Medical advances and their impact on the Trauma (Critical Illness) product line

Dr Bill Monday - CMO Munich Re Australia
2015 Financial Services Forum, Wellington
1. Setting the scene
2. Causes and contributors to mortality
3. Cardiac conditions
4. Cancer
5. Screening
6. Targeted therapy
7. Summary
1983

Discovery: First Disease Gene Mapped

A genetic marker for Huntington’s disease is found on chromosome 4.

Crusader life in Johannesburg sell a “Dread disease” accelerator rider benefit to cover heart attack, cancer, stroke and CABG to maximum cover of the equivalent of $30,000
Screening is advancing...Here is an example

This app analyses your skin moles and tells you whether your mole is a low or high risk for cancer.
Medical advances and impact on trauma experience
General advances in Medicine

- From diagnose and treat to predict and prevent. **Predictive Medicine**
- Lifestyle change, controlling risk factors, **wearable medical devices**
- Enhanced diagnostics and imaging
- Targeted therapy, polypills, vaccines, nanomedicine
- Genetics, genomics and **personalised medicine**
- **Big data**, electronic records, tele-medicine,
- Longevity, compression of ill health
- New surgical techniques (i.e Minimally invasive and Transcatheter surgery)
- Don’t forget the old enemies still hiding in the wings - epidemics, emerging infectious diseases, **antibiotic resistance**
Questions to ask, points to consider

• With the tremendous acceleration in medical knowledge is it possible to future-proof critical illness against these advances?

• Impact on mortality, morbidity and incidence/prevalence?

• Building in trends

• Changing definitions

• Is the current product sustainable?

• New product design?
Causes and contributors to Mortality in NZ

### PROPORTIONAL MORTALITY

- **Cardiovascular disease**: 32%
- **Cancer**: 29%
- **Chronic respiratory disease**: 7%
- **Diabetes**: 3%
- **Injuries**: 6%
- **Communicable, maternal, perinatal**: 5%
- **Other NCD's**: 18%

### Adult risk factors

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Current smoking (2011)</td>
<td>21%</td>
<td>19%</td>
<td>20%</td>
</tr>
<tr>
<td>Alcohol consumption, litres of pure alcohol (2010)</td>
<td>15.7</td>
<td>6.3</td>
<td>10.9</td>
</tr>
<tr>
<td>Raised Blood Pressure (2008)</td>
<td>25%</td>
<td>18.3%</td>
<td>21.6%</td>
</tr>
<tr>
<td>Obesity (2008)</td>
<td>27.3%</td>
<td>29.3%</td>
<td>28.3%</td>
</tr>
</tbody>
</table>
Myocardial infarction incidence decreasing

**Incidence of heart attacks.** The number of major coronary events among people aged 40–90; that is, the number of deaths from coronary heart disease (heart attacks) plus the number of non-fatal hospitalisations for heart attacks. Presented as an age-standardised number per 100,000 people.

- There were about 47,700 coronary events in 2009—463 per 100,000 people.
- Coronary events were twice as common for males as for females.
- The rate fell by almost one-third between 1997 and 2009, despite increased use of more sensitive diagnostic tests that may have led to a rise in the number of less severe heart attacks being diagnosed over time.

*Sources: AIHW National Hospital Morbidity Database, AIHW National Mortality Database, AIHW analysis of ABS unpublished confidentialised data.*
Diabetes projection to 2035

World diabetes cases expected to jump 55 percent by 2035

Current and projected cases of diabetes by region
600 million

- South and Central America: 59.8%
- Africa: 109.6%
- North America/Caribbean: 37.3%
- Middle East/North Africa: 96.2%
- Europe: 22.4%
- Southeast Asia: 70.6%
- Western Pacific: 46.0%

Top 10 countries by number of people with diabetes in 2013, ages 20 to 79

- China: 98.4 million
- India: 65.1 million
- U.S.: 24.4 million
- Brazil: 11.9 million
- Russia: 10.9 million
- Mexico: 8.7 million
- Indonesia: 8.5 million
- Germany: 7.6 million
- Egypt: 7.5 million
- Japan: 7.2 million

Source: International Diabetes Federation
S. Culp, 12/11/2013
Increasing number of cancers in New Zealand

<table>
<thead>
<tr>
<th>Year</th>
<th>est. New Cases</th>
<th>Male</th>
<th>Female</th>
<th>Both Sexes</th>
</tr>
</thead>
<tbody>
<tr>
<td>2012</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>11292</td>
<td>10045</td>
<td>21337</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age &lt; 65</td>
<td>4322</td>
<td>4878</td>
<td>9200</td>
</tr>
<tr>
<td></td>
<td>Age &gt;65</td>
<td>6970</td>
<td>5167</td>
<td>12137</td>
</tr>
<tr>
<td>2015</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>12251</td>
<td>10740</td>
<td>22991</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Age &lt;65</td>
<td>4476</td>
<td>5055</td>
<td>9531</td>
</tr>
<tr>
<td></td>
<td>Age&gt;65</td>
<td>7775</td>
<td>5685</td>
<td>13460</td>
</tr>
</tbody>
</table>
Cancer in New Zealand / Australia

Highest male incidence in the World

GLOBOCAN 2012 (IARC) Section of Cancer surveillance

GLOBOCAN 2012 (IARC) Section of Cancer surveillance)
Cardiac component
Trends in Interventional Cardiology

- CABG’s decreasing
- Stenting increasing
- Multiple stenting increasing at 6% per annum

Figure 4.6: Trends in cardiovascular procedures, 1996–97 to 2007–08

[Graph showing trends over time]

Changing definitions - Example Surgery to the Aorta

- Customer buys CI-product 2015
- Policy terminates 2040
- Customer needs new heart valve
- ...and is not covered (?)

Insurance companies will (need to) pay out „transcatheter“ claims sooner or later
Cancer
## Screening: Critical Illness - The Korean experience

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>52,000</td>
<td>76,000</td>
</tr>
<tr>
<td>2003</td>
<td>310,000</td>
<td>443,000</td>
</tr>
<tr>
<td>2004</td>
<td>1,025,000</td>
<td>1,439,000</td>
</tr>
<tr>
<td>2005</td>
<td>1,608,000</td>
<td>2,193,000</td>
</tr>
<tr>
<td>2006</td>
<td>2,125,000</td>
<td>2,843,000</td>
</tr>
</tbody>
</table>
Critical illness - Risk of change

One third of all claims in women and 10% of all claims in men were due to early stage thyroid cancer!

Pricing was based on pre-screening numbers …

… and insurance companies were facing losses.

Survival in early stage thyroid cancer is 100%
Screening
Incidence rate peaked in 1994 with introduction of PSA*.

* AIHW - Cancer incidence projections, Australia 2011-2020
DCIS- on the rise

Figure 2.10: Incidence of ductal carcinoma in situ by age group, females, Australia 1997 to 2008

Notes
1. The rates were age-standardised to the Australian population as at 30 June 2001 and expressed per 100,000 females.
2. The data for this figure are shown in Appendix Table D2.11.
Source: AIHW analyses of data supplied by state/territory cancer registries.
Tumour Markers- It’s not boring at all..........
Present recommendations for tumour marker testing in common malignancies*

<table>
<thead>
<tr>
<th>Malignancy</th>
<th>Sample</th>
<th>Screening</th>
<th>Assisting diagnosis</th>
<th>Prognosis, monitoring, surveillance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Liver</td>
<td>Serum</td>
<td>Alpha-fetoprotein (High risk pts)</td>
<td>AFP</td>
<td>AFP</td>
</tr>
<tr>
<td>Bladder</td>
<td>Serum</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Cervical</td>
<td>Serum</td>
<td>None</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>Gastric</td>
<td>Serum</td>
<td>None</td>
<td>None</td>
<td>CEA, CA 19</td>
</tr>
<tr>
<td>Testicular</td>
<td>Serum</td>
<td>AFP, B-HCG, LDH</td>
<td>AFP, B-HCG, LDH</td>
<td>AFP, B-HCG, LDH</td>
</tr>
<tr>
<td>Prostate</td>
<td>Serum</td>
<td>None</td>
<td>PSA</td>
<td>PSA</td>
</tr>
<tr>
<td>Colorectal</td>
<td>Faeces</td>
<td>FOBT</td>
<td>None</td>
<td>CEA</td>
</tr>
<tr>
<td>Breast</td>
<td>Serum</td>
<td>None</td>
<td>None</td>
<td>? CA -15</td>
</tr>
<tr>
<td>Ovarian</td>
<td>Serum</td>
<td>None</td>
<td>CA 125</td>
<td>CA 125</td>
</tr>
<tr>
<td>Multiple Myeloma</td>
<td>Serum, Urine</td>
<td>Paraprotein</td>
<td>Paraprotein</td>
<td>Paraprotein</td>
</tr>
</tbody>
</table>

(National Academy of Clinical Biochemistry USA)
Example – CEA - Just not good enough..

- A tumour marker linked mainly to colon cancer but sometimes elevated in other malignancies such as pancreas, stomach, lung, ovary.

- Can also be elevated by conditions that are not cancer such as inflammatory bowel disease, pancreatitis, diverticulitis, cirrhosis.

- Not approved by the FDA for screening.

- Used to follow up patients with known colon cancer.

- Limitations of CEA: Early tumours do not raise CEA, low sensitivity of 36%, variation from lab to lab.
Genetics:
The investigation of the roles, functions and patterns of inheritance of single genes.

Genomics:
The investigation of the function and structure of an entire genome and its interaction with environmental or lifestyle factors.

Proteomics:
The study of proteins for the diagnosis, prognosis and therapeutic prediction of disease.

Metabolomics:
The study of unique chemical fingerprint that specific cellular processes leave behind.
Tumour Proteomics

- Human Proteome project was officially initiated in 2008.
- Cancer proteomics one of the fastest growing research fields
- Systematic searches for cancer biomarkers are underway
- The expected outcome is the development of panels of biomarkers for early detection of cancer and prediction of the probable response to therapy
Multigene assays used to predict chemotherapy benefit

- A test called Oncotype DX searches for the presence of 21 breast cancer related genes in breast tissue and produces a score that predicts the risk of breast cancer recurrence.

- 10,273 women tested who had early stage hormone receptor + breast cancer

- 16% of women scored a low score below 10 (out of a possible 100) and were treated with hormone therapy alone and no chemotherapy

- 99% of these women treated with hormone therapy alone did not experience a recurrence within 5 years

Urine tests for cancer

- Mips test for prostate cancer
- A test for a specific gene fusion. A prostate cancer antigen and a PSA
September 25, 2013 -- A new urine test for prostate cancer that measures minute fragments of RNA is now commercially available to men nationwide through the University of Michigan MLabs. The new test—Mi-Prostate Score (MiPS)—improves the utility of the PSA blood test, increases physicians’ ability to pick out high-risk prostate tumors from low-risk tumors in patients, and may help tens of thousands of men avoid unnecessary biopsies.
Saliva used for biomarker development and personalized medicine

Potential to detect oral cancer, pancreatic cancer, lung cancer, ovarian cancer and breast cancer
Volatile organic compounds

Frankie the dog sniffs out cancer
BBC News March 18th 2015

VOC’s- Examples
Pentane, benzene, heptane, toluene, octane, nonane, decane, undecane, dodacene, tetracane, nitic oxide, haem oxygenase

Chinese Researchers have developed a simple rapid device for detecting volatile organic compounds on the breath, demonstrating potential for early cancer detection.
Washington DC. Feb 17 2015

From the Journal: Review of Scientific instruments
Changes in chromosomes years before cancer diagnosis could yield biomarker to predict cancer.

A distinct pattern in the changing length of blood telomeres, the protective end caps on our DNA strands, can predict cancer many years before actual diagnosis, according to a new study from Northwestern Medicine in collaboration with Harvard University*.

* Oncology news Australia  May 5th 2015
Stages of cancer - Example of male distribution (SEER data)

<table>
<thead>
<tr>
<th>Age</th>
<th>20-39</th>
<th>40-49</th>
<th>50-59</th>
<th>60-69</th>
<th>70+</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage I</td>
<td>42%</td>
<td>48%</td>
<td>46%</td>
<td>38%</td>
<td>32%</td>
</tr>
<tr>
<td>Stage II</td>
<td>17%</td>
<td>14%</td>
<td>15%</td>
<td>17%</td>
<td>15%</td>
</tr>
<tr>
<td>Stage III</td>
<td>18%</td>
<td>18%</td>
<td>18%</td>
<td>22%</td>
<td>24%</td>
</tr>
<tr>
<td>Stage IV</td>
<td>23%</td>
<td>20%</td>
<td>21%</td>
<td>23%</td>
<td>27%</td>
</tr>
</tbody>
</table>

100% 100% 100% 100% 100%

Most cancers are detected at an early stage and with all the new technology coming through, early cancer detection will increase further.
Cancer treatment- “Times they are a changing”

Surgery
Slash

Radiotherapy
Burn

Chemotherapy
Poison
Targeted therapy - Smart bombs have arrived
New drug therapies – target therapies

- HER 2-antibody + chemotherapy
  Drug attached to an antibody, releasing the drug at the location of interest

- Anti-angiogenesis
  Drugs in particular interacting with vascular endothelial growth factors
Genetics guiding cancer treatment

- Aggressiveness of Low Gleason Score Prostate Cancer

Kaplan-Meier analysis for patients with Gleason 6/7

Study population was separated into high-risk and low-risk cancers by expression of FGFR1, PMP22, and CDKN1A proteins

Recurrence-free survival after 10 years was significantly better in the molecular low risk group
Gene expression adding to future prognostication

Onwards- next tier of prognostic factors based on Molecular subtypes, Gene expression scoring and so forth
The cost

- Spending on Prescription drugs in the USA rose by $43.4 Bn in 2014 to reach $373.9Bn a 13.1 % increase from 2013
- New drugs to treat Hepatitis C, cancer, Multiple sclerosis and diabetes contributed to most of the growth.
- $11.3 bn went to pay for 4 new Hep C drugs. A 12 week course of one such drug, Sofosbuvir typically costs $80,000 a patient
- Speciality medicines now account for one third of prescription drug spending in the USA
Cancer Vaccines

- Training the immune system to fight cancer.
- Teaches the immune system to identify and destroy tumour cells by identifying unique proteins produced by the mutated cancer cells.
- A trial began in 2013 on patients with advanced melanoma.
- By looking at your genetic make up you could one day receive a personalised vaccine based on your own genetic susceptibility to cancer.
DTC Genetic testing

- DTC genetic testing - public awareness has increased from 29% to 37% in a study from the US.

- Awareness higher in those aged 50-64 and 65-74, college graduates, those with healthcare, those with a prior cancer diagnosis, internet use and living in urban areas.
Summary

- Deterioration in trauma experience (Certainly in Australia..)

- The trauma product is exposed to advances in medicine (both positively and negatively)

- Cancer most affected, cardiac appears stable

- Screening and new diagnostics will increase the incidence of cancer detection and shift the stage at diagnosis to the left (earlier stage and potential overdiagnosis)

- Genetic testing will become more important

- Anti-selection risk may well increase

- New surgical techniques etc require that definitions be regularly reviewed

- Careful following of advances in detecting neurodegenerative conditions.

- The sustainability of the product if left as is under serious threat..........however product design to match the payment to a specified severity level or functional outcome is gaining momentum and it to be applauded.
Thank you

Questions?