A World of Mortality Issues and Insights Seminar
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Session 3 – Impact of Seasonality on Mortality

Presenter
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Mortality Seasonality

A World of Mortality Issues and Insights

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Mortality shows clear seasonal trends, which may significantly affect the distribution of deaths within a calendar year.

The magnitude of seasonal influences varies by a number of factors including age, cause of death, geography, and socio-economic status.

Some of the results may surprise you…

Seasonality:
The tendency for deaths to be correlated with seasonal weather patterns.

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Seasonality Myths

**Myth:** There are more heat-related deaths than cold-related deaths

**Reality:**
- Mortality rates are generally 10-20% higher in the winter months than in the summer months in developed countries.

**Grain of Truth:**
- Ancient periods often experienced more summer deaths.
- Younger ages and accidental causes of death often have higher mortality rates during the summer.
- Tropical or monsoon climates will have elevated mortality during wet seasons.
- Some researchers have theorized that global warming will lead to elevated mortality due to increased cases of heatstroke.
**Myth:** Excess deaths in the winter are only attributable to influenza

**Reality:**
- Most causes of deaths experience seasonal variations.
- Circulatory and respiratory causes of death are also a major contributor to adverse winter mortality.

**Grain of Truth:**
- Influenza is one of the most seasonal causes of death.
- Flu seasons that exceed the epidemic threshold will cause the magnitude of winter seasonality to be more severe than average.
- Influenza leads to compromised immune systems and often contributes to more serious conditions.

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**Myth:** Higher suicide rates around the holidays also play a role

**Reality:**
- Suicides only make up 1-2% of total deaths and actually peak during the spring and fall months.
- Research from the Mayo clinic showed no elevated risk of suicide over a 35 year period immediately before, during, or after Thanksgiving, Christmas, or New Year’s Day.
- Research from the Annenberg Public Policy Center shows that the media perpetuates this myth.

**Grain of Truth:**
- One specific form of depression, seasonal affective disorder, is strongly correlated with winter.
Myth: *Winter seasonality must mean people are “freezing to death”*

Reality:
- “Freezing to death” is more a colloquial turn of phrase than a significant medical epidemic.
- There are only about 300 hypothermia deaths reported per year.

Grain of Truth:
- There is technically a correlation between “freezing” weather (< 0° C) and elevated mortality.

Myth: *Colder climates experience worse winter mortality*

Reality:
- Warmer climates have more seasonal variations in mortality than cold climates.

Grain of Truth:
- None.
Evidence of Seasonality

Ancient Seasonality

- Mortality in Ancient Rome, Egypt, and other warm regions peaked in the summer.
- Younger ages were more susceptible to seasonal trends.
- One of the primary causes of death was malaria, which peaks during summer months.

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Seasonality in Modern US Population

Source: National Center for Health Statistics Multiple Cause-of-Mortality Files. Data compiled by RGA

Seasonality in US Population

- Mortality Indexed to average level
- Winter months 10-15% higher than average
- Summer months approximately 10% lower than average

Source: National Center for Health Statistics Multiple Cause-of-Mortality Files. Data compiled by RGA
Seasonality in US Population

Winter / Summer Ratio = 
(Total deaths in Jan, Feb & Mar) / (Total deaths in July, Aug & Sept)

- W/S Ratio provides simple metric to study seasonality as one number for entire period.
- Ratio of 1.2 means winter mortality is 20% higher than summer mortality.


Impact of winter seasonality increases by increasing age.
- Younger ages have excess mortality in summer.

Source: National Center for Health Statistics Multiple Cause-of-Death Files. Data compiled by RGA
Impact of winter seasonality increases by increasing age.
Younger ages have excess mortality in summer.

At first glance, females appear more susceptible to seasonality.
### Seasonality in US Population: by Gender

- Less differential by gender after controlling for age.
- Younger men have worse summer mortality.

*Source: National Center for Health Statistics Multiple Cause-of-Death Files. Data compiled by RGA.*

### Seasonality in US Population: Education Level

- Socio-economic factors influence susceptibility to seasonality.

*Source: National Center for Health Statistics Multiple Cause-of-Death Files. Data compiled by RGA.*
Seasonality in US Population: Education Level

- Socio-economic factors influence susceptibility to seasonality.

Seasonality in Population Data - 1999-2007 by Education Level Completed

Seasonality in US Population: Medical Causes of Death

- Seasonality varies significantly by cause of death.
- Most causes other than cancer show some seasonality.
Seasonality in US Population: Medical Causes of Death

- Seasonality varies significantly by cause of death.
- Most causes other than cancer show some seasonality.
- Seasonality is more pronounced at older ages.

Seasonality in Population Data - 1999-2007 by Cause of Death (MEDICAL CAUSES)

- Cardiovascular
- Cancer
- Pneumonia
- Other Respiratory
- Alzheimer’s
- Diabetes
- HIV
- Baseline

Source: National Center for Health Statistics Multiple Cause-of-Death Files. Data compiled by RGA


- Most non-medical causes of death have less seasonal influences.
- Obvious exceptions:
  - smoke/fire accidents (winter)
  - drowning (summer)

Seasonality in Population Data - 1999-2007 by Cause of Death (NON-MEDICAL CAUSES)

- Accident (Drowning)
- Accident (Falls)
- Accident (Motor Vehicle)
- Accident (Smoke / Fire)
- Suicide
- Homicide
- Other External
- Baseline

Source: National Center for Health Statistics Multiple Cause-of-Death Files. Data compiled by RGA
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Seasonality in Other Countries

- Warmer countries generally have more winter seasonality than colder countries.


Explanations for Seasonality

- Biomedical Factors
- External Factors
- Behavioral Factors
Cold temperatures allow bacteria to survive longer, which has adverse effects on immune system’s resistance against respiratory infections.

Social crowding facilitates the rapid spread of infectious diseases.

Cold air leads to coronary vasospasm, a condition where blood vessels spasm causing them to narrow.

Cold air also affects the composition of blood. Reduced levels of plasma cause the blood to be thicker.

Internal air pollution is more present during the winter due to central heating (smoke, sulfur dioxide, and carbon monoxide)

Respiratory diseases (small particles getting into the sensitive parts of the lungs)

Cardiovascular diseases (aggravating existing heart disease)

Access to nutrition is reduced during the winter.

Fresh fruits and vegetables provide good sources for vitamin C

UV radiation of the sun provides a synthesizable source of vitamin D.

Both have positive effects on cardiovascular disease, renal function, autoimmune disorders and infections (including the flu).

Air conditioning has reduced the susceptibility to summer seasonality.

Influenza vaccinations have reduced the effects of winter over time.
Explanations for Seasonality

Behavioral Factors

- Individuals with known CAD could be over-exerting themselves with winter activities such as shoveling snow.
- Normal exercise routines and eating habits may be altered during the winter.
- Some individuals may not properly prepare for the cold weather.

And just for fun…
Seasonality by Month of Birth

- Research supports the notion that life expectancies are also dependent on the season (or month) of birth.

Explanations for Seasonality by Month of Birth

- There may be critical periods early in human life sensitive to seasonal variations.
- “Selective survival” for infants who survive during more difficult months.
- Nutrition of the mother or other pre-natal influences.
- Social factors that are closely related to a child’s birthday, such as the age that they enter school.
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