Critical Illness
Widening the search

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Gen Re
Contents

• An overview of CI
• Importance and difficulties of analysis
• Some UK experience
• Our own experience
• Model fitting and results
• Concluding Remarks
First Product

- **Company**: Crusader Life
- **Reinsurer**: Cologne Re
- **Developer**: Dr. Marius Barnard
- **Aim**: “Repair the finances of an individual”
- **First sale**: 1983
- **First claim**: 1 December 1984
Historic development & evolution

- First product covered 4 conditions
  - Heart attack
  - Stroke
  - Coronary artery disease requiring surgery
  - Cancer
- These conditions cover 90% of all claims
- Moved on...
  ...lists of diseases, severities, multiple payouts, catch-all
Analysis of critical illness experience...

- ...is important
- ...is complicated
  - Lots of components
  - Severities
  - Multiple pay product
  - Different definitions
    - Over market and over time
- Credibility and sub-division of data
Importance of analysis

- Unique underlying drivers
- Usual risk & lifestyle factors
  - Actuarial / Pricing
  - Underwriting / additions to pricing
- External “shocks” to experience
  - Medical advancement
  - Definition
What is a Heart Attack?

**MEDICAL ADVANCES**

**MID 1960s:**
CK and later CK-MB measurement

**EARLY 1990s:**
Evolution of cardiac troponin assays

**1979:**
WHO criteria for diagnosis of MI

**2000:**
Heart attack redefined - criteria now include elevated troponin levels

**2007:**
New universal heart attack definition

**CLINICAL HEART ATTACK DEFINITION**

**1979:**
WHO criteria for diagnosis of MI

**2000:**
Heart attack redefined - criteria now include elevated troponin levels

**ABI HEART ATTACK DEFINITION**

**1999 SOBP CI**
Original heart attack criteria

**REVISION 2002**
Allowed troponin increase as evidence

**REVISION 2006**
Minimum troponin level requirement e.g. cTnT > 1.0 ng/ml

... depends on who you ask
Importance of analysis

• Unique underlying drivers

• Usual risk & lifestyle factors
  • Actuarial / Pricing
  • Underwriting / additions to pricing

• External “shocks” to experience
  • Medical advancement
  • Definition
  • Screening
Example: Breast cancer in UK

- NHS screening programme
  - 2003 – 2012: Ages 50 – 70
  - 2012+: Ages 47 – 73
- Mammography every 3 years
- Diagnoses half of breast cancers
- Accelerates diagnosis of cancer
Example: Breast cancer

Age-specific incidence Great Britain

Source: Cancer Research UK
Example: Breast cancer

Age-specific incidence Great Britain

Source: Cancer Research UK
Example: Breast cancer

Age-specific incidence Great Britain

Source: Cancer Research UK
Screening

• Accelerates diagnosis

• Diagnoses more cases
  • “over-diagnosis”
  • Slow growing or naturally regress
  • non-symptomatic in lifetime
Prostate cancer

“If men lived long enough they would almost all die with histological evidence of prostate cancer” – NICE guidelines

1977 autopsy study results (Breslow)

<table>
<thead>
<tr>
<th>Age group</th>
<th>US White males</th>
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<tbody>
<tr>
<td>21-30</td>
<td>8%</td>
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<tr>
<td>31-40</td>
<td>31%</td>
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<tr>
<td>41-50</td>
<td>37%</td>
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<td>51-60</td>
<td>44%</td>
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<tr>
<td>61-70</td>
<td>65%</td>
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<tr>
<td>71-80</td>
<td>83%</td>
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<tr>
<td>Total</td>
<td>35%</td>
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</tbody>
</table>
Korea: Thyroid cancer experience

Screening rates

Dramatic Increase of Thyroid Cancer

Age-standardized rate (’03-’10), Female
Importance of analysis

- Unique underlying drivers

- Usual risk & lifestyle factors
  - Actuarial / Pricing
  - Underwriting / additions to pricing

- External “shocks” to experience
  - Medical advancement
  - Definition
  - Screening
  - Societal
What does analysis allow us to do?

• Getting pricing correct for the future

• Cost of guarantees
  • Better understanding of the uncertainties

• Future-proofing
  • product &
  • definitions
“Extending the Critical Path”

- CI incidence rates (UK population)
- Geodemographic analysis of incidence rates
- 188m records (NHS)
First, but probably last

“The calculations were used to advise companies how to refine their premiums”

“As a result of the work, insurers were likely to increase premiums for this group, experts said.”
Output (CIBT08 graduated rates)

Source: Extending the Critical Path (2013)
Claim cause for males

CIBT08 by Condition (Males)

Proportion of Total CIBT08 Rate

Source: Extending the Critical Path (2013)
Claim cause for females

CIBT08 by Condition (Females)

Source: Extending the Critical Path (2013)
# Geodemographic profiles

<table>
<thead>
<tr>
<th>TD group</th>
<th>Description</th>
<th>% of population</th>
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<tbody>
<tr>
<td>A1</td>
<td>Wealthy Executives</td>
<td>18.5%</td>
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<td>Affluent Greys</td>
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<td>Prosperous Professionals</td>
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<td>A2</td>
<td>Educated Urbanites</td>
<td>15.0%</td>
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<td>Flourishing Families</td>
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<td>A3</td>
<td>Secure Families</td>
<td>19.7%</td>
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<td>Starting Out</td>
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<td>A4</td>
<td>Aspiring Singles</td>
<td>12.6%</td>
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<td>Prudent Pensioners</td>
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<td>Settled Suburbia</td>
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<td>A5</td>
<td>Asian Communities</td>
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<td>Blue Collar Roots</td>
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<td>Post Industrial Families</td>
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<td>A6</td>
<td>Burdened Singles</td>
<td>20.3%</td>
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<td>High Rise Hardship</td>
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<td>Inner City Adversity</td>
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<td>Struggling Families</td>
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<td>Unclassified</td>
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Source: Extending the Critical Path (2013)
Our own book
Exposure and claims

- Approx. 1.35m life years and 2,700 claims
Exposure data

- 51% M
- 49% F
- 17% NS
- 83% S
- 1% 20-24
- 3% 25-29
- 13% 30-34
- 17% 35-39
- 20% 40-44
- 18% 45-49
- 13% 50-54
- 9% 55-59
- 5% 60+
- 3% 60+
Exposure data
Critical illness rates 2010-13
Critical illness rates 2010-13

- 19% of 40-44
- 29% of 40-44
- 44% of 40-44
- 62% of 40-44
- 100% of 40-44
- 145% of 40-44
- 199% of 40-44
- 320% of 40-44
- 512% of 40-44

as % of 40-44
Claim cause by age band

<table>
<thead>
<tr>
<th>Age Group</th>
<th>Cancers and Tumours</th>
<th>Cardiovascular</th>
<th>Nervous System</th>
<th>Respiratory System</th>
<th>Ear and Eye Disorders</th>
<th>Musculoskeletal Disorders</th>
<th>Renal / Kidney Disorders</th>
<th>Gastro-Intestinal</th>
<th>Auto-Immune Disorders</th>
<th>Endocrine Disorders</th>
<th>Gynaecological Disorders</th>
<th>Major Organ Transplant</th>
<th>Infectious Disorders</th>
<th>Major Organ Transplant</th>
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<td>45-49</td>
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<td>55-59</td>
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<td>60-64</td>
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<td>65+</td>
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- Cancers and Tumours
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- Musculoskeletal Disorders
- Renal / Kidney Disorders
- Gastro-Intestinal
- Auto-Immune Disorders
- Endocrine Disorders
- Gynaecological Disorders
- Major Organ Transplant
- Infectious Disorders
How does this compare?
How does this compare?
• Males approx. 118% of females (without age interaction)
Model fit

![Graph showing model fit between expected and actual claims]

- Expected claims versus Actual claims
- The graph illustrates the trend of claims, with data points and a fitted line indicating how well the model predicts actual claims.

2014 Convention knowing more 22-23 October, Cape Town
Claim cause by sex

- Cancers and tumours: 53%
- Cardiovascular: 28%
- Nervous system / neurological: 8%
- Respiratory system: 42%
- Musculoskeletal disorders: 40%
- Auto-immune disorders: 8%
- Renal / kidney disorders: 10%
- Endocrine disorders: 8%
- Blood disorders: 70%
- Skin disorders: 10%
- Major organ transplant: 70%
- Infectious disorders: 8%
- Gastro-intestinal: 42%
- Psychiatric disorders: 40%
- Gynaecological: 8%
- Ear and eye disorders: 28%
- Injury / accident / trauma: 42%
- Musculoskeletal disorders: 40%
- Gastro-intestinal: 42%
- Psychiatric disorders: 40%
- Gynaecological: 8%
Cancer & Cardio rates

Cancer rates

Cardiovascular rates
By smoker status

• Smokers approx. 183% of non-smokers (without age interaction)
Claim cause by smoker status

- Cancers and tumours: 53%
- Cardiovascular: 28%
- Nervous system / neurological: 8%
- Respiratory system: 2.9%
- Musculoskeletal disorders: 1.4%
- Auto-immune disorders: 1.4%
- Ear and eye disorders: 1.4%
- Renal / kidney disorders: 1.4%
- Injury / accident / trauma: 1.4%
- Endocrine disorders: 1.4%
- Gastro-intestinal: 1.4%
- Blood disorders: 1.4%
- Psychiatric disorders: 1.4%
- Skin disorders: 1.4%
- Gynaecological: 1.4%
- Major organ transplant: 1.4%
- Infectious disorders: 1.4%
Cancer & Cardio rates

Cancer rates

Cardiovascular rates

20-24 25-29 30-34 35-39 40-44 45-49 50-54 55-59 60+

NS S

0.0000 0.0010 0.0020 0.0030 0.0040 0.0050 0.0060

0.0000 0.0010 0.0020 0.0030 0.0040 0.0050 0.0060
By income/education

Model output

3 and 4 significant at 1% level
By duration

- Duration not significant at 5% level
- No evidence of select effect
Conclusions

• Interesting and important research and analysis
  • Understanding price and cost of guarantees

• Ability to spot trends / shocks quickly

• Test actual rating factors using own experience
  • Introduce extra factors

• Awareness of trends driving the CI trends

• Mortality improvement vs CI worsening