

Death and Aging in the Time of Influenza: United States, 1960-2002

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Research Questions

- To examine the trends and changes in age distribution of influenza and pneumonia mortality by sex.
- How has the age distribution of flu mortality changed over the last four decades in the United States? How is this different during the 1968/69 pandemic year?
- What are the differences in age distribution of flu mortality between flu and non-flu seasons?
- What is the sex differential in flu mortality given the difference in life expectancy between men and women? How is this different during the pandemic year?

Background

- Influenza is a major cause of mortality in the United States.
- Recent discovery of new influenza strains in humans have spurred concerns around another influenza pandemic.
- Influenza pandemics occur when a new strain of influenza virus emerges in the human population and spreads rapidly. The last pandemic was in 1968/69.
- Though the flu primarily affects the elderly, some studies have shown that younger people die during pandemic years (Simonsen, 1997; Thompson, 2003).

Data

- Multiple Cause-of-Death Mortality Data (1959-2003), U.S. National Vital Statistics System, National Center for Health Statistics, Centers for Disease Control and Prevention
- Human Mortality Database, University of California, Berkeley and Max Planck Institute for Demographic Research (www.mortality.org)

Methods

- Calculate age-adjusted and age-specific flu death rates by sex. All mention of flu deaths in this poster refers to flu and pneumonia deaths.
- Fit a Brass relational logit model to observe the changes in α - and β -parameters over time. The changes in the parameters show the changes in survivorship and age distribution.

Results

- Age-adjusted flu mortality rates** were higher among men than women and showed a cyclical pattern (Figure 2).
- Age-specific mortality rates** over time reveal that flu mortality declined at all ages in the 1970's, though less in the older age groups (Figure 3).
- The Brass β** associated with flu mortality has been increasing over the past few decades for both sexes during flu and non-flu seasons (Figure 4). The increase was much greater than that for all-cause mortality.
- The expected drop in β for the 1968/69 pandemic year was observed during the non-flu season, but not during the flu season.
- The β parameters for females increased at a faster rate than those of the males.
- The Brass α** showed a declining trend in both sexes for flu and non-flu seasons (Figure 4), while the α for all-cause mortality showed an increase.
- The male α parameters were declining at a higher pace than those of females.
- A drop in α was observed during the pandemic year, indicating stronger mortality, but only during the flu season.

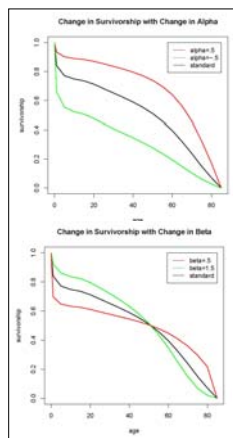


Figure 1. Change in survivorship with change in α and β parameters of the Brass logit model. The α is the 'level' parameter. A positive α means higher survivorship and weaker mortality. The β is the 'shape' parameter. β greater than one means better early survivorship compared to later adult survivorship. An increasing β means shifting of mortality into older ages.

Brass relational logit model:
 $Y_x = 0.5 \ln(l_x / (1 - l_x))$
 l_x = proportion surviving to age x
 The logits of l_x has a linear relationship such that:
 $Y_x = \alpha + \beta Y'_x$
 Y'_x = logits of the Brass standard
 α = level parameter
 β = shape parameter

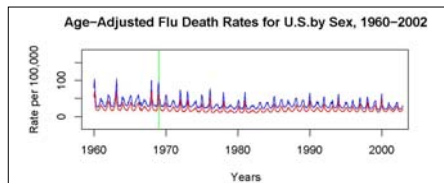


Figure 2. Age-adjusted flu death rates by sex, United States, 1960-2002 (adjusted for ICD code changes). The green line shows the 1968/69 pandemic.

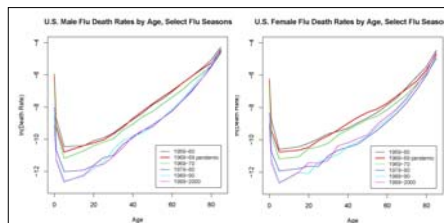


Figure 3. Age-specific flu mortality rates, United States, select flu seasons, 1960-2000.

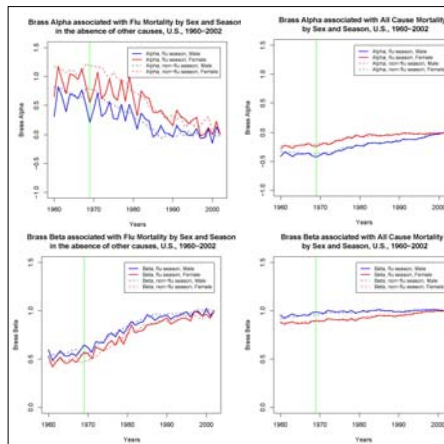


Figure 4. Brass parameters associated with all-cause mortality and flu mortality in the absence of other causes, U.S., 1960-2002. The α parameters for flu mortality showed a decline of 0.018 per flu season for males and 0.024 for females using the last flu season as the standard. A flu season was defined as December through March. Brass β for flu mortality showed an increase of 0.013 per flu season for males and 0.014 for females. Changes in non-flu seasons were similar. The green line indicates the 1968/69 pandemic year.

Discussion

- The 1968/69 flu pandemic did not kill more young people.**
 Contrary to previous studies, neither the Brass parameters nor the age-specific mortality rates showed that the age distribution of flu mortality shifted to younger age groups during the 1968/69 pandemic. The age-specific death rates were similar to those observed in 1959/60 and 1969/70 flu seasons.
- Flu mortality is not increasing at older ages. Flu mortality declined at almost every age group in the 1970's.**

The age-specific mortality rates showed a decrease at almost every age but less so in the older ages. The results from Brass β indicate that flu mortality is shifting to older ages. The observed drop in Brass β is probably due to this disproportionate decrease in mortality among the younger population rather than an increase in mortality among the elderly.

What caused this decline? The decline is not likely to be due to increased vaccine coverage. Flu and pneumonia vaccine coverage showed no increase among persons 65 years of age or older during the 1970's except during the 1976/77 "swine flu" (MMWR, 1995). One reason for the decline may be the build up of natural immunity since the 1968/69 pandemic. However, re-introduction of the H1N1 strain in 1977 had no effect on the decline. Improved overall health care may also have contributed to the decline. The Brass α parameters contradict this trend. However, the Brass model may not have captured the correct pattern.

For More Information

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Acknowledgements

This project was initiated at the Young Scientists Summer Program at the International Institute for Advanced Systems Analysis (IIASA). Andrew Noymer and Landis MacKellar supervised this project. Andrew Noymer extracted the data from the Multiple Cause of Death data file. This project was made possible by funding from the National Academy of Sciences and the National Institute of Aging training grant #T32-AG000246-12.