

# 13th Current Issues Seminar on Health Care Insurance (CIHCI) Mumbai, Hotel Sea Princess 2 August 2019

## Impact of wearables on morbidity

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Institute of Actuaries of India

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## **Note:**

The slides for this presentation have been prepared for discussion only with the CIHCI conference delegates to discuss the use of wearables in insurance. The results should not be relied upon for decision-making. They are a summary and necessarily omit details that may in some situations may be relevant. We recommend that should you intend to act upon the content of this presentation, you should consult with the presenter for appropriateness for your use.

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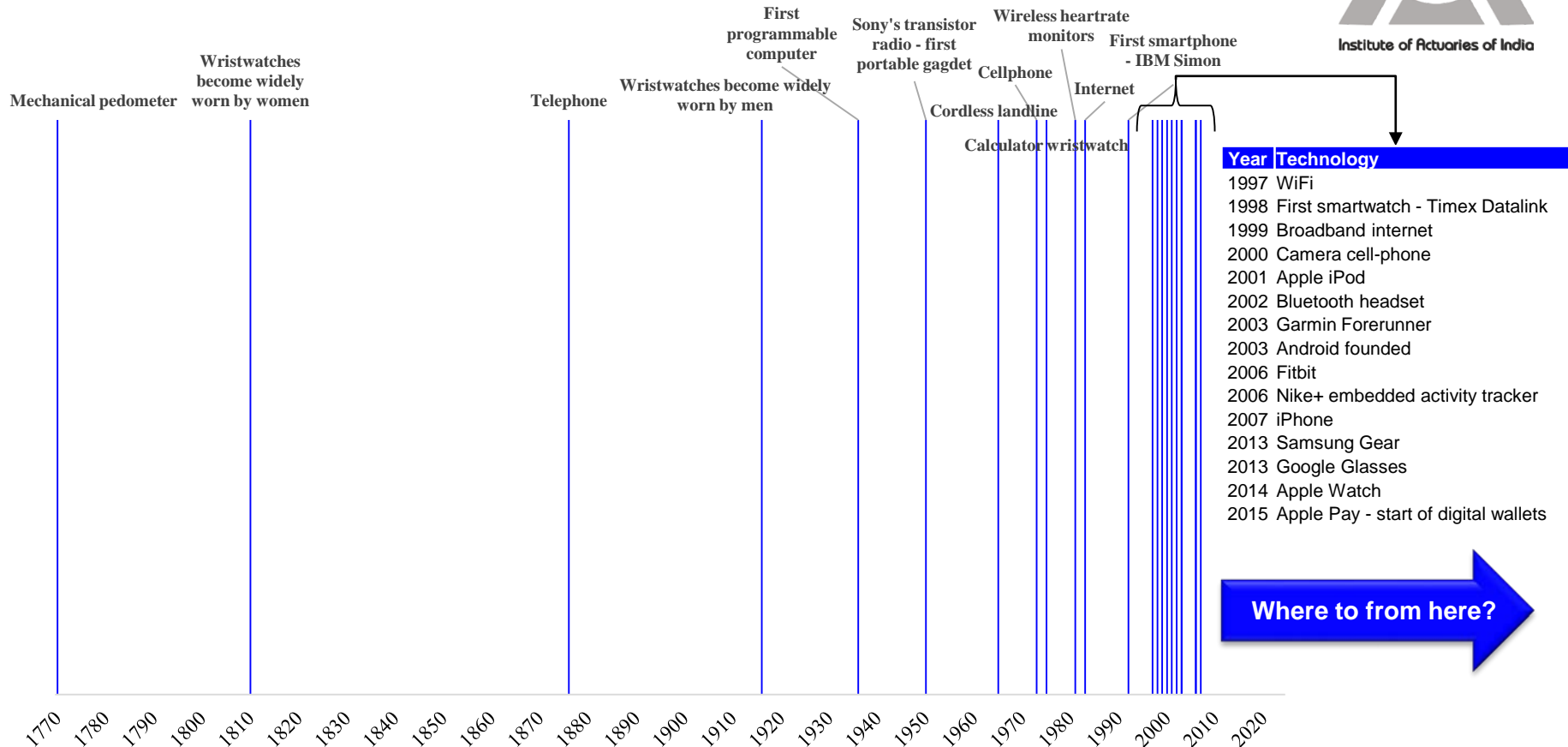
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# The role of wearables in insurance

# Wearables are fairly new technology and the associated landscape has evolved dramatically over recent years



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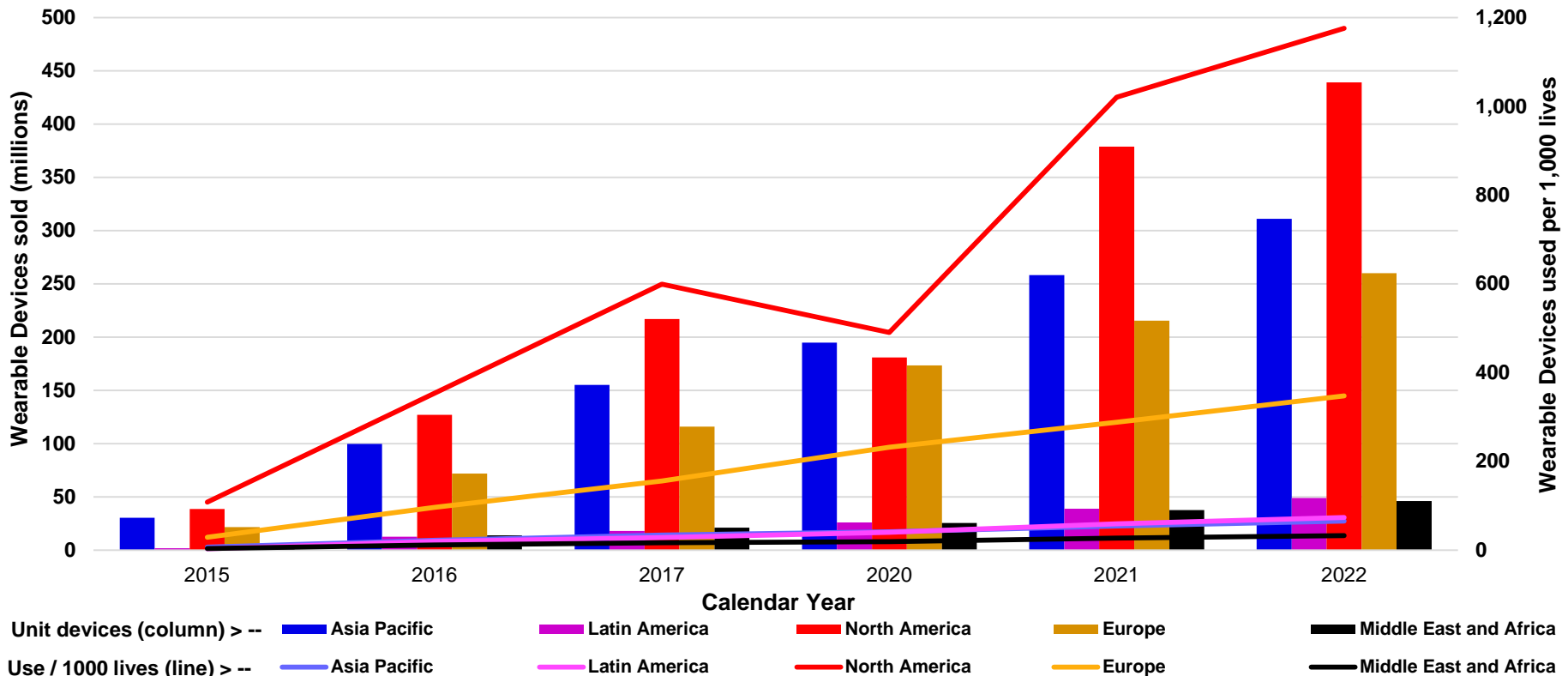
Where to from here?

The idea of wearables and supporting technology has been around for a few centuries but the growth rate of the technology has accelerated in recent decades.

# The use of wearables is growing internationally and projections show increases in use of wearables in coming years



**Projection on wearable device unit sales (millions) and wearable devices sales per 1,000 lives, by area**



By 2022 projections show more than one wearable device used per person in North America, with steady growth in all parts of the world

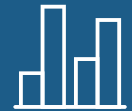
Wearable sales source: <https://www.statista.com/statistics/490231/wearable-devices-worldwide-by-region/>  
 World population source: <https://ourworldindata.org/grapher/historical-and-projected-population-by-region>

# The use of wearables in insurance is centred around three main objectives



1

Improve claims cost prediction



2

Make people healthier



3




Strengthen insurer's competitive position



## Two big questions remain:

1. *Do wearables add predictive power to claims cost prediction beyond what traditional and other big data measures are capable of? i.e. do wearables enhance current underwriting and pricing processes?*
2. *Can wearables make people healthier?*

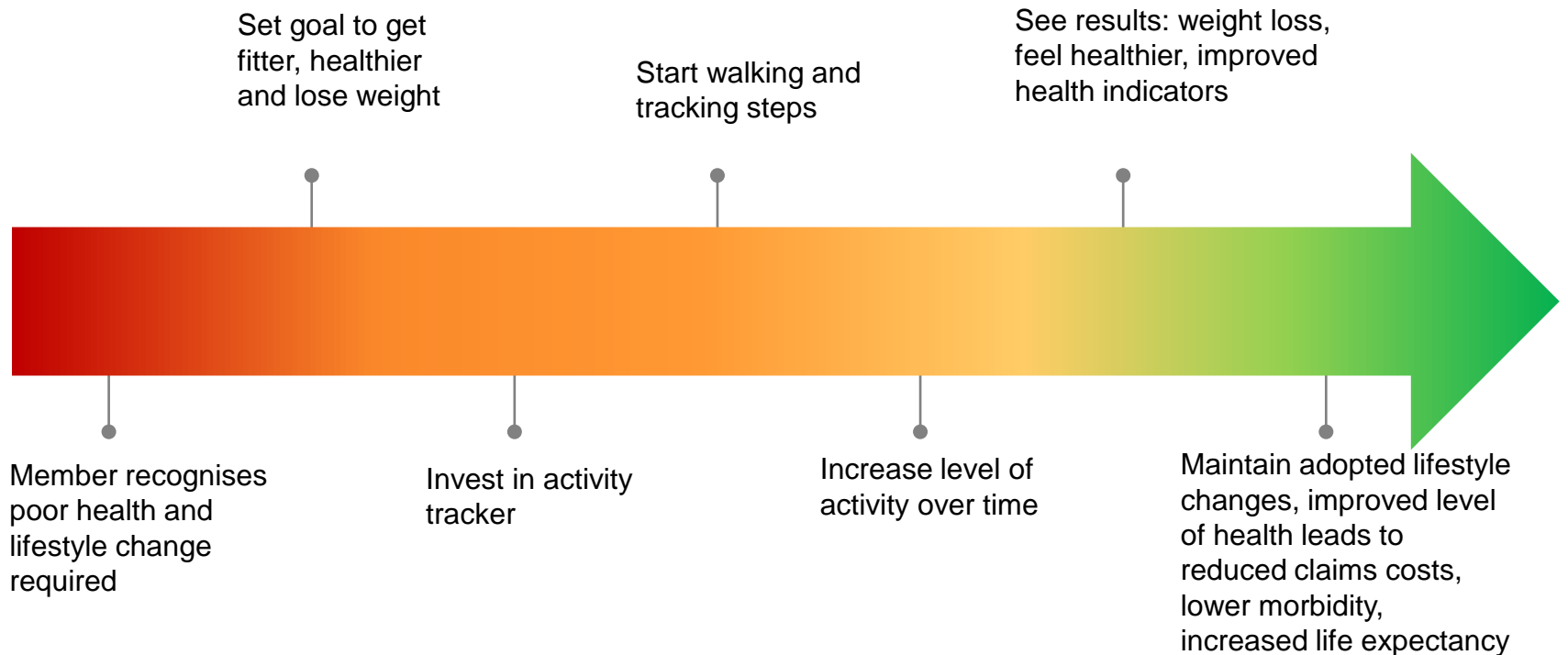
# Claims cost prediction opportunities and potential pitfalls

	Opportunities	Pitfalls
	<p><b>Collect real-time data</b></p> <ul style="list-style-type: none"> <li>• Large amounts of real-time data to track activity and health indicators of individuals</li> </ul>	<ul style="list-style-type: none"> <li>• Storing, processing and creating business value can be tricky</li> <li>• Risk of collecting incorrect or misleading data</li> <li>• Regulatory concerns</li> </ul>
	<p><b>Pricing rating factors</b></p> <ul style="list-style-type: none"> <li>• New rating factors not otherwise available</li> <li>• Enhance GLM predictive power</li> </ul>	<ul style="list-style-type: none"> <li>• Complex 'black box' pricing models</li> <li>• May not provide additional insights compared to traditional methods since the underlying science is still not clear (i.e. we don't know which factors are most predictive of morbidity)</li> <li>• Potentially expensive to incorporate</li> </ul>
	<p><b>Underwriting using additional data</b></p> <ul style="list-style-type: none"> <li>• New underwriting criteria not otherwise available e.g. 'good' wearables history may provide additional information to classify standard and sub-standard risks</li> </ul>	<ul style="list-style-type: none"> <li>• Potential for fraudulent methods used to achieve 'good' wearable records</li> <li>• Discrepancy between devices may produce different conclusions for different measures</li> <li>• Lack of evidence that 'good' wearable behaviour associated with better risks</li> </ul>

# Improving the health of members through wearable technology: Expectation vs. reality



## Expectation:





# Improving the health of members through wearable technology: Expectation vs. reality



## Reality:

Improvements in health that meet expectations through use of wearable technology have been identified **BUT** research also highlights it is not all as hoped.

Rand Health's research\* on wellness programmes in the USA found:

1

Fewer than 50% of employees completed wellness tests.

A fifth or less of those provided with follow-up actions actively participate to improve their health.

- The expected take up rate probably expected to be higher than 50%, but in reality this has been found to be significantly lower.

2

Using wearables as

**loss-framed incentive**

*(lower activity = higher financial cost to member)*

vs.

**gain-framed incentive**

*(higher activity = more discounts, no additional financial cost)*

Gives higher levels of engagement and greater levels of physical activity by even healthier members.

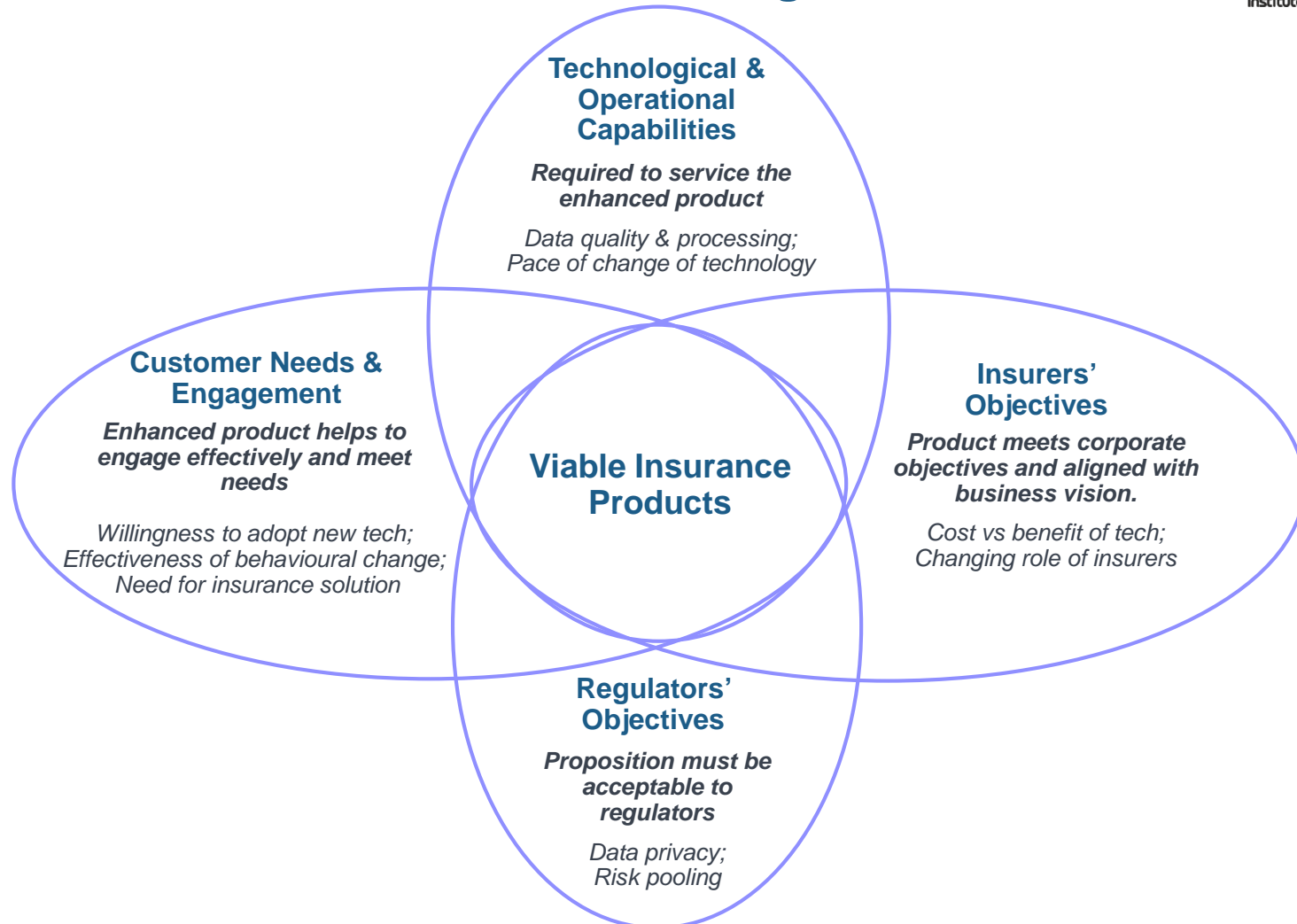
Whilst wellness programmes can be a useful tool to engage and encourage members to improve their health and lifestyle, it cannot be the only source of incentive to achieve this, rather needs to be used in conjunction with various other forces to help achieve the expected outcome.

Research by the IFoA wearables working party\*\* leads to the conclusion saying "...based on the current evidence, insurers should not pursue wearable health technology with the primary aim of driving change towards healthier behaviours".

\*Rand Health Source: [https://www.rand.org/content/dam/rand/pubs/research\\_reports/RR200/RR254/RAND\\_RR254.pdf](https://www.rand.org/content/dam/rand/pubs/research_reports/RR200/RR254/RAND_RR254.pdf)

\*\* IFoA Source: : IFoA paper on Wearables and the Internet of Things by the Wearables and Internet of Things Working Party presented on 18 June, 2018

# For wearables to be integrated into a viable insurance product, risks faced by key stakeholders need to be addressed so all stakeholders are aligned



Source: : IFoA paper on "Wearables and the Internet of Things" by the Wearables and Internet of Things Working Party presented on 18 June, 2018

# Many insurance companies around the world have already incorporated wearables into their existing propositions



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## Aditya Birla Health

Discounts for policyholders who record a specified number of steps using an activity tracker or attend gym sessions or have a health assessment.

## The Vitality Programme

Vitality members earn points and achieve a higher Vitality Status when they undertake activities to know improve their health. Higher Vitality statuses unlock higher rewards for benefits such as gym, travel and other discounts.

## AXA

Offers a free Withings Pulse fitness tracker. Participants receive discounts of over \$100 on their insurance policies, as well as discounts off any Withings product purchases when they complete a certain number of steps.

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## Oscar

Rewards customers who track their fitness data with gift cards for those reaching their step goals.

## United Healthcare

Rewards users with healthcare credits for reaching daily fitness goals.

## Qantas Assure

Policyholders receive Qantas frequent flyer points if they lead more active lifestyles.

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## Aetna

Track progress helping to receive health goals that are unique to individual, as well as recommendations, nudges and rewards.

## Esurance

SavorBand devices are offered which can capture information on food consumed, including recipes, cooking tips, and purchasing discounts along with other data.

## Beam Technologies

Uses Bluetooth enabled toothbrushes to reward good brushing habits with discounted insurance premiums and other rewards

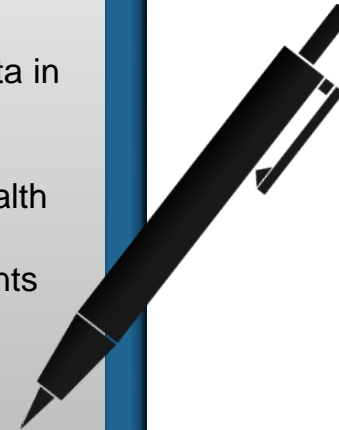
**What do consumers think?**

# Survey on tracking activity and health indicators using wearable devices

**We conducted a survey on LinkedIn to investigate what our contacts think about the use of wearables in insurance, with questions related to:**

- ✓ Demographic profile of responders
- ✓ Current use of wearable devices
- ✓ Opinions on sharing data with insurers
- ✓ Fairness on using wearable data in insurance pricing
- ✓ How the use of wearables has impacted activity levels and health indicators
- ✓ The impact of wearable discounts on insurance policy renewal

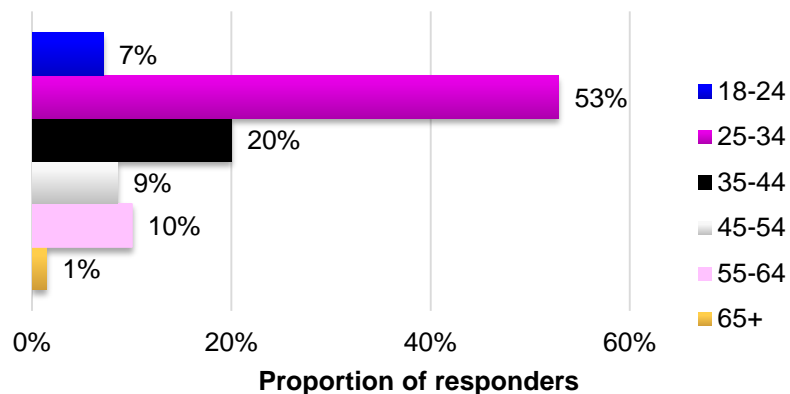
**Total responses: 70**



# Survey results: Demographic profile of responder



## Age Band

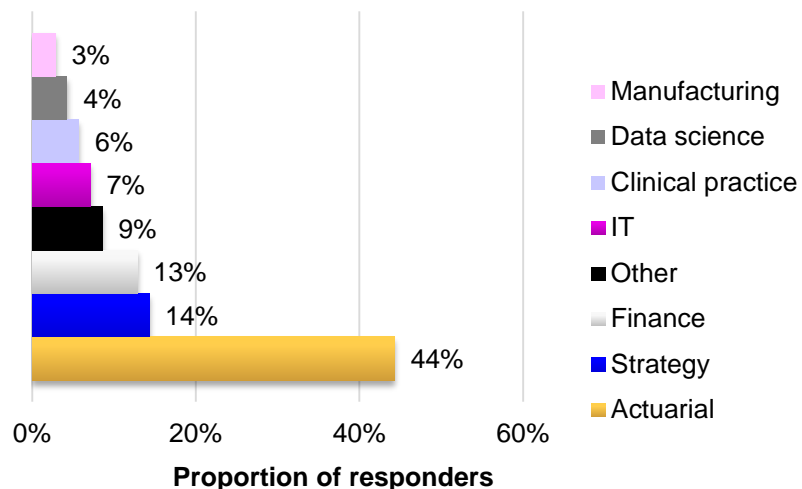


Our responders were mostly young adults in actuarial, strategic or financial roles based in the UK.

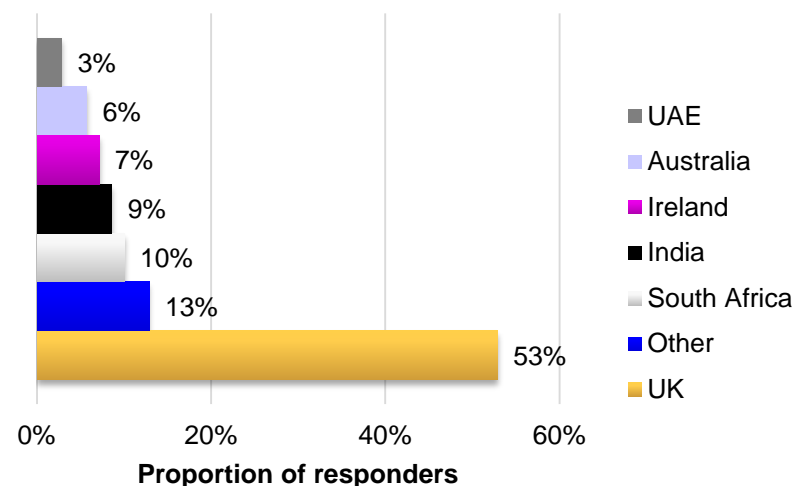
### Gender distribution:

- 41% female
- 57% male
- 1% prefer not to answer

## Job Type



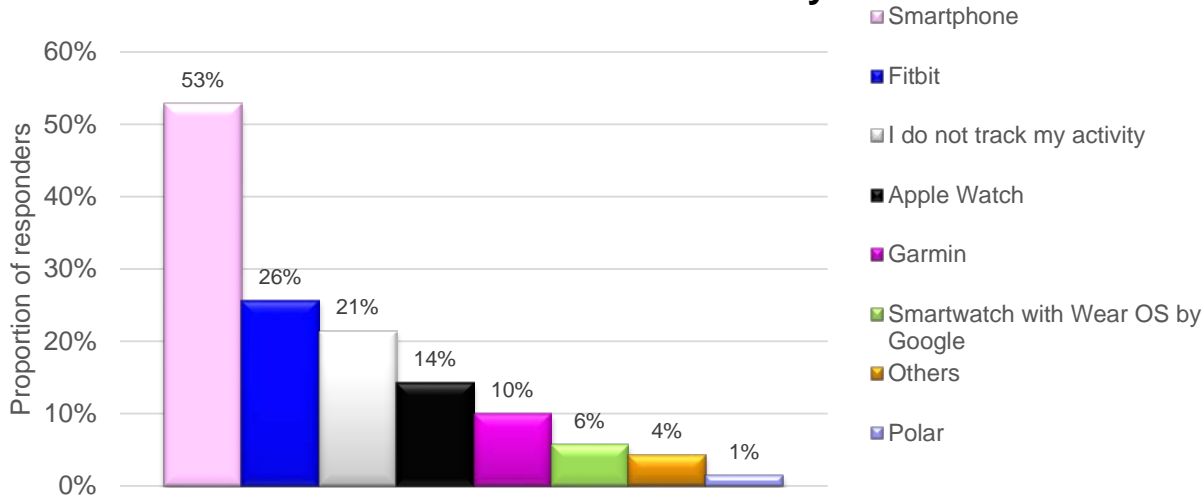
## Country



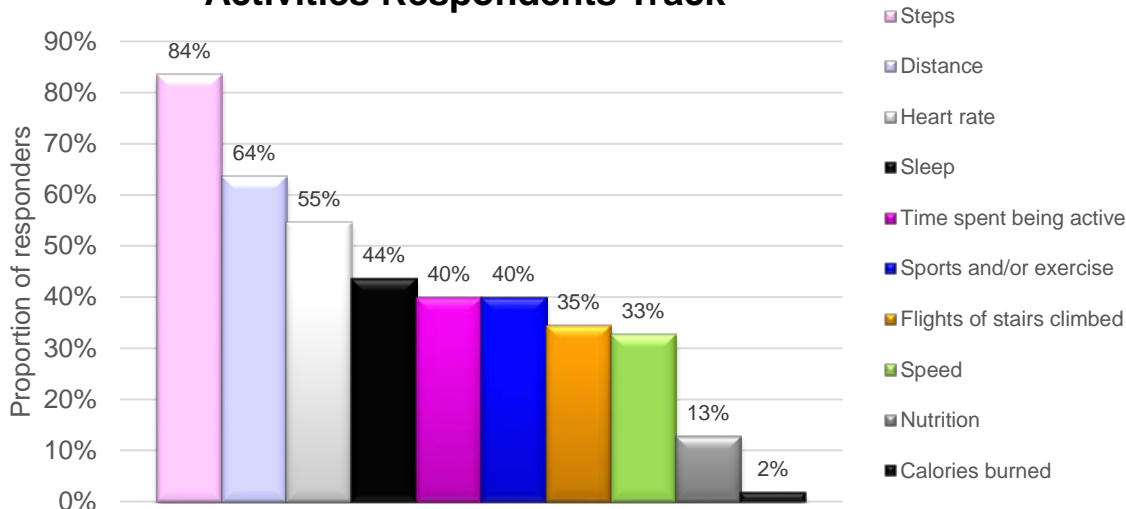
# Survey results: Devices, tracking activities and steps



## Main Devices Used to Track Activity



## Activities Respondents Track



Smartphones are used by more than 50% of responders, with Fitbit being the next most popular choice.

35% of responders use more than one device to track activity.

Out of those responders who track their activity, close to 50% have been tracking it for more than two years.

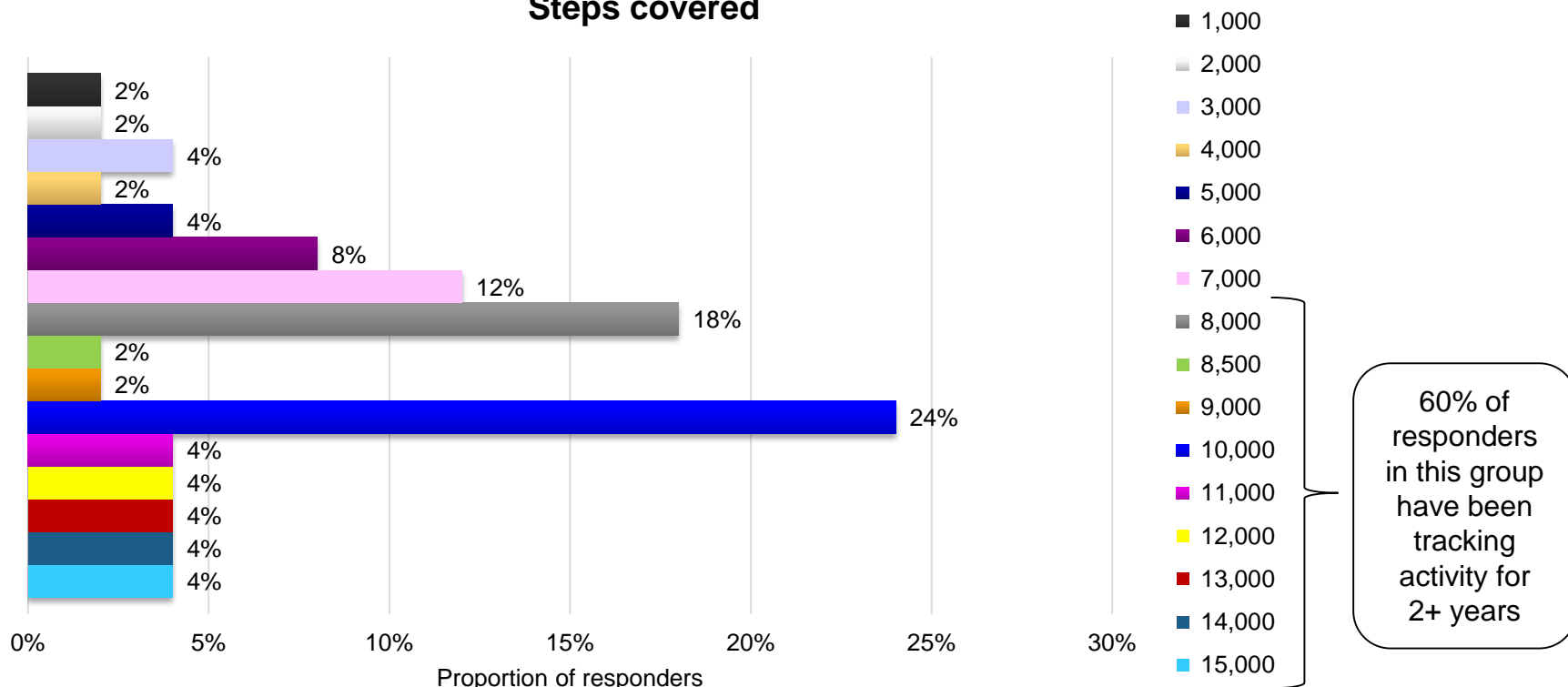
Most tracking is done during the daytime and during exercise periods, rather than during the night (sleep).

# Survey results: Steps covered

Most responders report that they cover 8,000 or more steps per day



### Steps covered





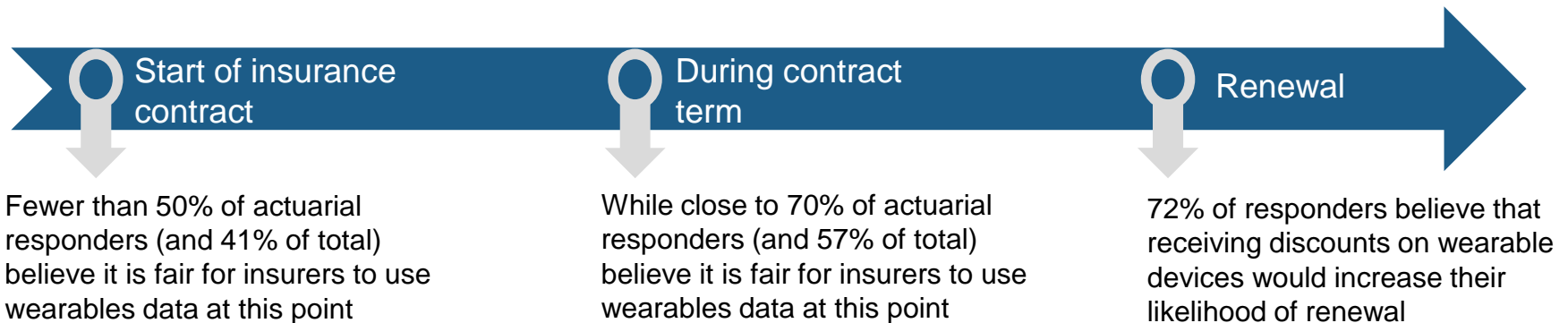
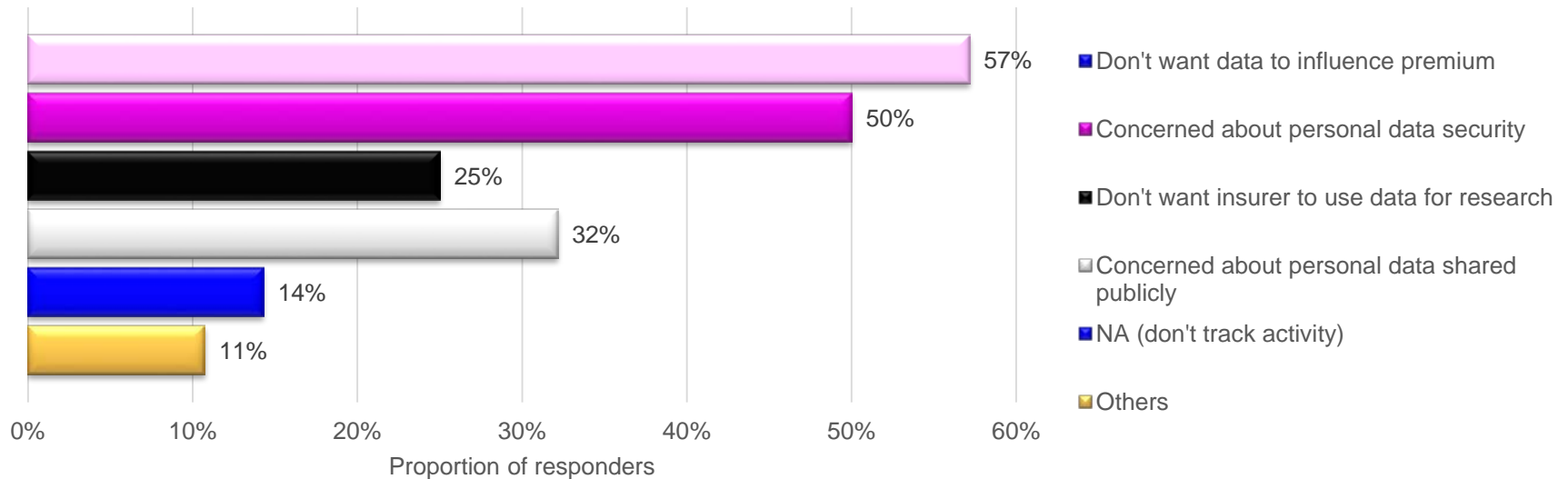
# Survey results: Sharing and use of data



Of our responders (who are mostly actuaries):

- 51% | 43% are willing to share data with their health | life insurer
- 40% are not willing to share data with any insurer

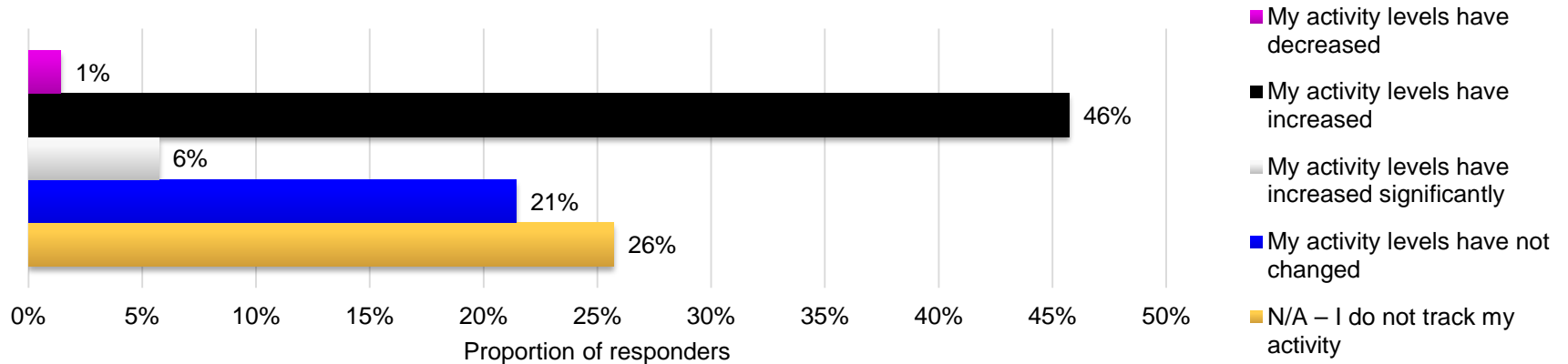
## Reasons for unwillingness to share data



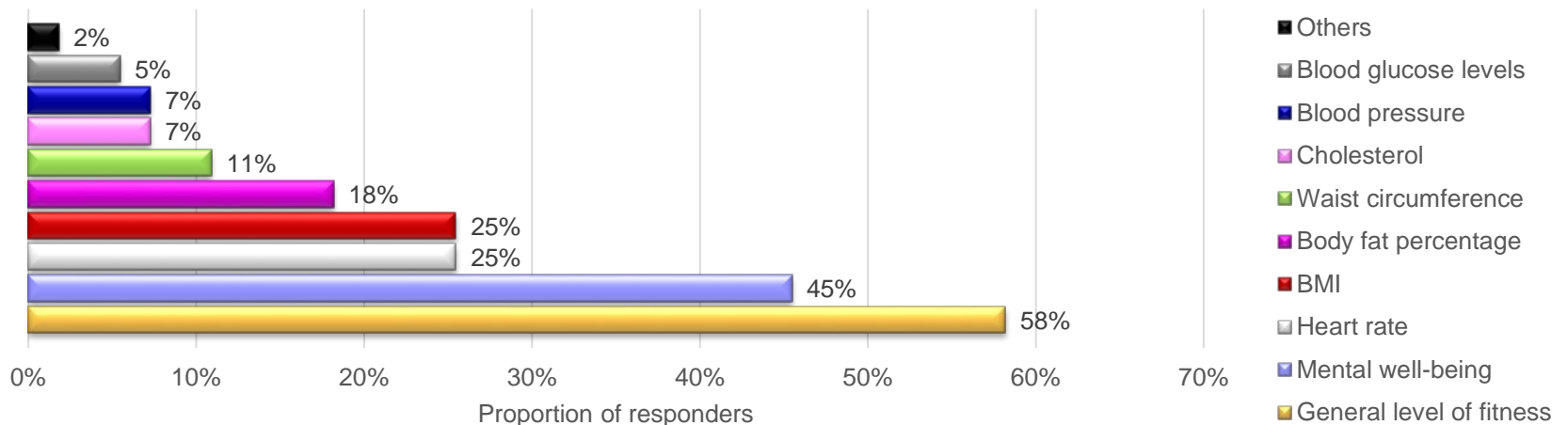
# Survey results: Wearables impacting activity level and improvement in measures



## Wearable devices influence activity level



## Perceived measures improved as a result of activity tracking



# Survey results: Interesting comments



## On sharing of data

I am concerned that there are implications to this that I cannot reasonably foresee.

I think people become neurotic measuring their movement.  
Nervous. Jittery

Seems a bit 'big brother' ish!

Too invasive is the main reason, also, I switch up which wearable I'm using depending on activity, and sometimes I don't wear any at all. This may look like I'm less active than I am

# Survey results: Interesting comments



## On Fairness of insurance firms using wearables data to set premiums

Activity should not dictate the premium but should have an effect on an incentivized reward program (Vitality Model). By having more active clients you will theoretically reduce the amount of pay-outs by having healthier clients.

Data risk insight for establishing rates. Up to individual if it should be used but if it can then it is useful information. Shouldn't be compulsory but should be optional.

Don't think there's enough data currently to be able to do this accurately

I don't think it is fair as everyone fitness levels are variable.

It depends on how the data is used and how accurate studies are relating to assumptions being set for premium rates. Someone logging limited data may not necessary be able to log more for practical reasons so basing premiums on that is not reasonable.

# Survey results: Interesting comments



## General comments

Another interesting idea is whether people could share their health data that they gather through blood tests (e.g. those offered by Thriva) and whether insurance companies could gather and use this data in a similar way to what you are thinking about with insurance.

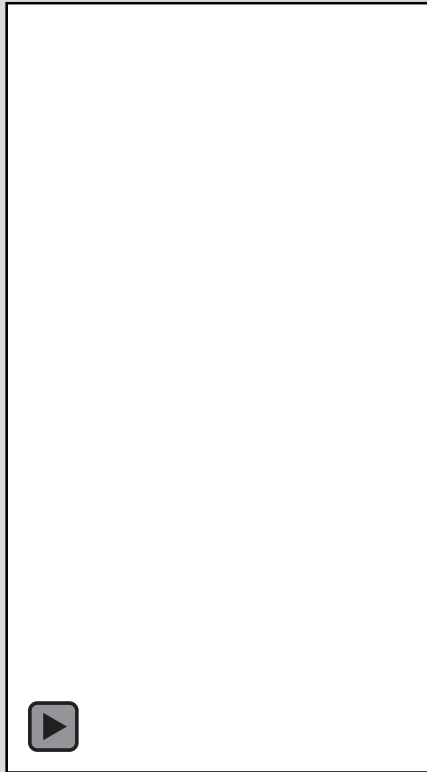
It should be part of a true shift to customer centric risk reducing insurance propositions. Remember buying insurance is buying peace of mind that you are financially prepared for adverse events. It's not supposed to be a savings scheme (which perfect pricing would turn it into).

Would have to be careful of using wearables data for rating and the data's correlation with age or other potential factors to ensure no double hit in premiums. E.g. likelihood for injuries affecting wearables consistent use for activities; general performance measurements obtained from wearables; etc...

I think it would work if it's managed in a similar manner to telematics, i.e. start on normal rates and evidence good habits. Whether it is affordable for the insurer to fund Fitbits I don't know, but as wearables are expensive people may be unlikely to buy them specifically to get an insurance discount.

**Are wearables useful in understanding morbidity?**

# There is potential for fraud and abuse if benefits and premium discounts depend on activity captured through wearable devices



There will be no shortage of creative ways to game the system and insurers will need to develop methods to guard against new types of fraud that will arise as a result of new technologies

## Mobile Phone Holder Shake Wiggle Device 1pcs toys or Mobile Phone WeChat Run Step Count Program

by Aerobin

★★★★★ 1 customer review

Price: **£6.61** & **FREE** delivery

Pay ~~£6.61~~ **£0.00**: get a **£30** gift card upon approval for the Amazon Platinum Mastercard. Terms apply.

**Note:** Not eligible for Amazon Prime.

1 new from **£6.61**

- **EASY TO USE:** It also can be used as a mobile phone bracket with good view of screen, easy to take. Battery or USB charging to operate, easy to use.
- **HIGH QUALITY:** Made of high quality metal and plastic, it is durable to use, it weighs only 354g/12.5oz and is very lightweight and can be used in any occasion.
- **GOOD GIFT:** Perfect gift for your friends or family, a good craft ornament, do you want to rank first in the WeChat sports rankings? Then this is your best choice
- **AFTER SALE GUARANTEE:** We care for every customer's feeling. If this product does not meet or exceed your expectations, please contact us at first, we will solve the problem immediately.
- **FUNCTION:** Pretend you're running and have your WeChat program record your steps automatically.

[› See more product details](#)

The introduction of games and insurance products that offer rewards for step counts has created a market for tools that simulate steps that are sold on Amazon.

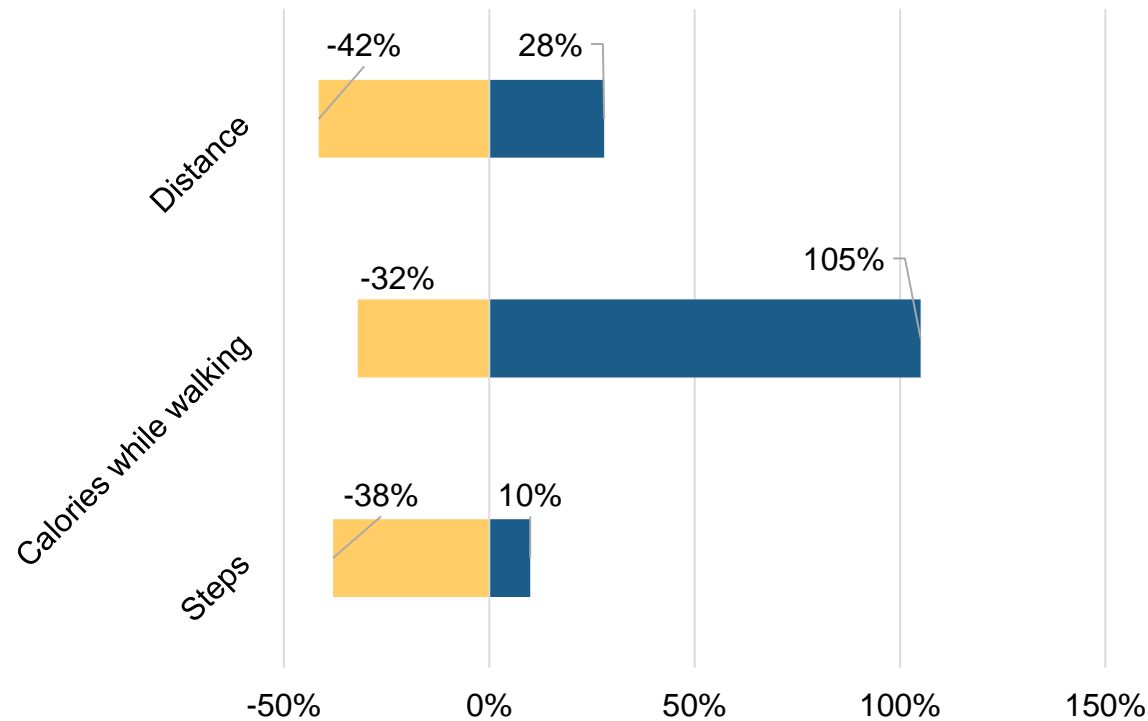
[https://www.amazon.co.uk/gp/product/B07S73YWG9?pf\\_rd\\_p=330fbd82-d4fe-42e5-9c16-d4b886747c64&pf\\_rd\\_r=AJFM6TYD1TV6YCFBSX5Q](https://www.amazon.co.uk/gp/product/B07S73YWG9?pf_rd_p=330fbd82-d4fe-42e5-9c16-d4b886747c64&pf_rd_r=AJFM6TYD1TV6YCFBSX5Q)

# Distance, steps and calorie counts recorded by wearables can be inconsistent



UK consumer watchdog, Which?, tested consistency in a range of metrics for various big brand fitness trackers\*.

Percentage difference in actual vs. recorded according to Which? experiment



The observed discrepancies could mean that policyholders could be unfairly rewarded/penalised according to the wearable device they have.

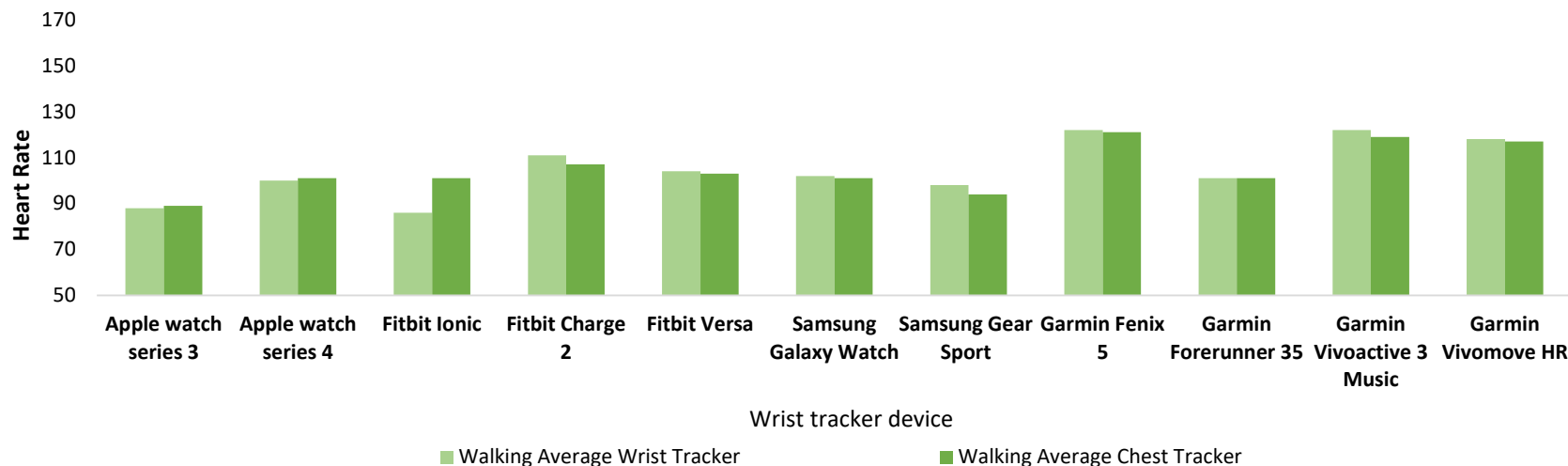
\*<https://www.which.co.uk/news/2019/04/marathon-training-here-are-eight-fitness-trackers-to-avoid/>



# Wearables can be worn continuously but may produce less accurate results than measurement techniques that are only used occasionally (e.g. chest straps)

The below graph shows the results of using various wrist devices alongside a chest strap to monitor heart rate at the same time.

### Heart Rate comparison between wrist trackers and chest trackers



On show **on average**, the wrist trackers results were similar to the chest strap. It was found however that some wrist watches were slower to respond to changes in heart rate.

Wearables can provide useful data on medical clinical information. As put by Dr. Gregory Marcus, from the University of California, users of wrist wearable should use the heart-rate monitors within the devices to look at **trends** over time, rather than for precise readings.

\*Source: <https://www.tomsguide.com/us/heart-rate-monitor,review-2885.html>

# Insurers will need to carefully consider how they collect, store, analyse and use the data generated by the wearable devices



## Health influencers

It is unlikely that wearables alone can influence health and reduce claims costs. In fact, the jury is still out about wellness programmes which are even more comprehensive so it is unlikely that wearables alone are going to achieve all of the objectives.



## Absolute vs. trend

How do you reward both those who are making improvements to their health (e.g. move from 3,000 to 8,000 steps per day) and those who are already at a high level (e.g. 15,000 steps per day).



## Regulation

Insurers will need to consider the relevant insurance and data protection regulation in their regions.



## Costs

There will be significant costs associated. For example:

- Funding/subsidising wearable devices.
- Infrastructure (e.g. cloud storage, computing power).
- Staff hiring and training.



## Engagement levels

Only some policyholders will be willing to share their data. How do you design benefits that are fair to all? Can you penalise those that share data but not those who don't?



## Data interpretation

The type and frequency of data being captured may make it challenging to derive any meaning from data analysis.



## Measures captured

What measures are being captured and used, and what are the challenges associated with this? For example, if distance is a measure of interest, what about the scenario where someone runs on a treadmill for an hour and logs 0 km.



## Funding considerations

# Providing top of the range devices will likely be to strengthen market position rather than giving users access to greater functionality

The below comparison looks at some main features of top rated 2019 fitness trackers, covering affordable to luxury devices.

- Most devices provide the majority of the main features currently expected of wrist wearables.
- The quality and potentially the accuracy of the products varies e.g. algorithms to track activity, or the screen size can vary considerably between different devices.

	Inbuilt GPS?	Heart Rate Tracker?	Activity Tracking?	Sleep Monitoring?	Waterproof?	Max battery life (Days, GPS off)	Max Price (Amazon UK)
YAMAY Fitness Tracker	No	Yes	Yes	Yes	3m	7	£31
Honor Band 4	No	Yes	Yes	Yes	50m	14	£35
Moov Now	No	Can pair with monitor	Yes	Can pair with monitor	50m	180	£55
Huawei Band 3 Pro	Yes	Yes	Yes	Yes	50m	12	£56
Amazfit Bip	Yes	Yes	Yes	Yes	3m	45	£63
Fitbit Inspire HR	No	Yes	Yes	Yes	50m	5	£70
Garmin Vivofit 4	No	No	No	Yes	50m	365	£86
Samsung Galaxy Fit E	No	Yes	Yes	Yes	50m	7	£89
Garmin Vivosmart 4	No	Yes	Yes	Yes	3m	7	£99
Garmin Vivosport	Yes	Yes	Yes	Yes	50m	7	£100
Fitbit Charge 3	No	Yes	Yes	Yes	50m	7	£119
Apple Watch Series 4	Yes	Yes	Yes	Can use an app	50m	0.75	£429

- All the above count calories burnt and number of steps.
- All but *Moov Now* have an interactive screen.
- All but *Apple Watch* work with Android and iOS technology.
- All but *Moov Now* and *Garmin Vivofit 4* can receive social media and phone alerts.

**Sources for top 2019 trackers:**

<https://www.techradar.com/uk/news/wearables/10-best-fitness-trackers-1277905>; <https://www.digitaltrends.com/wearables/best-fitness-trackers/>

**Amazon:**

<https://www.amazon.co.uk/>

## **Wearables and health risk assessments**

# Health risk assessments (HRAs) are health questionnaires used to evaluate members' health risks and quality of life



We test whether HRAs, which are generally clinically evidence-based, treat the measures that wearables are designed to improve

The Centers for Disease Control and Prevention (CDC) defines an HRA as:

*“A systematic approach to collecting information from individuals that identifies risk factors, provides individualized feedback and links the person with at least one intervention to promote health, sustain function and/or prevent disease”.*

**HRAs typically incorporate three key elements:**



- Demographic characteristics – age, gender, location.
- Lifestyle behaviours – exercise, eating habits, alcohol and tobacco use.
- Emotional health – mood, stress, life events.
- Physical health – height, weight, blood pressure, cholesterol levels.
- Current and previous health conditions.
- Preventive screenings.
- Readiness to change behaviours to improve health.

# We have compared publicly available HRAs as well as our proprietary Milliman Rapid Health Risk Assessment tool



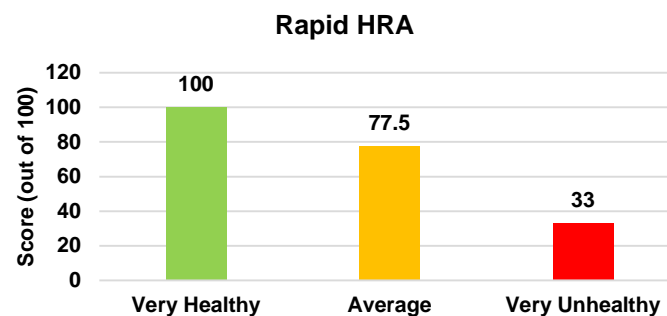
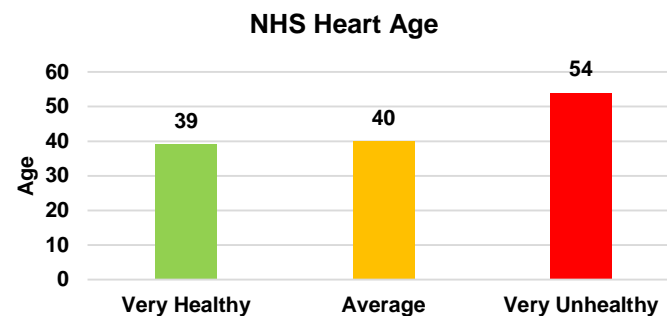
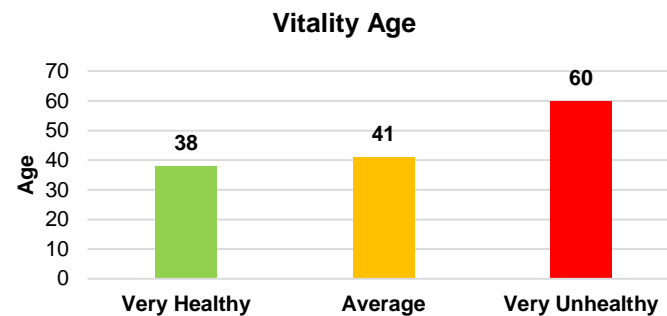
Question types	HRA tool		
	Vitality	NHS (UK)	Milliman Rapid HRA
Demographic features	✓	✓	✓
Lifestyle behaviours	✓		✓
Emotional health	✓		✓
Physical health metrics	✓	✓	✓
Current and previous health conditions		✓	✓
Preventive screenings		✓	✓
Readiness to change behaviours			✓
Output	Vitality Age	Heart Age	Health score out of 100

# HRA comparison of results



## Base case/Average

Age	40
Gender	Male
Height	5' 7"
Weight	64 kg
Waist circumference	30 inches
Exercise	5 hours per week
Blood pressure	120/80 mmHg
Glucose	4.5 mmol/L
Cholesterol	5.0 mmol/L
Pre-existing conditions	None
Food	Average fruit and veg intake
Smoking	Never
Alcohol	3 drinks per week
Mental health status	Normal levels of stress and tiredness



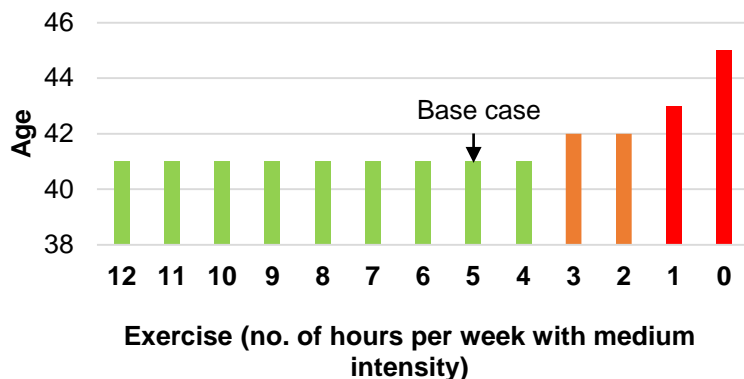


# How do HRAs value the measures that wearables are designed to directly influence

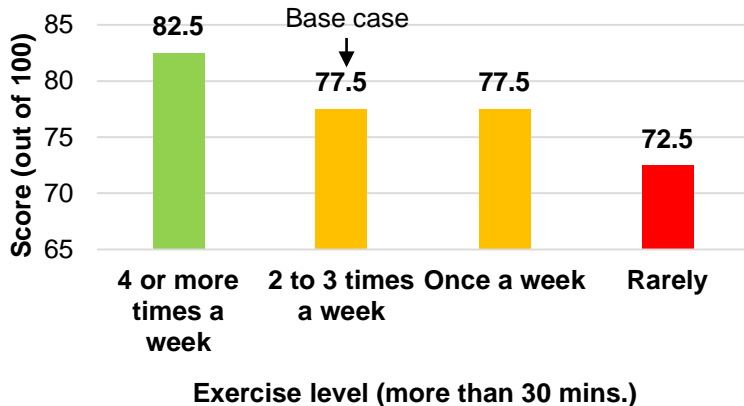


## Exercise

### Exercise: Vitality Age

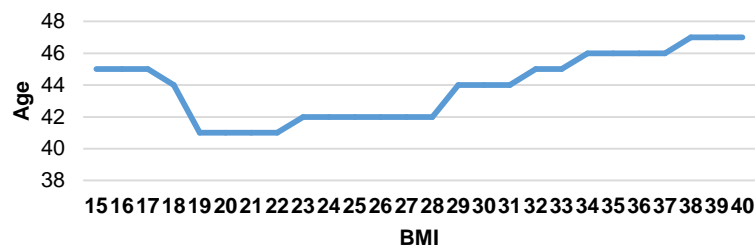


### Exercise: Rapid HRA

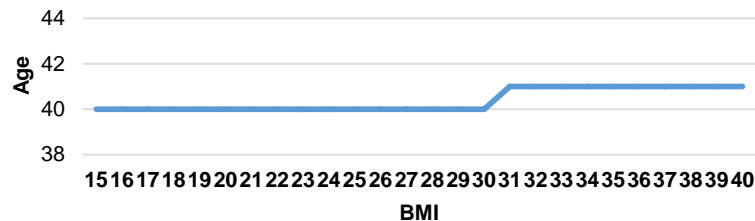


## BMI

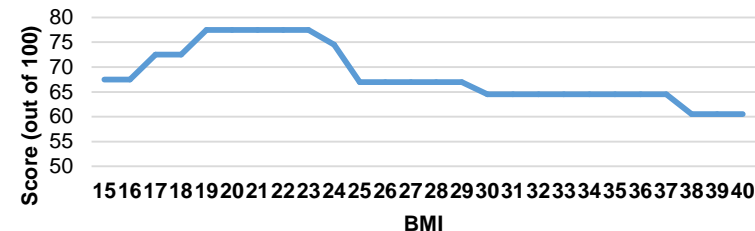
### BMI: Vitality Age



### BMI: NHS Heart Age

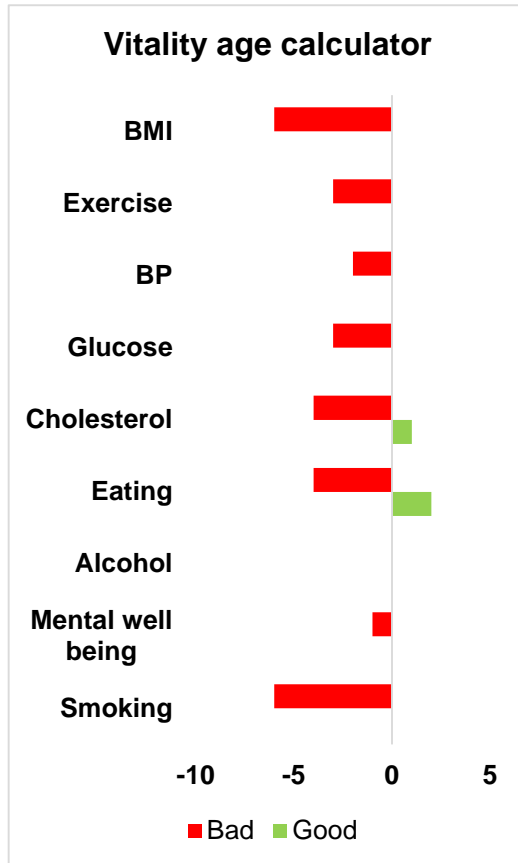


### BMI: Rapid HRA

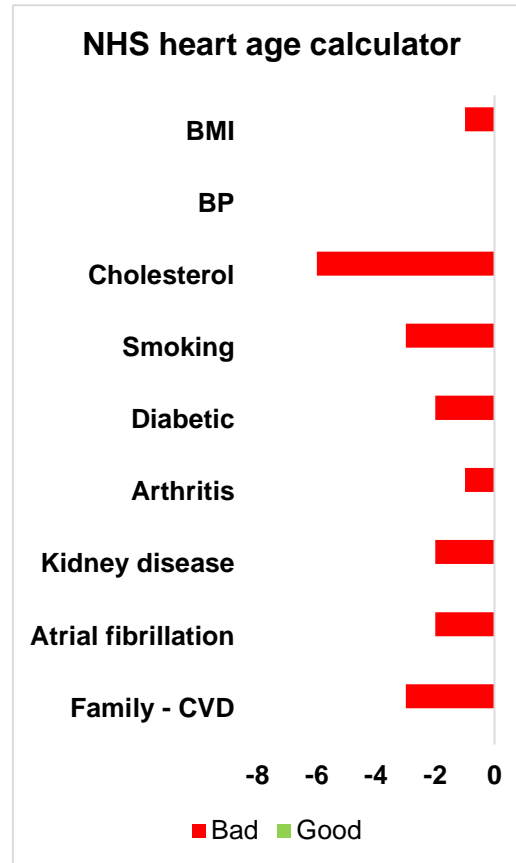


# Sensitivity of HRAs to key health metrics

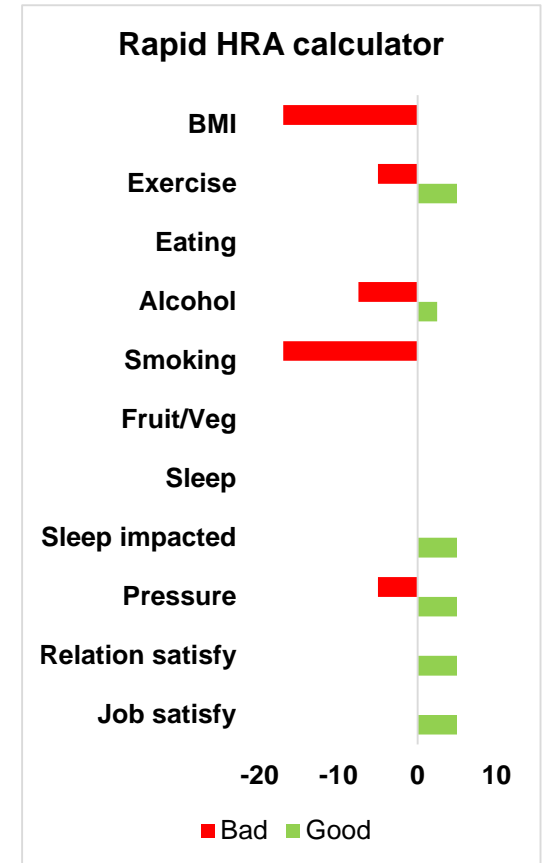
The charts below show the difference in output by varying each metric to 'good' or 'bad' from the baseline



**BMI and Smoking:** Major -ve impact  
**Alcohol:** No impact  
**Other influencers:** Moderate -ve impact  
**Cholesterol & Eating:** Mild +ve impact



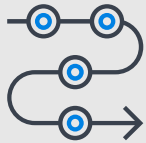
**Cholesterol:** Major -ve impact  
**BP:** No impact  
**Other influencers:** Moderate -ve impact



**BMI and Smoking:** Major -ve impact  
**Fruit/Veg and Sleep:** No impact  
**Exercise, Sleep & Mental well being:** Mild +ve impact

## Conclusion

# Conclusion

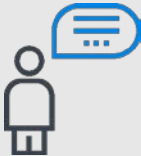


Use of wearables in insurance aims to improve claims cost prediction, make members healthier and strengthen insurers' competitive position.

However there is limited evidence that wearables change behaviour in the long-term, and indicators captured by wearables are not necessarily the main influencers of long-term health.



Wearables may encourage increased activity levels but should be considered as part of a comprehensive wellness offering. As illustrated by the HRA results, there are many factors other than activity that contribute to a person's overall level of measured health. Many of these factors are not captured by the widely available, non-medical grade wearables.



Our survey highlighted that our sample of respondents was fairly engaged with wearable technology and had varying views and levels of understanding of the wearables landscape, the use of wearables in insurance and whether they were happy for insurers to use their data.



Real-time data is an exciting big-data opportunity but its use needs to be carefully considered for its value, accuracy and fairness in how this translates to pricing and underwriting decisions that affect members.

**Questions?**



**Thank you**  
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