Session 9: Trends in Causes of Death

Moderator:  
Jim Miles

Presenters:  
Travis Short  
Brian Ivanovic
Causal drivers of future mortality trend

Dr. Brian Ivanovic
Agenda

Selection and disease burden
Recent and future trends in COD proportions
Thoughts on the future
The impact of selection on disease burden in life applicants and policyholders
Chronic disease burden in the population, applicants and insured groups

Both self selection and traditional objective biometric risk selection have been shown to significantly drive down prevalent disease in policyholders.

These two processes influence the ultimate cause of death patterns that will emerge in the policyholder group.

1. Medical problems self-reported or identified during the life underwriting process: direct business 1995-2004
## Risk for new disease in the general population vs. applicants/policyholders

Rates of incident disease are also lower in policyholders because the underwriting process objectively screens for and assesses the risk associated with various levels of key health risk factors.

The reduction of prevalent disease in policyholders and effect of lowering future disease incidence influence the ultimate cause of death patterns that will emerge in the policyholder group.

### Rates of incident disease

<table>
<thead>
<tr>
<th></th>
<th>US Pop 2004</th>
<th>Applicants</th>
<th>Policyholders</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Obesity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-44</td>
<td>21.7%</td>
<td>13.6%</td>
<td>12.2%</td>
</tr>
<tr>
<td>45-64</td>
<td>28.5%</td>
<td>18.1%</td>
<td>15.9%</td>
</tr>
<tr>
<td>65-74</td>
<td>27.5%</td>
<td>18.1%</td>
<td>15.2%</td>
</tr>
<tr>
<td>75+</td>
<td>16.6%</td>
<td>11.6%</td>
<td>9.9%</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-44</td>
<td>7.4%</td>
<td>3.6%</td>
<td>3.0%</td>
</tr>
<tr>
<td>45-64</td>
<td>30.5%</td>
<td>9.6%</td>
<td>8.2%</td>
</tr>
<tr>
<td>65-74</td>
<td>49.8%</td>
<td>20.6%</td>
<td>18.6%</td>
</tr>
<tr>
<td>75+</td>
<td>55.4%</td>
<td>28.3%</td>
<td>25.8%</td>
</tr>
<tr>
<td><strong>Smoking</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18-44</td>
<td>23.7%</td>
<td>13.8%</td>
<td>12.6%</td>
</tr>
<tr>
<td>45-64</td>
<td>22.4%</td>
<td>12.0%</td>
<td>10.4%</td>
</tr>
<tr>
<td>65-74</td>
<td>11.9%</td>
<td>6.4%</td>
<td>3.5%</td>
</tr>
<tr>
<td>75+</td>
<td>5.4%</td>
<td>5.5%</td>
<td>2.4%</td>
</tr>
</tbody>
</table>

1. BMI greater than or equal to 30 kg/m2
2. Persons told on 2+ office visits that they had htn, or HBP, to be classified as hypertensive. For applicants/policyholders a sbp>139 &/or dbp > 89
3. Current smokers have smoked at least 100 cigarettes in their lifetime and still currently smoke. For applicants/policyholders a positive cotinine.
4. Medical problems self-reported or identified during the life underwriting process: direct business 1995-2004
Income is a determinant in the level of risk factor burden observed in the population.

Monitoring for any divergence in risk factor trends could help explain widening gaps in mortality trend certain population subgroups.

Short term trends across most risk factor categories are fairly stable.

**Health risk factor burden by income level: 2011**

- **Not physically active**
- **Smoking**
- **Obesity**
- **Hypertensive**
- **Elevated cholesterol**

**Income groups for cholesterol**

- <$35K, $35-49.9K, $50-74.9K, $75-$99.9K, $100K+

**Income groups for cholesterol**


National Health Interview Survey

Behavioural Risk Factor Surveillance System
Self selection influences on prevalent and incident disease

Differences in the burden of disease between groups defined by income measures may contribute to differences in death rates by cause for certain conditions.

Differentials in the prevalence of diabetes by income category is a potential risk for increasing disparities in future cardiovascular disease rates between income groups.
Recent and future trends in COD proportions in population and insured groups
While we know the absolute death rates are much lower in insured groups we can still evaluate the proportional contribution of major COD's. In this more restricted age band (to better emulate the age distribution of insured business) CA (27.6%) and CVD (27.5%) proportions are basically the same in the general pop in 2013 which is a strong indication of the success we are having in reducing CVD deaths in the US.
Drivers of future trend

- **Pop**
  - Reduction/control of cardiovascular risk factors
  - Earlier cancer diagnosis/treatment progress
  - Obesity
  - Prescription drug abuse
  - Rise of neurodegenerative conditions as a COD (due to increased longevity)
  - Period effects

- **Insured**
  - Objective biometric underwriting of CV risk factors
  - Shift/evolution in underwriting
    - Declining utilization of objective health screens in underwriting
    - Increasing utilization of database driven underwriting
      - e-requirements
      - "scores" (aka predictive models)
    - Telemetric underwriting off of sensors ("body area network")

It’s the combo of the 2 that drive future insured COD trends
Possible deviation in CVD death rate declines between pop and insured

- A continued downward trend in CVD deaths is a dominant feature in the general population and has benefited mortality trend in both pop and insured groups.

- There is a deviation in the proportional trends noted for CVD deaths between population and insured.
  - Observed in internal Swiss Re studies of reinsured business
  - Same pattern noted in industry COD studies of higher face business\(^1\)

- Because declines in CVD deaths are likely a strong contributor to both pop and insured trend this could influence the future rate of mortality improvement in insured groups.

1. SOA High face amount mortality study 2012
Pop vs insured trends for other COD’s

- Cancer proportional trends flat in pop and insured studies (but CA proportion higher in insured)

- For accidental and respiratory deaths degree of similarity in proportions between pop and insured tied to nature of underlying business
  - Direct business: higher accidental and lower respiratory proportions in insured vs pop
  - Reinsured business: proportions for these 2 COD’s are more similar to population proportions (higher proportion of substandard business)

- Published industry studies
  - A more variable but declining trend of accidental deaths noted in industry studies of higher face business
  - A more variable but rising trend of respiratory deaths noted in industry studies of higher face business

1. SOA High face amount mortality study 2012
Drivers of future trend
Drivers of future insured COD trends.

- Population
  - Changes in health risk factor burden
  - Improvements in chronic disease management

- Target market
  - What effect will increased penetration of new applicant markets have on COD trends. If the population demographics change the underlying disease burden and health risks in groups also will change?

- Underwriting
  - Will long term losses of functional cardiovascular testing be offset by new underwriting tools (ex. NT-proBNP)?
  - What effect will predictive models have on COD patterns? Consider the prior relationships between SES and prevalent disease and health risk factors. Also need to consider model performance against the performance of what those models are replacing (changes in the permeability of underwriting)?
©2015 Swiss Re. All rights reserved. You are not permitted to create any modifications or derivative works of this presentation or to use it for commercial or other public purposes without the prior written permission of Swiss Re.

The information and opinions contained in the presentation are provided as at the date of the presentation and are subject to change without notice. Although the information used was taken from reliable sources, Swiss Re does not accept any responsibility for the accuracy or comprehensiveness of the details given. All liability for the accuracy and completeness thereof or for any damage or loss resulting from the use of the information contained in this presentation is expressly excluded. Under no circumstances shall Swiss Re or its Group companies be liable for any financial or consequential loss relating to this presentation.
Trends in Cause of Death

C.O.D. Reliability and Cause Specific Mortality Observations

Travis Short, ASA, MAAA
Example COD on a Death Certificate

1. ACUTE CONGESTIVE HEART FAILURE
   DUE TO, OR AS A CONSEQUENCE OF
   (b) LETHAL LEVELS OF POTASSIUM CHLORIDE
   DUE TO, OR AS A CONSEQUENCE OF
   (c) LETHAL INJECTION

PART II. Other significant conditions contributing to death but not resulting in the underlying cause given in PART I.

NATURAL, ACCIDENT, HOMICIDE, SUICIDE, UNDETERMINED, (SPECIFY)
20a. HOMICIDE
20b. MAY 10, 1994
20c. 12:17 A.M.
20d. 20a. NO
20e. STATE PRISON
20f. LOCATION (CITY, VILLAGE OR TOWN, OR TWP., OR RD, DIST. NO., COUNTY, STATE)

AUTOPSY (YES NO)
19a. YES
19b. YES

WHY AUTOPSY PERFORMED (SPECIFY)

HOW INJURY OCCURRED (SPECIFY)

victim injected with lethal drugs per judicial order
COD Reliability

- COD reliability varies with age and cause

- Autopsies
  - Rates have declined over time: estimated 40-60% prior to 1970’s; ~5% recently (2014).

- NYC – Improving COD Reporting
  - 2008 Publication on improving accuracy of COD reporting in response to known over-reporting of cardiovascular deaths.
  - Intervention at 8 NYC hospitals with high heart disease deaths led to a decrease in proportion of heart deaths reported (shown right).
  - Non-intervention hospitals heart deaths decreased from 26.6% to 24.4% in the same period.
  - 2012 Update with additional guidelines.
Trends vs Changes in COD Specificity – Two Examples

Cancer Specificity Issues
(from Technologies for Determining Cancer Risks from the Environment)

- Improper diagnosis
- Improvements in ascertainment
- Primary site not specified
- Incorrect primary site
- Incomplete transfer of information to death certificate
- Increased access to medical care and changes in diagnosis

Falls in Older Ages
(A) Unintentional injury, age 65+
Capturing Cause of Death in Insurance Claims

<table>
<thead>
<tr>
<th>Direct Company</th>
<th>Reinsurer</th>
<th>What is captured?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cause of Death Capture</td>
<td>Certificate Provided to Reinsurer</td>
<td>Underlying cause only</td>
</tr>
<tr>
<td>Record COD captured by direct company</td>
<td>Capture directly from death certificate</td>
<td></td>
</tr>
</tbody>
</table>
John Doe; Male
DOB: 1/1/56; DOD: 2/5/2012
G COD: Neoplasms  T COD: Circulatory

• G = Generali USA Life Re
• T = Transamerica Re
Cause-Specific Mortality Observations
from SCOR Global Life’s U.S. Reinsurance Experience

Unless specified otherwise:
Calendar Years 2006-2012
Policy Face Amounts 100K-4.9M
By Count
Excludes SI, GI, Post-Level Term, Substandard

A/E ratios relative to 2014VBT
Three Ways to Analyze Cause of Death

(by Count)

Proportion of Total

- Cancer: 39.2%
- Circulatory: 18.8%
- Respiratory: 15.4%
- External: 21.7%
- Other/Unspecified: 4.9%

Cause Specific Death Rate per 100K

- Cancer: 60.0
- Circulatory: 30.0
- Respiratory: 10.0
- External: 20.0
- Other/Unspecified: 40.0

Cause Specific A to E

- 2014 VBT: A/E
Trend by Calendar Year: Males

14VBT A/E by Count; Dur 3+; Iss Ages 18+; Att Ages 18-79
Trend by Calendar Year: External Causes Males

- Suicide
- MVA
- Aviation
- Homicide
- Drowning
- Accidental Drugs / Poisoning
- External Other

14VBT A/E by Count; Dur 3+; Iss Ages 18+; Att Ages 18-79
Trend by Calendar Year: External Causes Females

- Suicide
- MVA
- Aviation
- Homicide
- Drowning
- Accidental Drugs / Poisoning
- External Other
by Issue Age Group: Males

Cancer  Circulatory  Respiratory  Suicide  MVA  Aviation  Homicide  Drowning  Accd. Drugs / Poison  External Other  Other / Unspecified

18-39  40-49  50-59  60-69  70-79

14VBT A/E by Count; Dur 1-15
References