reports are typically low and unreliable. The accumulation of rates across years are needed in order to provide reliable data for certain groups that are being studied (e.g. Asian Americans or young adults). In addition to low mortality rates, there are many subtypes of leukemia. These heterogeneous disease types of leukemia have to be grouped together to get usable results, and these rates are still too small to hone in on specific counties, defaulting this analysis to a look at the overall state rather than specific areas within the state. Time is also a limitation of CDC

WONDER. Data is available for 1999-2016, making it difficult to analyze data prior to 1999 and after 2016.

There are various risk factors for leukemia, but with no identified direct cause, it is difficult to develop an effective prevention plan. Since there is little that can be done to change a person's family history or genetics, prevention can be focused on limiting environmental exposures. Despite the higher incidence of leukemia in Whites nationwide, one study found that Blacks have worse five-year survival rates and there are significant racial differences in survival.[6] Another study found that being Black, living in an area with high poverty, and Medicaid insurance status were independently associated with worse survival outcomes.[7] Since Blacks in Wisconsin already experience health disparities compared to their White counterparts, focusing on disparities that impact survival rather than mortality could be of greater interest for public health. A potential prevention plan could be to promote tobacco cessation and improve the environmental areas that people live and work in to limit exposures to pesticides and industrial chemicals.[8] Leukemia may have a lot of genetic and health history influences, but targeting upstream factors and eliminating disparities could potentially improve the chances of preventing leukemia.

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Table 1: Epidemiology of Leukemia in Wisconsin, 1999-2016. Age-adjusted to the 2000 U.S. population.

	# Deaths	Rate per 100,000 (Age Adjusted or Age-Specific)	95% CI	RR
Gender				
Male	4,989	10.5	10.2 - 10.7*	1.8
Female	3,801	5.9	5.7 - 6.1	1.0
Race (and/or Ethnicity)				
White	8,450	7.9	7.7 - 8.1	1.0
Black	244	6.4	5.5 - 7.2*	0.8
Native Am/Alaska Native	47	8.6	6.1 - 11.7	1.1
Asian/Pacific Islander	49	4.2	2.9 - 5.7*	0.5
Ethnicity				
Hispanic or Latinx	101	4.3	3.2 - 5.3*	0.5
Not Hispanic or Latinx	8,687	7.9	7.7 - 8.0	1.0
Age group				
<45	585	1.0	0.9-1.0	1.0
45-64	1,512	5.8	5.5-6.1*	5.5
65+	6,693	48.1	46.9 - 49.2*	47.2
**Statistically significant*				

Figure 1. Leukemia age-adjusted mortality rates, 1999-2016 in the United States. Age-adjusted to the 2000 U.S. population.

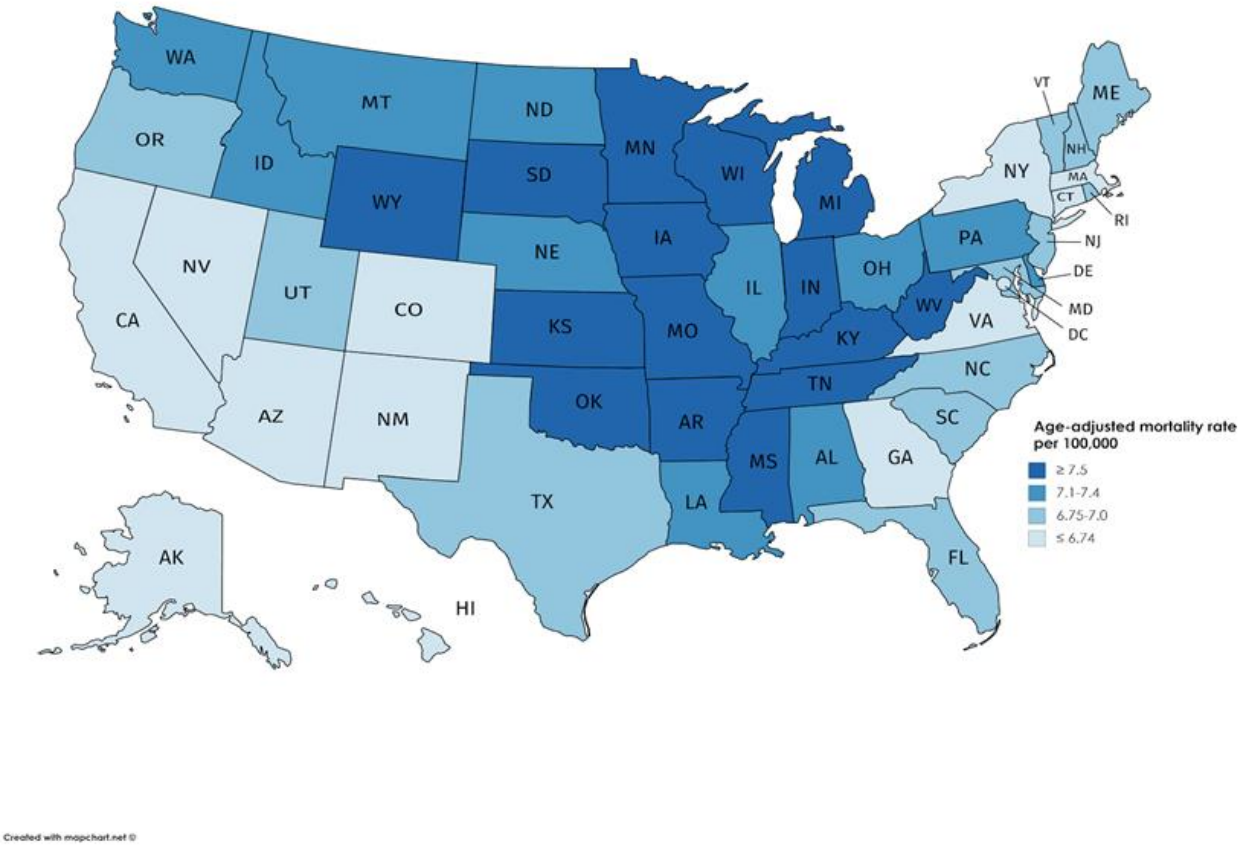

Figure 2. Leukemia age-adjusted mortality rates, 1999-2016 in the United States and Wisconsin. Age-adjusted to the 2000 U.S. population.