ARIMA prediction model for mortality caused by non-Hodgkin Lymphoma in the United States population up to the year 2050: A CDC WONDER Database analysis

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Background

Non-Hodgkin lymphomas are the eighth leading cause of cancer-related mortality in the United States. In this mortality database study of death certificates, obtained from a data registry spanning from 1999 to 2024, we examined mortality trends using national mortality datasets among individuals suffering from non-Hodgkin lymphomas in the United States.

Methods

In this retrospective study, our aim was to analyze these trends in mortality among US residents by demographic characteristics including gender, race/ethnicity, and geographic characteristics like urbanization and census region, and prediction of future years based on the existing data by Autoregressive Integrated Moving Average (ARIMA) forecasting modeling. The national mortality data from the multiple causes of death files in the CDC WONDER Database were queried by applying the ICD-10 codes as C82-C85 for non-Hodgkin to identify deaths among the US population from 1999 to 2024.

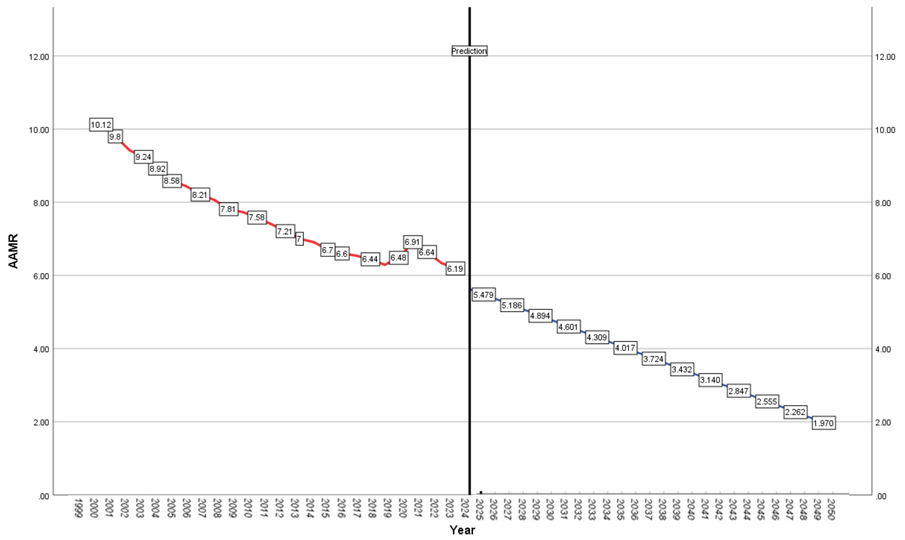
Conclusion:

These findings provide valuable insights into age-adjusted mortality patterns among the United States population with non-Hodgkin Lymphomas. Mortality rates are predicted to decline significantly among the US population with certain demographic and geographic characteristics such as females, Black Population, metropolitan areas, and those belonging to the Northeast region had lower future predictions of AAMR.

Results

There were a total of 670,831 deaths due to non-Hodgkin lymphomas in the United States from 1999-2024 with a crude mortality rate of 8.30 per 100,000 population with 56% of them being males and 44% females. Mortality rates (AAMR) continued to trend down from 1999-2024 overall (AAPC: -1.95[-2.07 to -1.86]), and in both genders but showed an increase from 2021 onwards with a significant APC rise during COVID-19 pandemic (2018->2021 with APC +2.45[1.08-3.09]). ARIMA predictive model shows a significant decline in mortality rates up to the year 2050 especially in the female gender (AAMR: 0.70), Black population (AAMR: 1.74), Northeast region (AAMR: 1.18), and metropolitan areas (AAMR: 0.42).

Figure 1: showing ARIMA prediction model for non-hodgkin's lymphoma mortality in United States.



Graphs/Data

Table 1: Autoregressive Integrated Moving Average (ARIMA) forecasting model for predicting age-adjusted mortality rates in non-Hodgkin lymphoma in United States.

Study variables	AAMR in 1999	Lowest AAMR (year)	AAMR in 2024 (provisionally)	Average Annual Percentage Change (AAPC)	ARIMA forecast prediction for 2050
Total	10.12	6.19 (in 2024)	6.19	-1.95 (-2.07 to -1.86)*	1.90
Gender					
Female	8.07	4.60 (in 2024)	4.60	-2.26 (-2.42 to -2.14)*	0.70
Male	12.95	8.20 (in 2024)	8.20	-1.79 (-1.94 to -1.66)*	3.30
Race					
White	10.56	6.60 (in 2024)	6.60	-1.87 (-1.99 to -1.77)*	2.30
Black	7.64	4.63 (in 2023)	4.70	-1.77 (-2.04 to -1.47)*	1.74
Hispanic	7.55	5.11 (in 2019)	5.38	-1.15 (-1.43 to -0.88)*	2.87
Asian or Pacific Islander	6.12	4.01 (in 2017)	4.21	-1.28 (-1.56 to -1.01)*	2.04
American Natives	5.73	3.76 (in 2022)	4.52	-1.46 (-2.13 to -0.72)*	2.22
Census Region					
Northeast	10.39	5.72 (in 2024)	5.72	-2.24 (2.41 to -2.07)*	1.18
Midwest	10.91	6.68 (in 2024)	6.68	-2.09 (-2.16 to -1.88)*	2.42
South	9.60	6.06 (in 2024)	6.06	-1.69 (-1.87 to -1.56)*	2.16
West	9.85	6.26 (in 2024)	6.26	-1.76 (-1.93 to 1.63)*	2.07
Urbanization†					
Metropolitan	10.17	6.20 (in 2019)	6.36 (in 2020)	-2.25 (-2.34 to -2.16)*	0.42
Non-metropolitan	9.90	6.82 (in 2019)	7.26 (in 2020)	-1.55 (-1.85 to 1.40)*	2.11

Mortality rates are presented as Age Adjusted Mortality Rates (AAMR) per 100,000 population.
†For urbanization, age-adjusted mortality rates are only available up to the year 2020.
* P-value for Join Point Quantile Regression significant at <0.05.

Figure 2: showing state-wise non-hodgkin's lymphoma mortality in United States.

