The Impact of Wellness Engagement on Morbidity and Mortality – a Big Data Case Study

Emile Stipp, November 2016
Agenda

01  The Vitality Shared Value Model and Big Data

02  Wellness Engagement and Morbidity Improvements

03  Wellness Engagement and Mortality Improvements
Totalling 15 markets and 4 million Vitality clients

- AIA Vitality
- Discovery
- Generali
- John Hancock
- Manulife
- Ping An
- Sumitomo Life

- Singapore (2013)
- Australia (2014)
- Hong Kong (2015)
- Philippines (2015)
- Malaysia (2016)
- SA (1997)
- UK (2004)
- Germany (2016)
- France (2017)
- Austria (tbd)
- Canada (2016)
- China (2009)
- Japan (2016)
Vitality – a shared value contract with members
Vitality is based on ongoing health activities and rewards to drive continued member engagement.
A business model that generates Big Data

Wellness data:
- nutrition
- screening
- exercise

Operational data:
- Emails
- Calls
- web / app

Morbidity & Mortality data:
- Health & Life insurance data

Demographic data:
- Family
- Age
- Geography
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Vitality impact by disease: snapshot view

Vitality impact by disease (Adjusted for age, gender, option and SES)
Vitality impacts claims in 3 ways - longitudinally

01 | Age Selection Effect

- Vitality enables DHMS to attract and retain younger people than competitors.
- What is the impact of this younger profile on the claims experience on DHMS?

02 | Initial Engagement Selection Effect

- Vitality enables DHMS to attract and retain healthier people than competitors.
- What is the impact of this healthier profile on the claims experience on DHMS?

03 | Behaviour Change Effect

- Vitality encourages members to increase engagement in healthy behaviour.
- What is the impact of this behaviour change on the claims experience on DHMS?
Average claims of a medical scheme increase by 2.5% for every year that the average age of a medical scheme increases.
• DHMS is 1.5 years younger than the industry, resulting in claims savings of 3.7%. This is equivalent to R6.8bn in claims between 2008 – 2015.

• Not all of these savings may be attributable to Vitality, as DHMS may attract younger members by offering certain benefits that appeal to the younger market, for example.

• An adjustment was made to isolate the impact of Vitality, based on the difference in claims experience between new members who joined Vitality immediately upon DHMS membership, and those members who did not join Vitality.
Engagement results in lower healthcare costs

Example of GLM results: The Year 5 model for IH hospital costs

- **People that start at a high level of exercise have 17% lower hospital costs** than those unengaged.

- **People that start at a low level of engagement and increase exercise reduce their hospital costs by 14%.**
The distribution of new members by VEM points in their first semester of joining (or the beginning of 2008 for those members in force) was applied to the factors from the GLMs.

Initial engagement selection includes behaviour maintenance and any effect of a decrease in engagement.

This was done for an 8 year period based on the actual PLPM claims, assuming no change in the distribution of members by VEM status over the period.

An adjustment was made to the savings to allow for the level of natural exercise using data from the Healthy Company Survey to isolate the impact of Vitality.
The distribution of members by VEM points was applied to the factors from the GLMs.

This was done for a 7 year period based on the actual PLPM claims, given the change in the distribution of members by VEM points over the period.

The savings estimated only included the positive effects of those members who increased engagement over the period.

The savings were not offset by the increase in claims of those members who decreased engagement, as members who decrease their engagement would have done so irrespective of their Vitality status.
There is strong correlation between Vitality reward utilisation and Vitality engagement, but this could purely be selection. Can we say that the rewards change behaviour?

Higher initial and subsequent engagement associated with higher benefit use
Evidence from Device Data: single users vs all users

Steps for all users

Hard to see a pattern in a single user’s step data
Evidence from Device Data: single users vs all users

Steps for all users

Hard to see a pattern in a single user’s step data

Setting up a randomized control trial in a commercial environment difficult; and hard to avoid observation bias
Evidence from Device Data: look at all the data

Steps for all users
Evidence from Device Data that Vitality *changes* engagement behaviour:

Steps for all users

- **12,500 steps bonus points level**
- **10,000 steps points level**
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Mortality – initial selection and behaviour change

Heat map of relative effect on mortality

a. People that start at a high level of exercise have 55% lower mortality than those unengaged

b. People that start at a low level of engagement and increase exercise reduce their mortality by 69%
Mortality investigation using health insurance data: Comparison of improvements

Mortality relative to non-integrated

Percentage

<table>
<thead>
<tr>
<th></th>
<th>Life</th>
<th>All</th>
<th>3 year lag*</th>
<th>No SE Std</th>
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<tbody>
<tr>
<td>100% Non-integrated</td>
<td>87</td>
<td>83</td>
<td>84</td>
<td>79</td>
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<td>DHMS 2008-2015</td>
<td>66</td>
<td>46</td>
<td>52</td>
<td>41</td>
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<tr>
<td>Life</td>
<td>38</td>
<td>36</td>
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<td>Non-integrated</td>
<td>47</td>
<td>53</td>
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Key Observations:

- Improvements deepen when Socio Economic class standardization removed demonstrating correlation although smaller than expected.
- DSY Life and Health improvements are closer than expected.

* Lag between status used and period in which mortality measured
Insights from Global Burden of Disease: Drivers of excess mortality

Cause of death

- Unintentional injuries
- Transport injuries
- Self-harm and interpersonal violence
- Other non-communicable diseases
- Other communicable, maternal, neonatal, and nutritional diseases
- Nutritional deficiencies
- Neurological disorders
- Neoplasms
- Neonatal disorders
- Neglected tropical diseases and malaria
- Musculoskeletal disorders
- Mental and substance use disorders
- HIV/AIDS and tuberculosis
- Digestive diseases
- Diarrhea, lower respiratory, and other common infectious diseases
- Diabetes, urogenital, blood, and endocrine diseases
- Cirrhosis
- Chronic respiratory diseases

Risk factor distribution

Exposure of risk factors vary across populations

Males aged 45-49 in one Population

- Systolic Blood Pressure distributed Log-Normally
  - Mean: 128.13
  - Std dev: 13.27

- Bone Mineral Density distributed Normally
  - Mean: 0.936
  - Std dev: 0.226

Relationship between heightened risk factors and excess mortality

- Causes of death vary by country
  - Australia
  - Japan
  - South Africa
  - United Kingdom
  - United States

- Raw qx comparison by country
  - Australia Population
  - Japan Population
  - UK Population
  - US Population
  - Australia Counterfactual
  - Japan Counterfactual
  - UK Counterfactual
  - US Counterfactual
  - South Africa Population
  - South Africa Counterfactual

Case Study: Cardiovascular disease
Estimate relative improvements

Comparison of the Insured population to country counterfactual (theoretical minimum mortality – after removal of all lifestyle risk factors)

<table>
<thead>
<tr>
<th>Age band</th>
<th>Improvements Relative to Insured Population</th>
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<tr>
<td>20 to 24</td>
<td>28%</td>
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<td>25 to 29</td>
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<td>30 to 34</td>
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<td>70 to 74</td>
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<td>75 to 79</td>
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Gold and Diamond vs country counterfactuals

Comparison of gold and diamond Discovery Health Raw Qx to counterfactual (Males)

High engagement results at older ages: limited Vitality data, but also counterfactuals doesn’t adjust for public health, quality of care, social, economic and cultural factors.
Mortality – further improvement by duration of engagement

**Mortality by Duration**

Deaths per 100,000

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<thead>
<tr>
<th>Duration</th>
<th>No - Vitality</th>
<th>Quintile 1</th>
<th>Quintile 2-3</th>
<th>Quintile 4-5</th>
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**Relative Mortality by Duration**

Relative Deaths per 100,000

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**Standardised for:**
- Age
- Gender
- RUB* at initial duration
- Socio-Economic Status

**Quintiles measure engagement:**
- 5 = high engagement
- 1 = low engagement
- Engagement = exercise, healthy food, screening

*RUB = Resource Utilisation Band – clinical measure of how healthy or sick a person is*
Conclusion

- Many sources of new data – but need technology & tools & skills required to ingest, curate and analyse structured and unstructured data

- Multi-disciplinary teams required to understand:
  - What is in the data
  - How to interpret the results

- Shared value provides enabling ethical framework for access to consumer data, and the ways in which it is used

- Incentivised wellness programmes result in positive behavior change which result in significant morbidity and mortality improvements
  - This effect increases with duration
  - And, at high levels of engagement, appears consistent with theoretical minimum mortality rates
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