Session 34 • Wellness & Wearables: Science, Applications, and Update on Manulife Vitality

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Head of Manulife Vitality program
Agenda

- Why the life insurance industry needs to incorporate technology
- Examples of wearable metrics in life insurance
- The science behind these metrics
- Emerging developments
- How Manulife Vitality uses wearable technology
Why do we need technology?
I promise

- To share background to help you consider the opportunity and challenges that the technology and resulting data present to actuaries

- **To leave you with the impression that this is the future of our industry**
  - Through technology we can help to mold behaviours and monitor many data points with the goal of improving our customers' lives
Continuous change in the world

Canadian life insurance market is overdue for innovation

- Life insurance ownership continues to decline
- Rapid developments in technology
- Rising customer expectations
- Emergence of big data/analytics
- Mortality risk factors have changed

LIMRA, Canadian Individual and Group Life Insurance Trends, 1982-2013
A program based on behavioural science

The major drivers of disease burden are poor lifestyle choices

4 lifestyle behaviours
1. Poor diet
2. Physical activity
3. Smoking
4. Alcohol

4 chronic conditions
1. Cardiovascular disease
2. Diabetes
3. Chronic lung disease
4. Various cancers

60% of deaths worldwide

Source: Vitality analysis using Global Burden of Disease data (2000-2013)
Improving healthy behaviours

Individual behaviour is irrational in relation to their health

- **Healthcare**: Benefits are immediate, price is hidden
- **Wellness**: Benefits are hidden, price is immediate
Manulife *Vitality* – creating a virtuous shared value cycle

- Healthier society
- Improved productivity
- Reduced healthcare burden
- Better value through improved price and benefits
- Improved health
- Lower claims
- Increased customer satisfaction
- Deeper relationship with clients
- Increased sales opportunity
Wearables in insurance today
A brief history...

- **2009**: Fitbit Tracker
- **2010**: Jawbone UP
- **2011**: Samsung Galaxy Gear
- **2012**: Apple Watch, Fitbit Surge
- **2013**: Microsoft Band, Fitbit Charge
- **2014**: Basis Peak, Apple Watch 2, Fitbit Charge 2, Fitbit Blaze
- **2015**: Basis recall, Pebble sold, Gear S3, vivosmart HR+, vivoactive HR
- **2016**: Microsoft Band, UP2 & UP3, Gear S2
- **2017**: Apple Watch 3?, Fitbit Alta HR, Garmin vivosmart HR
Accuracy of wrist-based fitness trackers

Now, we’ve no reason to query any specific findings based on our real world tests but the problem with lab studies is that they take a while, then the analysis takes a while then publishing takes a while. In short, all these wearables have now been replaced - the Apple Watch has a Series 2 for instance, the Basis and Microsoft Band are pretty much dead and no-one cares about old Samsungs or Mio bands and watches.

It’s a shame as we need this kind of rigorous testing for metrics like heart rate in which companies often use similar tech but can produce very different results. The next study by this team will take the volunteers out of the lab and walking and exercising in their normal lives. I just hope they can upgrade the tech.

Momentum multiply

- Wellness and rewards in South Africa
- Life insurance discount
- Many supported devices
- Active Dayz
  - Going to the gym
  - 10,000 steps
  - 300 calories
  - Certain qualifying events

https://www.momentum.co.za/for/you/multiply/premier/myriad

(https://www.momentum.co.za/wps/wcm/connect/momV1/1af78e41-2d01-45e8-bfb7-4461d43ac517/HHS+Premier.png?MOD=AJPERES&CACHEID=1af78e41-2d01-45e8-bfb7-4461d43ac517)
MLC On Track

- Life Insurance in Australia
- Garmin Vivosmart HR
- Target 900 points in 160 days
- 5% discount for 1st and/or 2nd
  - So 10% if hit target in both periods
- Discount for life of policy
- Big Cloud Analytics

UnitedHealthcare Motion

- Corporate wellness program in US
- Various devices including Fitbit Charge 2
- Up to $4 per day
  - Health insurance deductible credits
- Frequency: 300 steps in 5 mins
  - 6x at least an hour apart
- Intensity: 3,000 steps in 30 mins
- Tenacity: 10,000 steps per day

http://consultant.uhc.com/articleView-18035
Mainstream metrics in life insurance today

- Steps
- Activity
- Inactivity
- Resting heart rate
- Sleep
The science behind these metrics
Steps

- Average daily steps at baseline
- All-cause mortality adjusted hazard ratio 0.94 per 1,000 increase in steps
- Adjusted for
  - Age
  - Sex
  - BMI
  - Energy intake
  - Smoking status
  - Alcohol consumption
  - Education level

<table>
<thead>
<tr>
<th>Increase in steps</th>
<th>Adjusted hazard ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,000</td>
<td>0.94</td>
</tr>
<tr>
<td>5,000</td>
<td>0.73</td>
</tr>
<tr>
<td>10,000</td>
<td>0.54</td>
</tr>
</tbody>
</table>

Physical activity dose-response curve

- At least 7.5 metabolic equivalent hours per week
  - 150 minutes of moderate exercise
  - 75 minutes of vigorous exercise
- Model adjusted for:
  - Age
  - Sex
  - Educational level
  - Smoking status
  - Cancer history
  - Heart disease
  - Alcohol consumption
  - Marital status
  - BMI

Physical activity and steps

- Low correlation between daily step count and physical activity time
- Independently protective for mortality when included in same model
  - Daily step count
  - 3+ hours of vigorous activity per week

Inactivity

- Meta analysis
  - Over 1 million individuals
  - Almost 85,000 deaths

- Examples of covariates controlled for
  - Age
  - Sex
  - Smoking status
  - Alcohol consumption
  - Education
  - BMI
  - Most controlled for health in some way

- Expect to be highly correlated with steps

Ekelund et al (2016), [http://dx.doi.org/10.1016/S0140-6736(16)30370-1](http://dx.doi.org/10.1016/S0140-6736(16)30370-1)
Resting heart rate

- Meta analysis
- 10 beats/minute increment
  - Relative risk 1.09 for all-cause mortality
  - 1.12 / 1.07 for < 6 / 6+ covariates
  - Blood pressure
  - Smoking
  - BMI
  - **Physical activity**
  - Serum cholesterol
  - Diabetes
  - Alcohol
  - Education
- Evidence of publication bias
  - Correcting for this reduced relative risk to 1.04

Sleep

- Meta analysis
  - 2.2 million participants
  - 271,500 deaths
- Night sleep duration
- Controlled for confounders
- Subgroup mean age under 65

Liu et al (2016), http://dx.doi.org/10.1016/j.smrv.2016.02.005; own chart
Hypothetical illustration

<table>
<thead>
<tr>
<th></th>
<th>Standard</th>
<th>Preferred</th>
<th>Relative mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steps</td>
<td>7,000</td>
<td>10,000</td>
<td>0.83</td>
</tr>
<tr>
<td>Activity</td>
<td>0-1x</td>
<td>1-2x</td>
<td>0.86</td>
</tr>
<tr>
<td>Inactivity</td>
<td>8+ hrs</td>
<td>6-8 hrs</td>
<td>1.00*</td>
</tr>
<tr>
<td>Resting heart rate</td>
<td>70 bpm</td>
<td>60 bpm</td>
<td>0.96</td>
</tr>
<tr>
<td>Sleep</td>
<td>6 hrs</td>
<td>7 hrs</td>
<td>0.95</td>
</tr>
</tbody>
</table>

For illustration purposes only
This simplified approach of multiplying relative mortalities together may not be appropriate
Actual relative mortality may be higher or lower than shown
Other mainstream metrics
Examples of other metrics from mainstream devices

- Heart rate (recovery, maximum, minimum, night-time, etc)
- Stress (HRV)
- VO2 max
- Body composition
- Body temperature
- Ambient temperature
V02 max

- Maximum rate at which oxygen can be used during exercise
- Indication of cardiorespiratory fitness
- Model adjusted for
  - Age
  - Smoking
  - Alcohol consumption
  - Marital status
  - Family history of disease
  - Education

Emerging developments
Examples of emerging developments

- Blood pressure
- Pulse Wave Velocity
- Muscle oxygen levels
- Hydration
- Detecting /monitoring illness
- Emotions
Pulse Wave Velocity

- Speed at which pulse wave propagates
- Gives an indication of arterial stiffness
  - Low speed is optimal
  - Indicates low blood pressure and soft arteries
- Meta analysis
- Relative risk for 1 SD increase in PWV is 1.42
- Most studies adjusted for
  - Age
  - Sex
  - Blood pressure

Detecting / monitoring illness

Apple Watch detects heart irregularity with 97 percent accuracy

Digital Health: Tracking Physiomes and Activity Using Wearable Biosensors Reveals Useful Health-Related Information

Xiao Li1*, Jessilyn Dunn1,2*, Denis Salins1*, Gao Zhou1, Wenyu Zhou1, Sophia Miryam Schüssler-Fiorenza Rose3,4, Dalia Perelman5, Elizabeth Colbert5, Ryan Runge1, Shannon Rego5, Ria Sonecha1, Somalee Datta1, Tracey McLaughlin5, Michael P. Snyder1

Insurance applications
Possible uses in insurance

- Segmentation
- Risk-based pricing
- Post-issue underwriting
- Claims
- Distribution
- Engagement / cross-sell
Smoker identification

http://somatixinc.com/smokebeat/
Personality and wearables

- Involve me
- Show me you care
- Give me details
- Be brief, be bright
- Be gone

I found wearing it quite annoying

I enjoyed wearing it

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Sunshine Yellow  Earth Green  Cool Blue  Fiery Red
The Four Rs
The Four Rs

- Regulations
- Reasonable expectations
- Risks
- Rewards

Safety Recall of all Basis Peak watches

[UPDATE – September 16, 2016]

On June 13 we shared reports of overheating in Basis Peak watches, and we recommended that you stop wearing your Basis Peak watch right away. We had hoped to update the software on your watch to address the problem. Unfortunately, despite our best efforts, we aren’t able to develop such a solution without completely compromising the user experience. As a result, we are asking that you return your Basis Peak watch and authorized accessories for a full refund at your earliest convenience. This was a tough decision, but your safety is our top priority.
Morbidity & Mortality Improvement

Drivers of Improvement

- Purchase positive selection
  - Growing risk pool to include more healthy lives
- Retention positive selection
  - Retaining more healthy lives that might have otherwise become uninsured
- Improvement in health
  - Health Awareness
  - Behaviour Changes

Source: Discovery Integrated Annual Report 2016
Get rewarded for healthy living

Life insurance today distinguishes between levels of health only once

Many other types of insurance dynamically set their price, such as auto insurance, and home insurance.
A simple, intuitive member journey

Member holds a single membership with **Manulife Vitality**

Vitality Health Review

VITALITY AGE

PERSONAL PATHWAY

POINTS AND STATUS

REWARDS

- Gym Workout
- Walking
- Other Physical Activity

- Flu Shot
- Non-Smoker
- Health Screenings

- Online Education
- Goal Setting
- Dental Screening

BRONZE  SILVER  GOLD  PLATINUM
# Vitality Points™ for healthy living

**Manulife**

**Vitality Health Review™ (VHR)**

**Points** | **Maximum per program year**
--- | ---
Welcome Bonus – Complete VHR in first 90 days after the insurance policy date | 1,200 One per lifetime
Annual wellness check | 1,000 One per year
Blood pressure check | 750 One per your other life (Minimum: 900 points)

**Vitality Check™ (Annual Health Screening)**

**Points** | **Maximum per program year**
--- | ---
BMI of 18.5 to 24.9 | 1,000 One per year
BMI of 25 to 26 | 750 One per your other life (Minimum: 900 points)
Dyslipidemia, Pre-hypertension or Stage 1 Hypertension | 750 One per year
Total cholesterol reading < 200 mg/dL, LDL cholesterol reading < 130 mg/dL, or HDL cholesterol reading > 40 mg/dL | 1,000 One per your other life (Minimum: 900 points)

**Physical Activity**

<table>
<thead>
<tr>
<th>Physical Activity</th>
<th>Points</th>
<th>Maximum per program year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical activity review</td>
<td>250</td>
<td>Once per year</td>
</tr>
<tr>
<td>Workouts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Light workout (one of the following):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 3,000-5,295 steps can be done using your wearable device</td>
<td>10</td>
<td>Once per year</td>
</tr>
<tr>
<td>• Using a heart rate monitor, exercise at an average of 50% of your maximum heart rate for 15-29 minutes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Using the My Activity Tracker app on other than a health device, you can burn between 100 and 195 calories during a workout.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard workout (one of the following):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 10,000-15,099 steps and 30 minutes of moderate aerobic activity</td>
<td>20</td>
<td>Once per year</td>
</tr>
<tr>
<td>• Using a heart rate monitor, exercise at an average of 50% of your maximum heart rate for 30-44 minutes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Walking at a health rate for 30 minutes or more</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Using the My Activity Tracker app on other than a health device, you can burn between 200 and 275 calories during a workout.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Advanced workout (one of the following):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• 15,000-30,000 steps and 45 minutes of moderate aerobic activity</td>
<td>30</td>
<td>Once per year</td>
</tr>
<tr>
<td>• Using a heart rate monitor, exercise at an average of 50% of your maximum heart rate for 45-59 minutes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Using the My Activity Tracker app on other than a health device, you can burn between 300 and 629 calories during a workout.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Organizational Events**

<table>
<thead>
<tr>
<th>Event</th>
<th>Points</th>
<th>Maximum per program year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking, Running, Cycling, Triathlon</td>
<td>250</td>
<td>Once per year</td>
</tr>
<tr>
<td>Level 1</td>
<td>Run or walk 3 km</td>
<td>250</td>
</tr>
<tr>
<td>Level 2</td>
<td>Run or walk 6 km or bike 30 km</td>
<td>1,000</td>
</tr>
<tr>
<td>Level 3</td>
<td>Run or walk 9 km or bike 60 km</td>
<td>2,000</td>
</tr>
</tbody>
</table>

**Additional Points**

<table>
<thead>
<tr>
<th>Activity</th>
<th>Points</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet &amp; nutrition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coffee, tea, or milk</td>
<td>50</td>
<td>Once per week</td>
</tr>
<tr>
<td>Nutrients</td>
<td>150</td>
<td>Maximum 1,000 points per year</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>75</td>
<td>Once per year</td>
</tr>
<tr>
<td>Quit, check-in</td>
<td>75</td>
<td>Once per year</td>
</tr>
</tbody>
</table>

**For the most recent program information, please visit Manulife.ca/Vitality.**

**Manulife**
Vitality Points™ for healthy living

Light workout (one of the following):
- 5,000–9,999 steps per day using your wearable device
- Using a heart rate monitor, exercise at an average of 60% or more of your maximum heart rate for 15–29 minutes
- Using the MapMyFitness app (or other calorie counting app), you burn between 100 and 199 calories during a workout

Standard workout (one of the following):
- 10,000–14,999 steps per day using your wearable device
- Using a heart rate monitor, exercise at an average of 60% or more of your maximum heart rate for 30–44 minutes
- Working out at a health club for 30 minutes or more
- Using the MapMyFitness app (or other calorie counting app), you burn between 200 and 299 calories during a workout

Advanced workout (one of the following):
- 15,000 or more steps per day using your wearable device
- Using a heart rate monitor, exercise at an average of 60% or more of your maximum heart rate for 45 minutes or more
- Using the MapMyFitness app (or other calorie counting app), you burn 300 or more calories during a workout
Wearable Technology integration

COMPATIBLE DEVICES AND VERIFIED WORKOUTS

- **Garmin Connect and Garmin Connect Mobile App**
- **Fitbit and Fitbit App**
- **Polar and Polar Beat App**
- **Map My Fitness Suite**
- **Under Armour Heart Rate Strap and Polar Heart Rate Strap**
- **Apple Health App**
- **Apple Watch**

**Vitality Points**

**Calories**, **Steps**, **Heart Rate**

**Third Party Compatible Devices (See Device Compatibility List)**

**Partnered Devices**, **Third Party Devices**, **Data Aggregator**, **Calories**, **Steps**, **Heart Rate**, **Active Watch**, **Active Calories**

-Manulife
Customer interactions

Estimated average number of customer contacts over 20 years (and average per year)

<table>
<thead>
<tr>
<th>Category</th>
<th>Average Interactions per Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Life</td>
<td>~2</td>
</tr>
<tr>
<td>Non-Life</td>
<td>~2</td>
</tr>
<tr>
<td>Motor</td>
<td>~4</td>
</tr>
<tr>
<td>Health</td>
<td>~15</td>
</tr>
<tr>
<td>Retail</td>
<td>~50</td>
</tr>
<tr>
<td>Telco</td>
<td>~70</td>
</tr>
<tr>
<td>Banking</td>
<td>~110</td>
</tr>
<tr>
<td>Technology companies</td>
<td>~120</td>
</tr>
<tr>
<td>Social media</td>
<td>~400</td>
</tr>
</tbody>
</table>

SOURCE: McKinsey analysis
Data collection
Early indications are great

The proportion of members engaging in physical activity has increased substantially in the first 4 months of the program with 19% earning points for physical activity on the program in the first month, increasing to 41% by the fourth month.

Physically active members exhibited a substantial increase in their average number of point-earning physical activity events over a 4-month period, increasing 20% from their second to their fourth month on the Vitality program.

Physically active members saw an increase of over 20% in their average step count during the first four months on the Vitality program.
Future
Questions

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AVP and Head of Manulife Vitality

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Wellness & Wearables: Science, Applications, and Update on Manulife Vitality

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