U.S. Myeloma Trends Report

2025-04-24

Overview

This report presents an extensive epidemiological analysis of multiple myeloma incidence trends across the United States from 1999 to 2021, focusing on both age group and state-level variations. Drawing on extensive surveillance data, the report provides statistical summaries, visualizations, and formal hypothesis testing to assess disparities and trends in disease burden.

This information serves as both an analytical summary and a reproducible reference for public health professionals, epidemiologists, and policymakers seeking to understand and address disparities in multiple myeloma incidence.

Two datasets are used in the analysis:

1. U.S. Myeloma Incidence Grouped by Year and Age Group

2. U.S. Myeloma Incidence Grouped by Year and State

Report Contents

1. **Trends Over Time and Age Groups**
   - Line graphs depicting the distribution of myeloma cases by age group and by year.
   - Histograms and faceted histograms to explore frequency distributions across age demographics.
   - Box plots comparing the spread and central tendency of myeloma cases across age groups.
   - Summary statistics to support descriptive insights.
2. **Heatmap Analysis**
   - A heatmap visualizing the relative myeloma incidence rates by age group and year to detect clustering patterns.
3. **State-Level Comparative Analysis**
   - Side-by-side box plots displaying the distribution of crude incidence rates across selected states.
   - Summary tables and visualizations from normality and variance testing (e.g., Shapiro–Wilk, Levene's Test).
   - Execution of appropriate hypothesis tests (e.g., Student's t-test, Welch's t-test, ANOVA, Kruskal–Wallis) based on data characteristics.
   - Post-hoc Tukey HSD analysis where applicable.
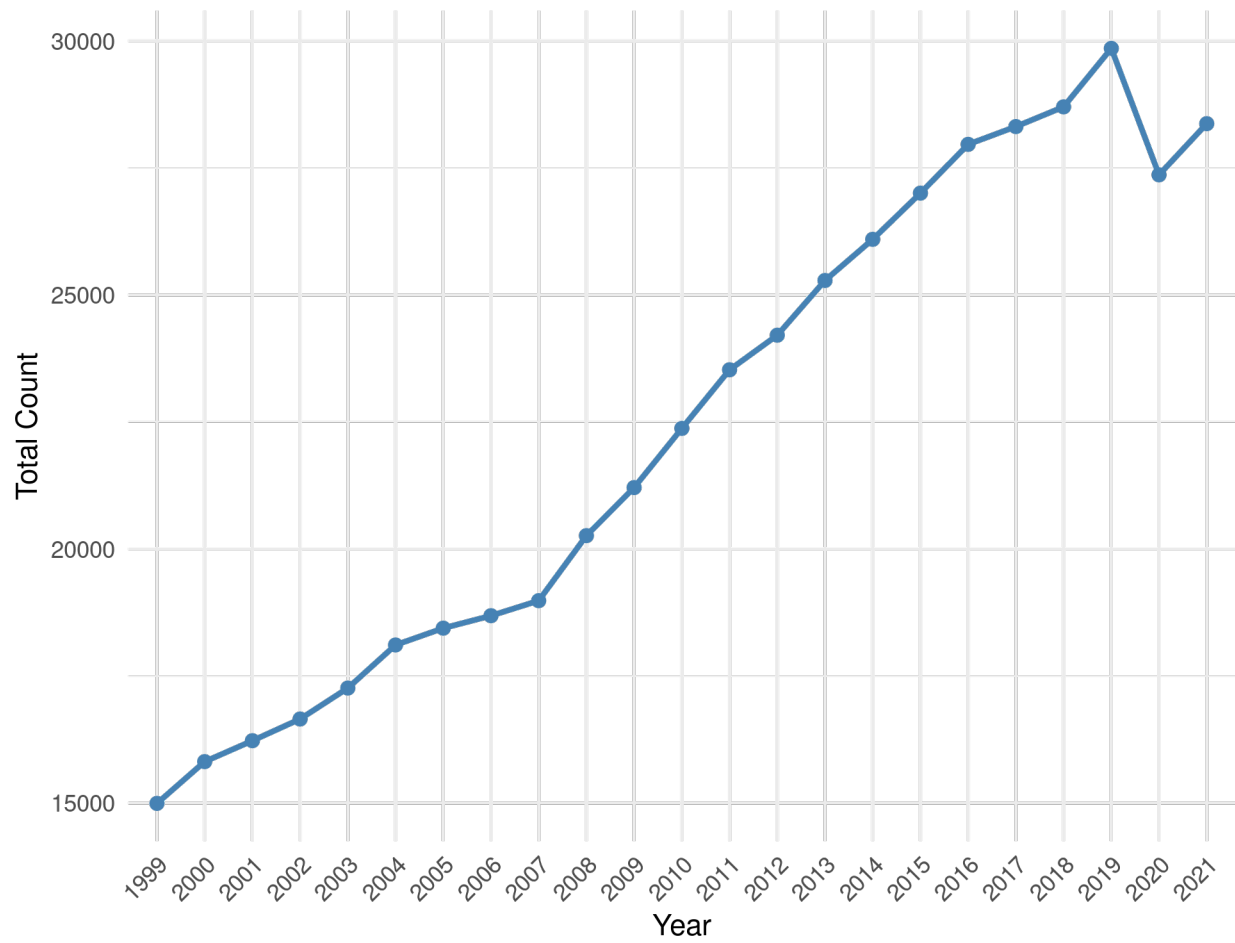4. **Decision Tree Visual Aids**
   - Visual guides outlining the decision-making process for selecting appropriate statistical tests based on data assumptions.

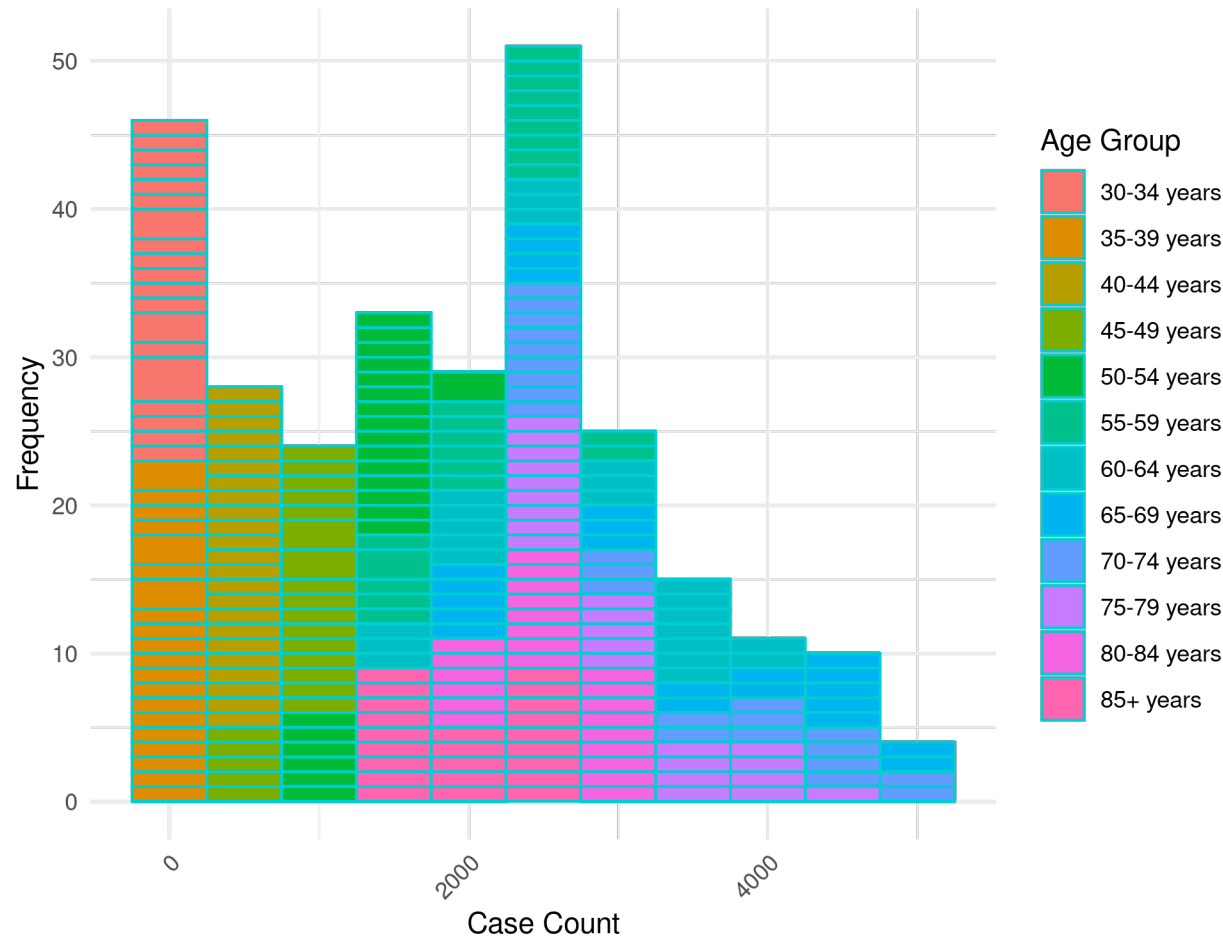# U.S. Myeloma Incidence Grouped by Year and Age Group
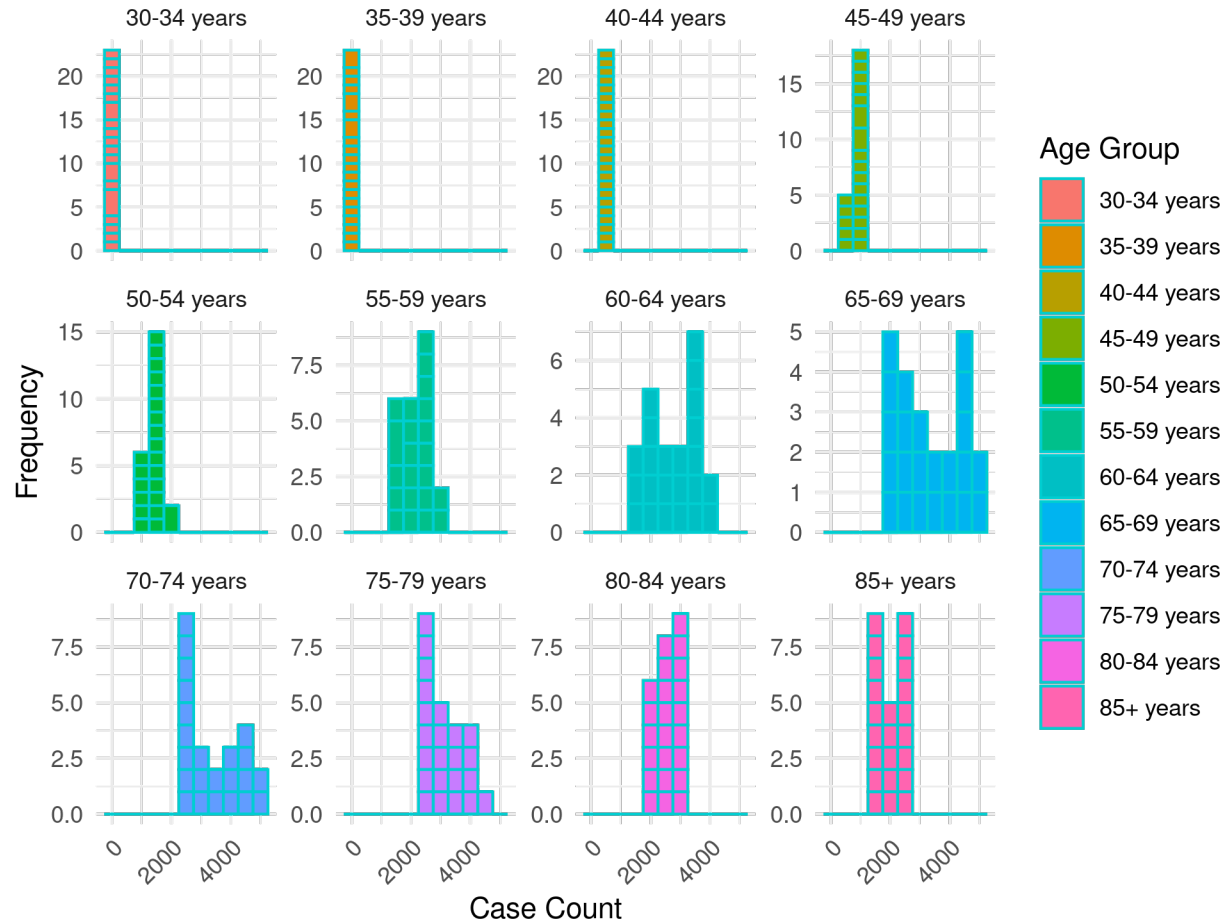
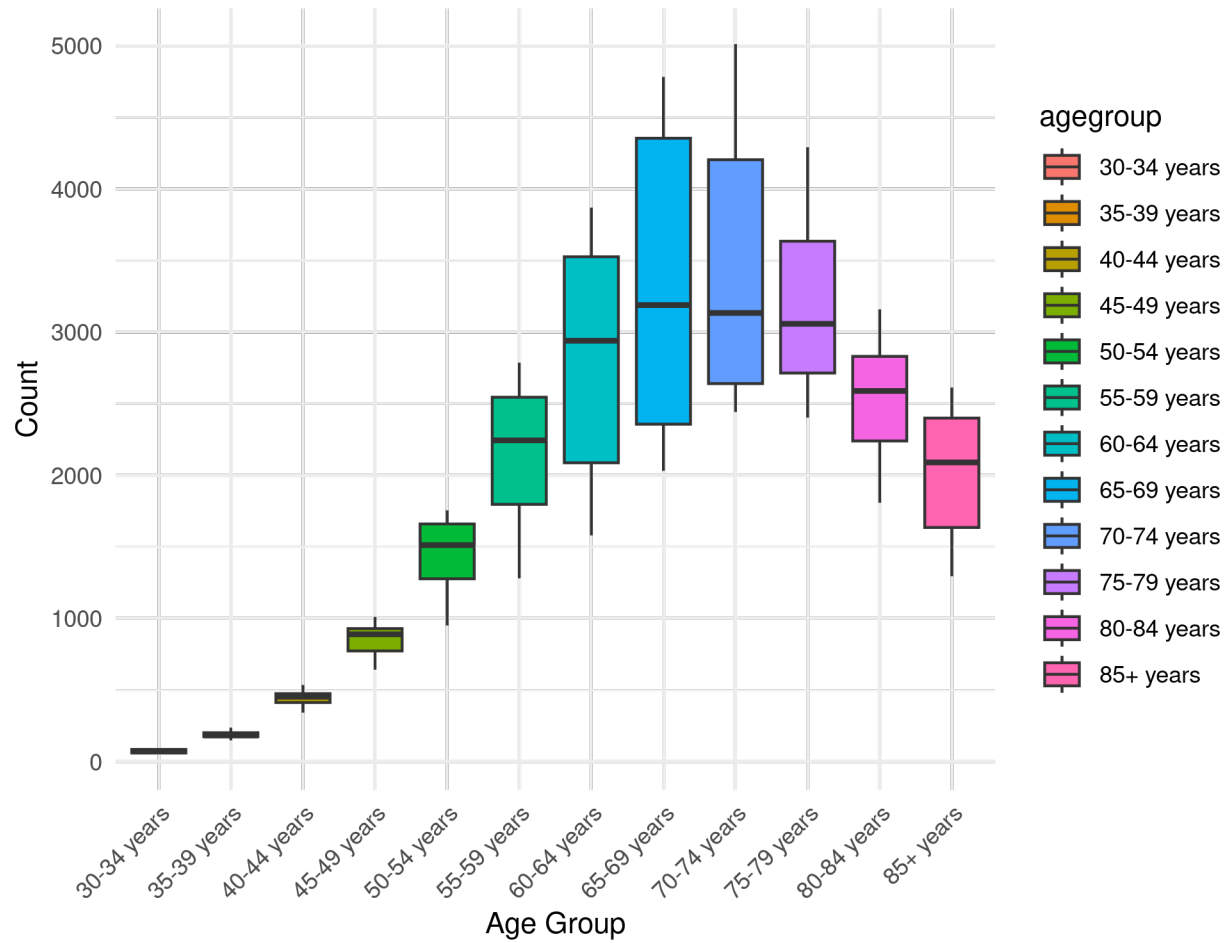**Line Graph: Myeloma Cases by Age Group**
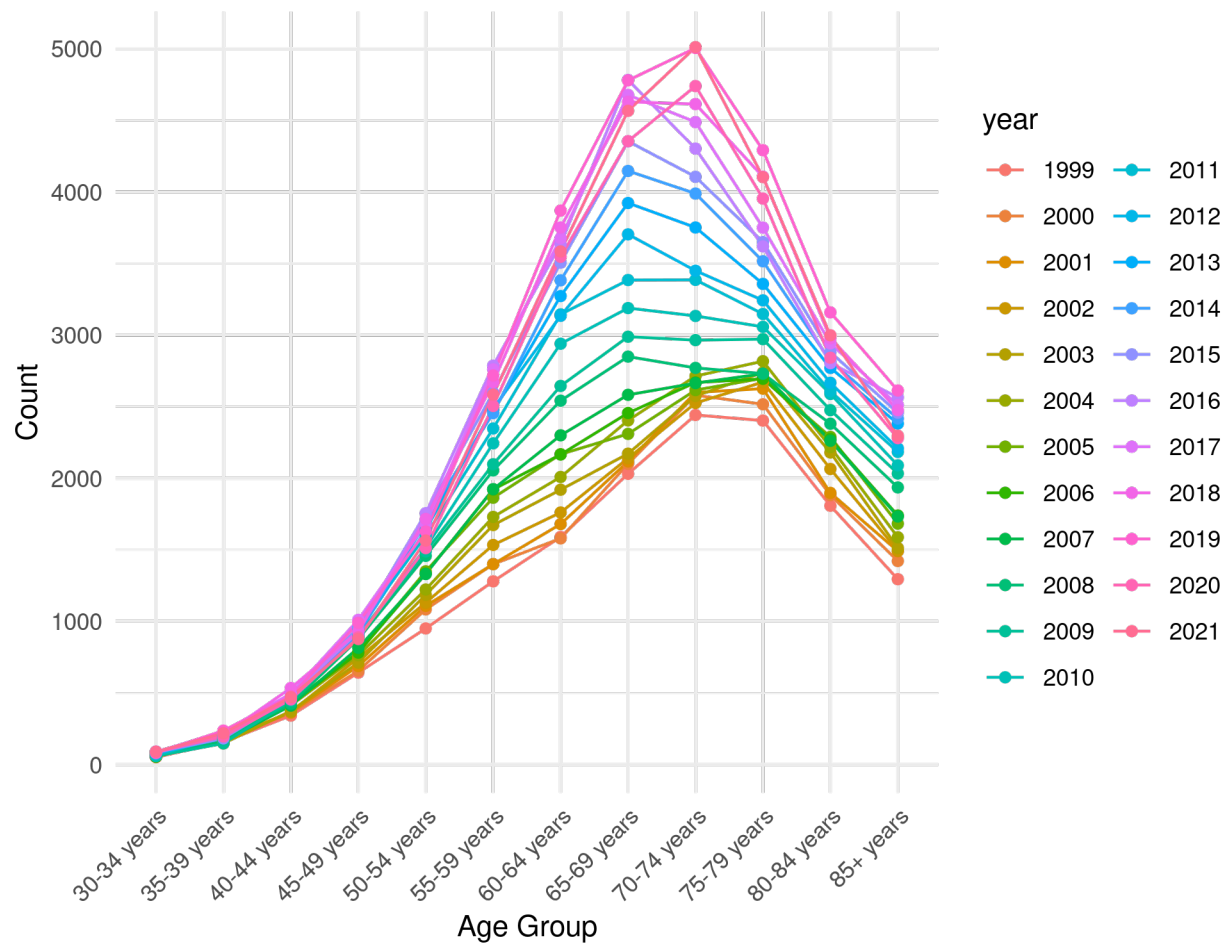
Line Graph: Myeloma Cases by Year

Histogram: Myeloma Cases by Age Group

Faceted Histogram: Myeloma Cases by Age Group

Side-by-Side Box Plots: Myeloma Cases by Age Group


Summary Statistics for Myeloma Cases by Age Group

Age Group	Mean	Median	Min	Max	SD
30-34 years	72.52	72	51	91	13.44
35-39 years	186.57	183	148	237	24.26
40-44 years	439.61	453	342	535	51.03
45-49 years	850.22	889	642	1011	108.30
50-54 years	1452.61	1512	951	1755	243.71
55-59 years	2152.39	2244	1280	2787	481.73
60-64 years	2774.35	2940	1580	3870	792.57
65-69 years	3332.57	3189	2031	4783	1034.02
70-74 years	3439.26	3134	2442	5012	901.34
75-79 years	3191.43	3058	2403	4292	575.98
80-84 years	2512.74	2589	1808	3159	395.59
85+ years	2017.83	2090	1295	2613	423.99

Heatmap of Myeloma Incidence Rates by Age Group
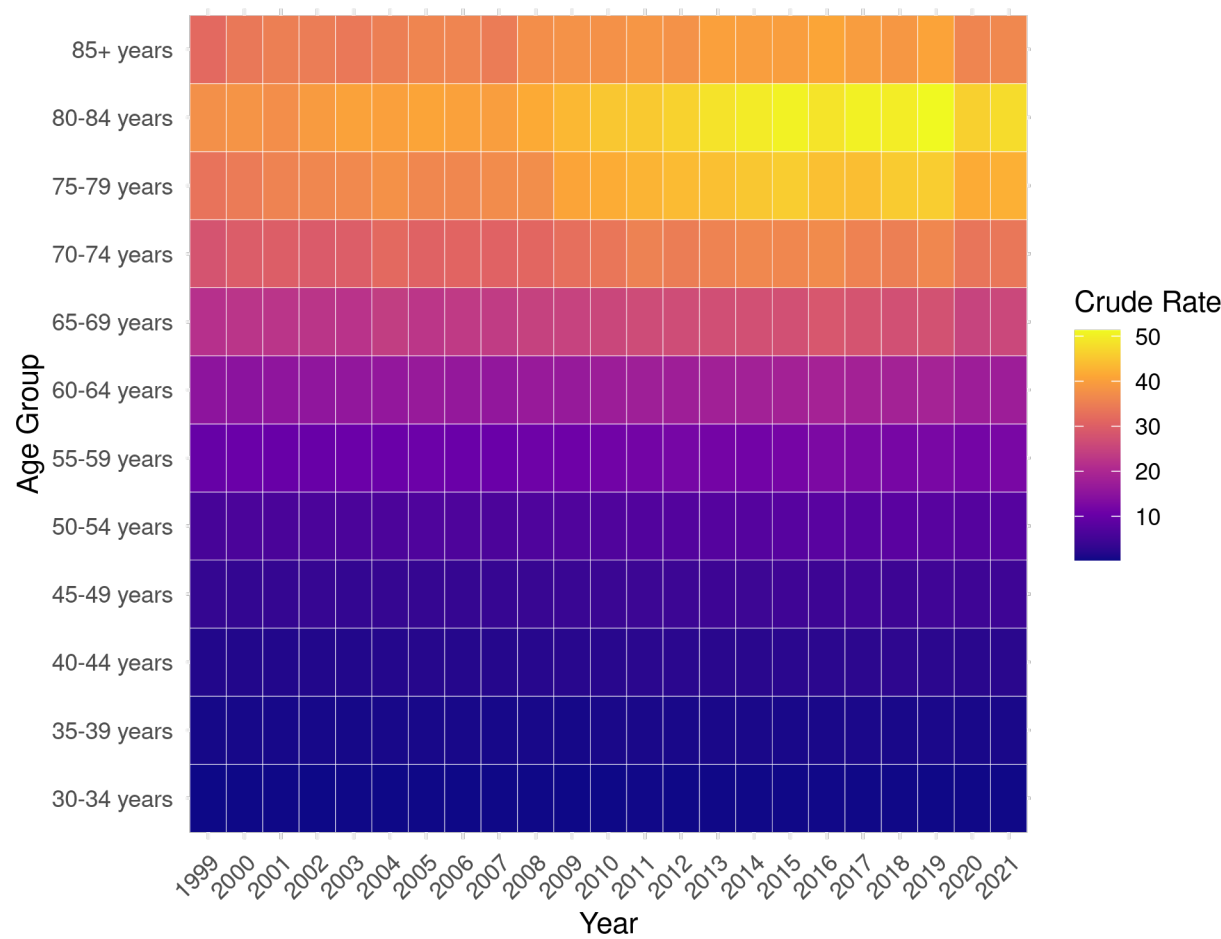
U.S. Myeloma Incidence Grouped by Year and State

Side-by-Side Box Plots: Myeloma Crude Rate Distributions by Selected States
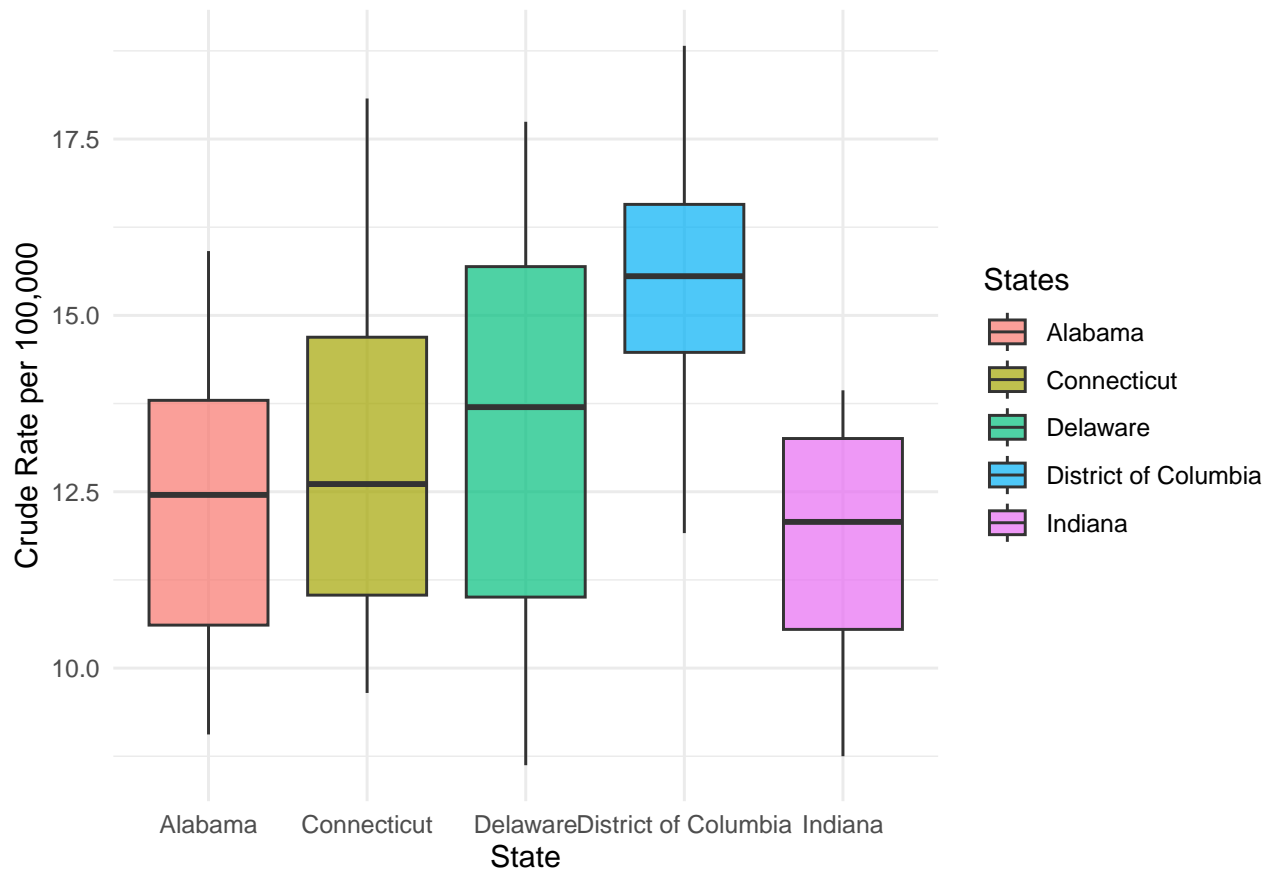
Normality, Variance, and Statistical Testing of Myeloma Crude Rates by State

Table 2: Shapiro-Wilk Normality Test by State

States	Shapiro-Wilk p-value
Alabama	0.4348
Connecticut	0.5010
Delaware	0.2430
District of Columbia	0.6644
Indiana	0.0640

Table 3: Levene's Test for Homogeneity of Variance

F.value	p.value
2.0531	0.092

Table 4: Main Hypothesis Test Results

Test	F.value	p.value
One-Way ANOVA	8.9072	0

Table 5: Tukey HSD Post-Hoc Results

Comparison	Mean Difference	Lower CI	Upper CI	Adjusted p-value
Connecticut-Alabama	0.6020	-1.1917	2.3958	0.8842
Delaware-Alabama	1.0230	-0.7707	2.8168	0.5119
District of Columbia-Alabama	3.0832	1.2895	4.8770	0.0001
Indiana-Alabama	-0.4930	-2.3290	1.3430	0.9453
Delaware-Connecticut	0.4210	-1.3728	2.2147	0.9661
District of Columbia-Connecticut	2.4812	0.6874	4.2749	0.0019
Indiana-Connecticut	-1.0950	-2.9310	0.7409	0.4662
District of Columbia-Delaware	2.0602	0.2665	3.8540	0.0158
Indiana-Delaware	-1.5160	-3.3520	0.3200	0.1558
Indiana-District of Columbia	-3.5762	-5.4122	-1.7402	0.0000

Decision Trees for Statistical Test Selection Based on Normality and Variance Assumptions

Two-State Decision Tree

Multi-State Decision Tree