

By: Hannah Wang, Jerry Zhang, Brian Yoon and William Chen





COVID-19 TOPIC

- COVID-19 is an infectious disease discovered in Wuhan, resulting in the 2020 pandemic outbreak.
- Personal and familial experiences with COVID-19 short-term and drastic long-term symptoms.
- Over 1.1 million deaths in U.S. and 86 million people worldwide.

RESEARCH QUESTION: What is the relationship between age groups and COVID-19 mortality rates in the United States over time, and how have these rates evolved from the start of the pandemic until June 28, 2023?





OUR DATASET

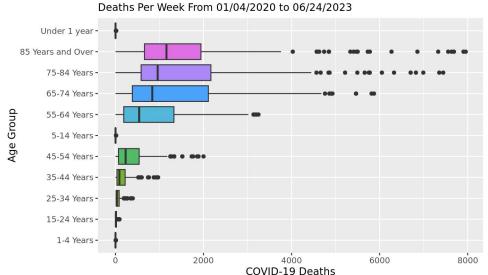
A tibble: 2,002 × 8

| Data as of <chr></chr> | State <chr></chr> | MMWR Week <dbl></dbl> | End Week <chr></chr> | Sex <chr></chr> | Age Group <chr></chr> | Total Deaths <dbl></dbl> | COVID-19 Deaths <dbl></dbl> |
|---------------------------|----------------------|--------------------------|-------------------------|--------------------|--------------------------|---------------------------------|--------------------------------|
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | Under 1 year | 403 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 1-4 Years | 79 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 5-14 Years | 99 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 15-24 Years | 605 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 25-34 Years | 1261 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 35-44 Years | 1771 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 45-54 Years | 3284 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 55-64 Years | 7936 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 65-74 Years | 11789 | 0 |
| 06/28/2023 | United States | 1 | 01/04/2020 | All Sex | 75-84 Years | 14546 | 0 |

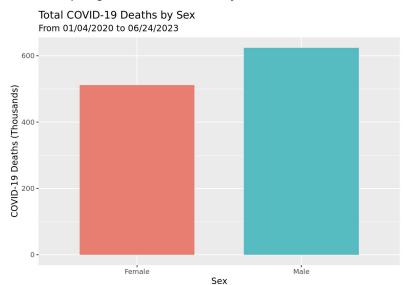
- The data in this data set is collected and updated every week and covers information within all 50 states of the USA and the District of Columbia.
- Sourced from the CDC's National Center for Health Statistics (NCHS, 2023).

EDA Highlights

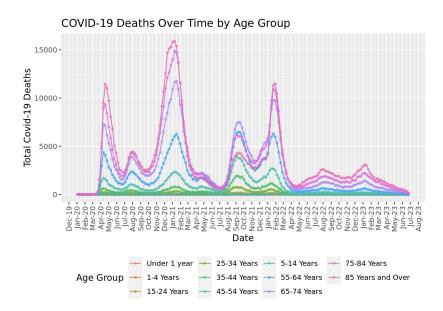


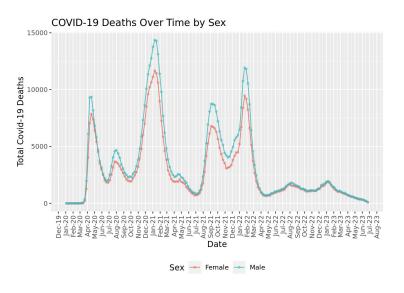


Bar Plot comparing women and men mortality



EDA Highlights Cont.





The line plot showing the relationship between covid-19 deaths of males compared to females illustrates consistently higher number of deaths among males over time.

Models and Other Analysis

Table of coefficients for easier visualization:

Term

Male

Age Group 85 Years and

Over:Sex Male

Coefficient

-198.97253

 $\begin{array}{c} {\rm COVID-19\,Deaths} = 0.70330 \\ +5.98352 \cdot {\rm AgeGroup_{15-24}} + 25.41758 \cdot {\rm AgeGroup_{25-34}} \\ +62.17033 \cdot {\rm AgeGroup_{35-44}} + 141.42308 \cdot {\rm AgeGroup_{45-54}} \\ +0.63187 \cdot {\rm AgeGroup_{5-14}} + 337.03297 \cdot {\rm AgeGroup_{55-64}} \\ +570.49451 \cdot {\rm AgeGroup_{65-74}} + 717.50549 \cdot {\rm AgeGroup_{75-84}} \\ +944.03297 \cdot {\rm AgeGroup_{85+}} + 0.55495 \cdot {\rm AgeGroup_{75-84}} \\ +0.09890 \cdot {\rm Gender} + 3.02198 \cdot {\rm AgeGroup_{15-24}} \cdot {\rm Gender} \\ +15.27473 \cdot {\rm AgeGroup_{25-34}} \cdot {\rm Gender} + 38.73626 \cdot {\rm AgeGroup_{35-44}} \cdot {\rm Gender} \\ +106.48901 \cdot {\rm AgeGroup_{45-54}} \cdot {\rm Gender} - 0.02747 \cdot {\rm AgeGroup_{5-14}} \cdot {\rm Gender} \\ +197.43956 \cdot {\rm AgeGroup_{55-64}} \cdot {\rm Gender} + 258.33516 \cdot {\rm AgeGroup_{65-74}} \cdot {\rm Gender} \\ +194.54945 \cdot {\rm AgeGroup_{75-84}} \cdot {\rm Gender} - 198.97253 \cdot {\rm AgeGroup_{85+}} \cdot {\rm Gender} \\ +0.14286 \cdot {\rm AgeGroup_{-1}} \cdot {\rm Gender} \end{array}$

$$ext{Gender} = egin{cases} 1 & ext{if Male} \ 0 & ext{if Female} \end{cases}$$

Separate linear regression models were constructed for age and sex.

Additive Model AIC: 60474.25 Interaction Model AIC: 60423.79

Lower AIC for the interaction model indicates an important interaction effect.

| ieiii | Coefficient | Term | Coefficient |
|-----------------------------------|-------------|-----------------------------------|-------------|
| Intercept | 0.70330 | Age Group 55-64 Years | 337.03297 |
| Age Group 15-24 Years | 5.98352 | Age Group 65-74 Years | 570.49451 |
| Age Group 25-34 Years | 25.41758 | Age Group 75-84 Years | 717.50549 |
| Age Group 35-44 Years | 62.17033 | Age Group 85 Years and Over | 944.03297 |
| Age Group 45-54 Years | 141.42308 | Age Group Under 1 year | 0.55495 |
| Age Group 5-14 Years | 0.63187 | Sex Male | 0.09890 |
| Age Group 15-24 Years:Sex Male | 3.02198 | Age Group 35-44 Years:Sex Male | 38.73626 |
| Age Group 25-34 Years:Sex Male | 15.27473 | Age Group 45-54 Years:Sex Male | 106.48901 |
| Age Group 5-14 Years:Sex Male | -0.02747 | Age Group 55-64 Years:Sex Male | 197.43956 |
| Age Group 65-74 Years:Sex | 258.33516 | Age Group 75-84 Years:Sex | 194.54945 |

Male

Age Group Under 1 year:Sex

Interaction Model

Term

Coefficient

0.14286

CONCLUSION AND LIMITATIONS

- Age appears to have a significant impact on COVID-19 deaths.
 - The higher the age group an individual is in, the higher their mortality likelihood.
- Effect of age group on deaths is different for males and females.
 - Males had a higher mortality rate.
- Applicable to vaccine research with emphasis on uncovering treatments for older individuals rather than focusing on gender related treatments.
- <u>Limitations</u>: underlying health conditions, behavioral impacts, socioeconomic status, country of collected dataset. Future work could explore these variables' impact on COVID-19 deaths.