



Optimising  
shared-value  
through

# PERSONAL HEALTH PATHWAYS

**A behavioural science  
framework for members  
and insurers**

SEPTEMBER 2024



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# The science behind **PERSONAL** **HEALTH PATHWAYS**

## Executive summary

### Global challenge of increasing non-communicable disease

Healthcare systems and insurers worldwide are facing the dual pressures of aging populations and rising chronic disease prevalence, compounded by the escalating costs of new treatments and technologies. This creates significant strain on the sustainability of healthcare systems. Within Discovery Health Medical Scheme (DHMS), for example, members with chronic conditions incur, on average, 3.8 times higher annual costs than healthy members, and spend 32.7% more of their life expectancy in poor health. This impacts both individual health outcomes and healthcare costs, driving long-term increases in insurance premiums.

### Healthy habits lead to better health outcomes and reduced cost

Habits play a crucial role in shaping health outcomes. By coupling healthy lifestyle behaviours, such as regular physical activity and a balanced diet, with proactive health-seeking actions, such as medicine adherence, regular health checks, and screening, individuals can significantly improve their health trajectory, enhancing their chances of living healthier and longer lives. Leveraging Discovery Health and Vitality's extensive dataset, combined with advanced causal inference methodologies, has led to a breakthrough in understanding the direct impact of healthy habits on both mortality and morbidity.

Evidence from this study shows that improving one's clinical and physical activity habit from a poor habit to a strong habit results in a **13%** and **16%** reduction in in-hospital costs respectively. The impact of habit formation is thus significant. This paper shows that incentivising the formation of clinical habits generates **R2.50 of actuarial surplus**, and the formation of physical activity habits generates **R3.90, for every R1 invested** in a chronic member base.

As longevity increases and chronic diseases become more prevalent, healthcare systems must transition to focus on prevention and proactive disease management. This requires identifying simple, personalised actions that build healthy habits driving improved health outcomes and lower healthcare costs.

### Precision and personalisation improves healthy habit formation

While the evidence of healthy habits improving health outcomes and reducing healthcare costs is clear, the challenge lies in driving targeted and sustained behaviour change. Key to behaviour change is personalisation - delivering precise and personalised health and lifestyle recommendations, customised communication and individualised rewards, based on each individual's specific needs, preferences, and circumstances. This approach makes interventions more specific and relevant, ultimately improving uptake and engagement and leading to better habit formation and improved health outcomes.

### Personal Health Pathways as the platform for personalisation and healthy habit formation

Developing personalised health recommendations for a large population, optimised to reduce morbidity, mortality, and healthcare costs, requires extensive data, advanced analytics, and machine learning, alongside expertise in behavioural science and health economics. Leveraging Discovery's rich data, data science, and behavioural science capabilities, we have created Personal Health Pathways, delivering customised healthcare journeys for 2.2 million adult members of Discovery Health Medical Scheme. Through an intuitive digital platform, Personal Health Pathways delivers personalised health and lifestyle actions, communication, and rewards that foster engagement and lasting behaviour change, driving better health outcomes.

*This paper explains the science behind Personal Health Pathways and how it works – for you, for society, and for us as a purpose-led, shared-value business.*

# Optimising shared-value in healthcare

A behavioural science framework underpins the approach to optimising shared-value in healthcare. This framework shows that healthy habits lead to better health outcomes and reduced healthcare costs, emphasises the importance of personalisation in driving sustainable behaviour change, and positions Personal Health Pathways as the platform for personalisation and healthy habit formation.

A behavioural science framework for improved health outcomes:



Alignment between improving individual health outcomes and delivering economic benefits for both insurers and members forms the foundation of the shared value proposition:

$$\begin{array}{ccccccc} \frac{\Delta \text{Personalisation}}{\text{Member}} & \times & \frac{\Delta \text{Habit}}{\Delta \text{Personalisation}} & \times & \frac{\Delta \text{Health Outcome}}{\Delta \text{Habit}} & \times & \frac{\text{Value}}{\Delta \text{Health Outcome}} = \frac{\text{Value}}{\text{Member}} \\ \text{How is personalisation implemented for the member?} & & \text{Why is personalisation important for habit formation?} & & \text{How do habits affect health outcomes?} & & \text{How are these health outcomes valuable to the member and health systems?} \end{array}$$



# 01

## Understanding habits: a path to lasting behaviour change

The psychology of habits and how habit changes  
drive improvement in health outcomes

△ *Habit* × △ *Personalisation* = △ *Health Outcomes*

# Habit theory | A path to lasting change

A habit is formed when an action is consistently completed to the point where it becomes automatic and predictable. By focusing on this progression from action to behaviour to habit, Personal Health Pathways aims to make proactive clinical and physical activity habits an automatic and sustainable part of all individuals' lives.

## What is a **habit**?

### Action

A specific, intentional, and often conscious activity or task that an individual engages in at a particular moment in response to a specific situation or goal.



Is there an **event**?



Did 5K steps



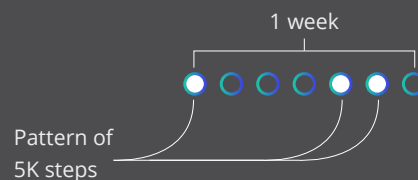
**Pattern**  
of actions  
creates a

### Behaviour

A pattern of actions or conduct that is typically guided by one's attitudes, beliefs, or values. It encompasses a range of actions and can be repeated over time.



Is that event **repeated**?



**Consistent**  
behaviours  
create a

### Habit

A specific behaviour that is ingrained and becomes automatic through repetition. It is performed regularly. Habits are typically formed through consistent practice and can be beneficial or detrimental.



Is that repetition **predictable**?



Repeated and predictable pattern

Members can improve their health outcomes by establishing and maintaining **physical activity** and **health-seeking or clinical habits** — consistent routines that drive long-term well-being. Physical activity habits, such as regular exercise or daily steps, improve cardiovascular health, manage weight, and boost mental well-being. Clinical habits, including routine check-ups, following medical advice, and undergoing preventive screenings, enable early detection and effective management of health conditions. By engaging in these habits regularly, members can reduce their risk of chronic diseases, improve their overall quality of life, and take a proactive approach to health management. The strength of habits lies in their capacity to transform intentional actions into automatic behaviours, making it easier for individuals to sustain healthy lifestyles effortlessly over time.

# What is a clinical habit?

A clinical habit is defined by the consistent completion of a clinically relevant action. To identify a clinical habit, past healthcare utilisation data is analysed to determine the predictability of an action's completion. When actions are consistently completed over a fixed time frame, it suggests that a clinical habit has been established.

## What is a clinical habit?

A clinical habit refers to the consistency with which health-seeking actions are completed over a particular time frame. These habits are examined across a broad range of clinically relevant actions that support the prevention, early detection, and management of health conditions.

Guided by clinical standards, each clinical action has a recommended frequency referred to as a "cycle", to maintain ongoing health and prevent complications, referred to as a 'cycle.'

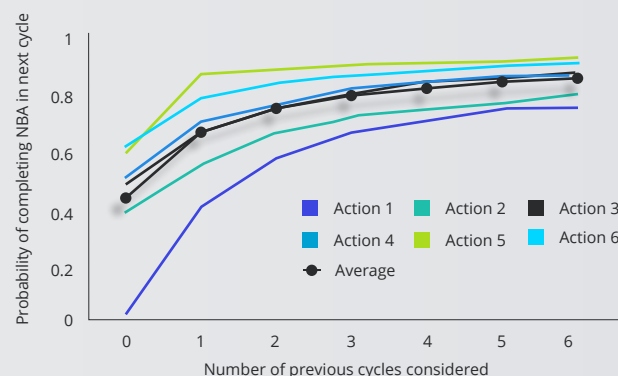
*Clinical recommendations for a member living with diabetes*

CLINICAL ACTION	CATEGORY	CYCLE
Collect medicine	Pharmacy	Monthly
Go for an HbA1c test	Pathology	Biannually
Consult with your primary care GP	Provider	Biannually
Go for a liver function test	Pathology	Annually
Go for a kidney function test	Pathology	Annually
Go for a cholesterol test	Pathology	Annually

## Forming a clinical habit

To determine if a clinical habit has been established, it is important to assess how many past cycles should be reviewed before the action's completion becomes predictable. For diabetes-related clinical actions, evidence suggests that if a member completes the action in each of the previous three cycles, there is, on average, an 80% chance of completion in the next cycle. Consistent completion across three cycles indicates that the member has likely formed a habit of performing that action.

*Probability of completing actions in next cycle given previous cycle completions*

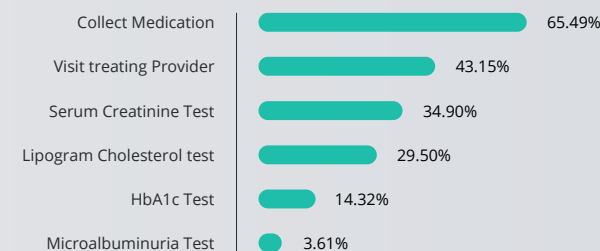


## Most individuals do not complete their clinical actions regularly

Habits provide valuable insights into the behaviours of members living with diabetes, revealing which actions they consistently engage in and identifying opportunities for improvement.

A large proportion of DHMS members living with diabetes are consistently collecting their medication and visiting their treating provider; however, many are not completing their pathology tests as recommended.

*Proportion of DHMS members living with diabetes in a habit of each clinical action*





# Understanding clinical habits

To gain a deeper understanding of how individuals manage their chronic conditions, habits across clinically relevant actions are combined into a value-weighted composite measure called the Clinical Habit Index (CHI). This index summarises the overall habits displayed in managing the condition.

## Developing the Clinical Habit Index

The CHI summarises the overall habits displayed in managing a chronic condition, with a score of 0 indicating poor management and a score of 1 reflecting consistent completion of all clinically relevant actions.

### Clinical Habit Index Formula

$$\frac{1}{N} \sum_{i=1}^N \frac{w_i \times \text{completed cycles}}{\min(\text{cycle exposure}, 3)^*} = w_1 \left( \frac{1}{3} \right) + w_2 \left( \frac{2}{3} \right) + w_3 \left( \frac{1}{3} \right) + w_4 \left( \frac{3}{3} \right) + w_5 \left( \frac{2}{3} \right) + w_6 \left( \frac{3}{3} \right)$$

Action 1      Action 2      Action 3      Action 4      Action 5      Action 6

$N$ : The total number of clinically relevant actions available for a member.

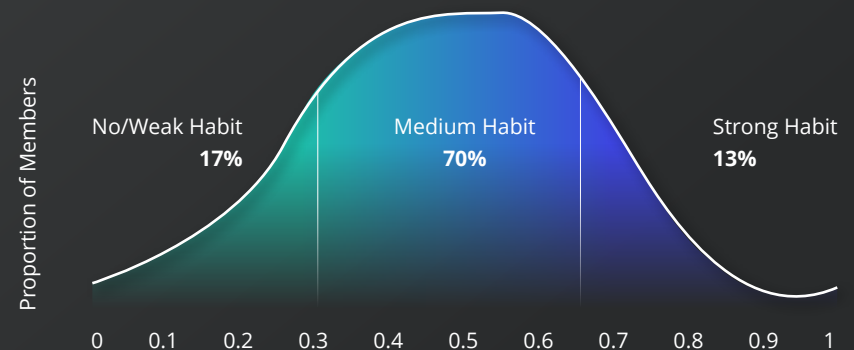
$w_i$ : The normalized value-weight of the  $i^{\text{th}}$  clinical action captures its relative importance in shaping the overall Clinical Habit Index. This weight is determined by sophisticated models that evaluate the economic impact of each action, assigning higher weights to actions that generate greater economic value. By doing so, the Clinical Habit Index is more significantly influenced by high-value actions.

\*Each action contributes to the CHI from the first cycle of exposure, ensuring immediate inclusion without requiring three full cycles, thereby providing a comprehensive view of the member's management habits.

## Most individuals take action to manage their chronic condition but very few manage them consistently

Using the CHI, only ~13% of the DHMS diabetic population are in a strong habit across all clinically relevant actions

CHI distribution of DHMS members living with diabetes



- **No/Weak Habit (0-0.33):** Minimal engagement; the upper range suggests at least one completion per action
- **Medium Habit (0.34 – 0.66):** Moderate engagement; the upper range indicates at least two completions per action.
- **Strong Habit (0.67 – 1):** High engagement; a score of 1 reflects consistent completion of all clinical actions.

# There is a strong link between care management programmes and clinical habits

Despite many members living with diabetes making efforts to manage their chronic condition, few are doing so consistently. Our analysis shows that members enrolled in Discovery care management programmes demonstrate higher Clinical Habit Index scores, underscoring the positive influence of these programmes on health-seeking habits.

Significant progress has been made through care management programmes developed by Discovery Health. These programmes are established, integrated mechanisms aimed at enhancing clinical outcomes for targeted segments of chronic patients, with a primary focus on provider-driven healthcare coordination to improve health outcomes.

Members enrolled in care management programmes such as Diabetes Care or Cardio Care demonstrate higher Clinical Habit Index scores compared to eligible members who are not enrolled, underscoring the positive influence of these programmes on clinical habits.

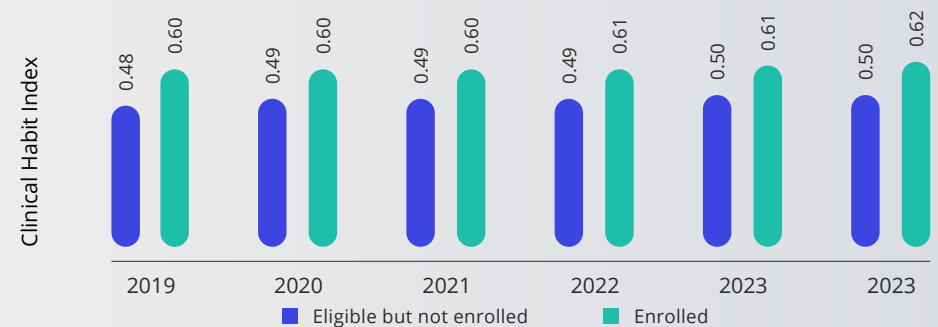
In 2023, stronger clinical habits among members in care management programmes correlated with an 11% reduction in healthcare utilisation per life per month, after adjusting for age, gender, plan type, and comorbidities. This reduction underscores the powerful impact of cultivating clinical habits.

For chronic members and beyond, Personal Health Pathways seeks to harness the power of habit, reaching a broader and more diverse range of members with unique health needs and circumstances. Looking ahead, there is a hypothesis that strengthening health-seeking habits will reduce morbidity and mortality. To confirm or challenge this hypothesis, causal techniques are essential to validate the broader impact of these behavioural interventions on long term health outcomes.

**Clinical Habit Index before and after Diabetes Care programme enrolment**



**Members enrolled on Diabetes Care have improved health-seeking habits**



# What is a **physical activity** habit?

A physical activity habit is defined as the consistent completion of physical activity actions with a high degree of predictability. To identify a physical activity habit, at least six weeks of data are required to determine if a particular pattern is predictable. We label the pattern of behaviour a strong habit when we can predict it with a high degree of accuracy. This identification and classification of habits for each individual becomes a powerful and critical data point in managing health outcomes.

For the purposes of this research, we have classified physical activity habits to understand the health benefits of improving them.

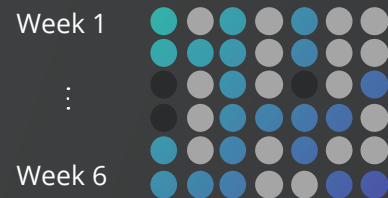
**The classification is based on three core characteristics:**

The action: what you do.

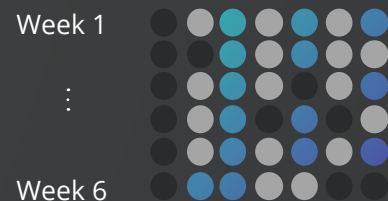
The frequency of the action:  
how often you do it.

The predictability of the action:  
how consistently you do it.

## Member 1 Training data



## Member 2 Training data



We build a predictive model per individual member

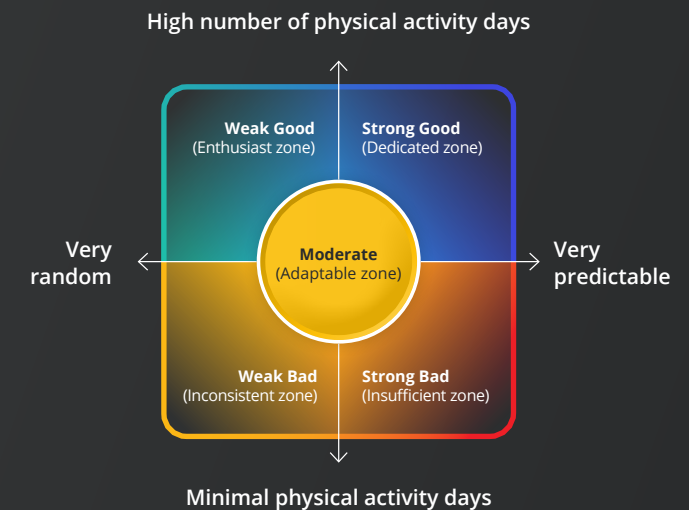


Lasso  
Logistic  
Regression  
Model

**R<sup>2</sup>**  
(model score)

How well past behaviour  
predicts future behaviour

## Classification of habits based on model score





# 02

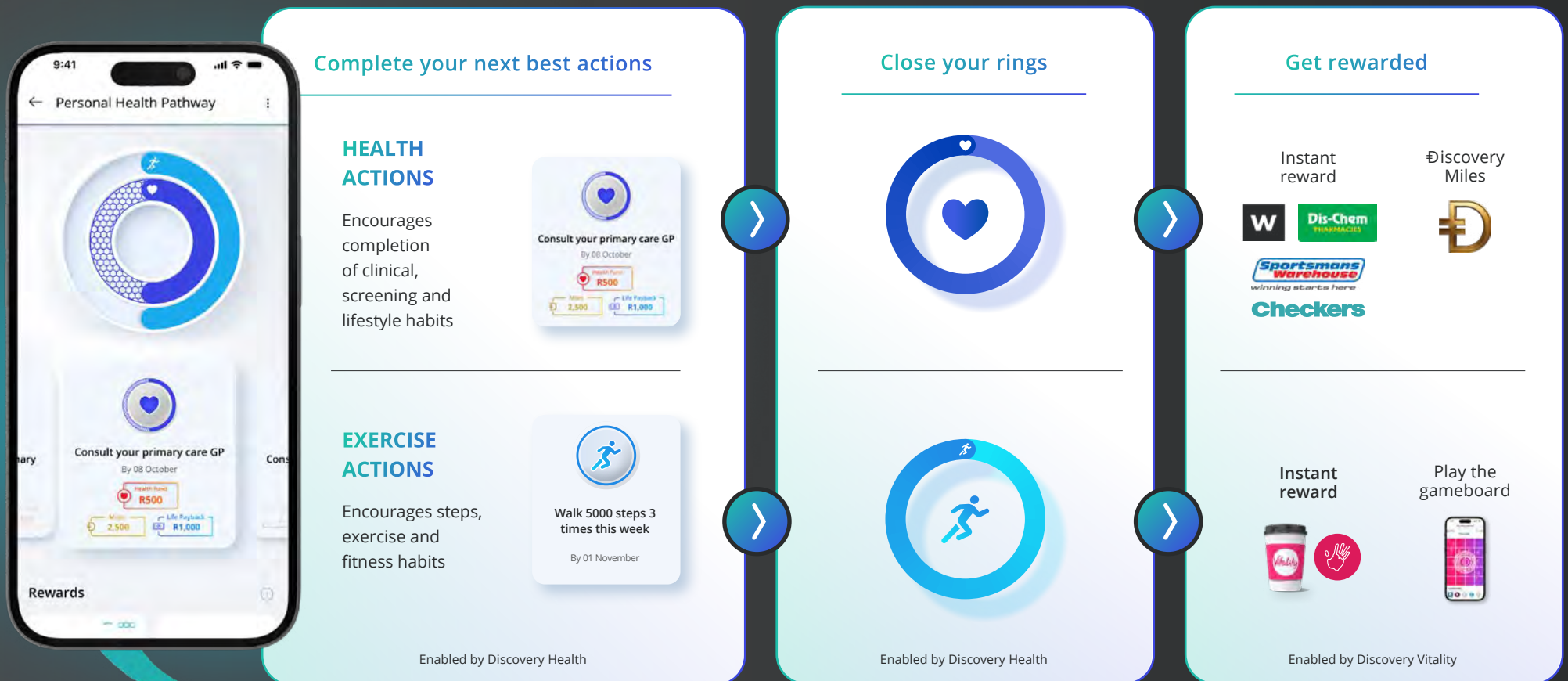
## Personal Health Pathways as the platform for personalisation and healthy habit formation

How sophisticated data science and machine learning capabilities enable hyper-personalisation of actions, rewards, and communication to drive healthy habits and sustained engagement

△ *Habit* × △ **Personalisation** = △ *Health Outcomes*

# Introducing Personal Health Pathways | A personalised programme that encourages healthy habits

Personal Health Pathways operationalises shared-value by guiding medical scheme members through personalised healthcare pathways towards healthier habits and rewarding them along the way. Personal Health Pathways manifests in a simple personalised healthcare pathway through the Discovery Health app and an intuitive WhatsApp journey, making it easy for members to form healthy habits and improve their long-term health.



# Personalising rewards, actions and communication

Personal Health Pathways harnesses personalised rewards, tailored actions, and targeted communication to foster meaningful and lasting behaviour change. By aligning interventions with individual needs and preferences, Personal Health Pathways enhances member engagement and drives positive health outcomes.

## Personalised communication

A sophisticated communication engine ensures that members receive their actions at the optimal time, in the style and through the channel that most resonates with them, encouraging them to complete the actions.



## Personalised and precise actions

By leveraging the world's largest clinical and lifestyle data set, combined with advanced risk segmentation, machine learning, and data science capabilities, next best actions are personalised, precise, and dynamic for every member.

## Personalised rewards

To drive engagement, members are rewarded for completing their next best actions with actuarially-matched, compelling incentives. These rewards are personalised for each member, adjusting dynamically based on the likelihood of completion and the potential impact on the member's long-term health outcomes

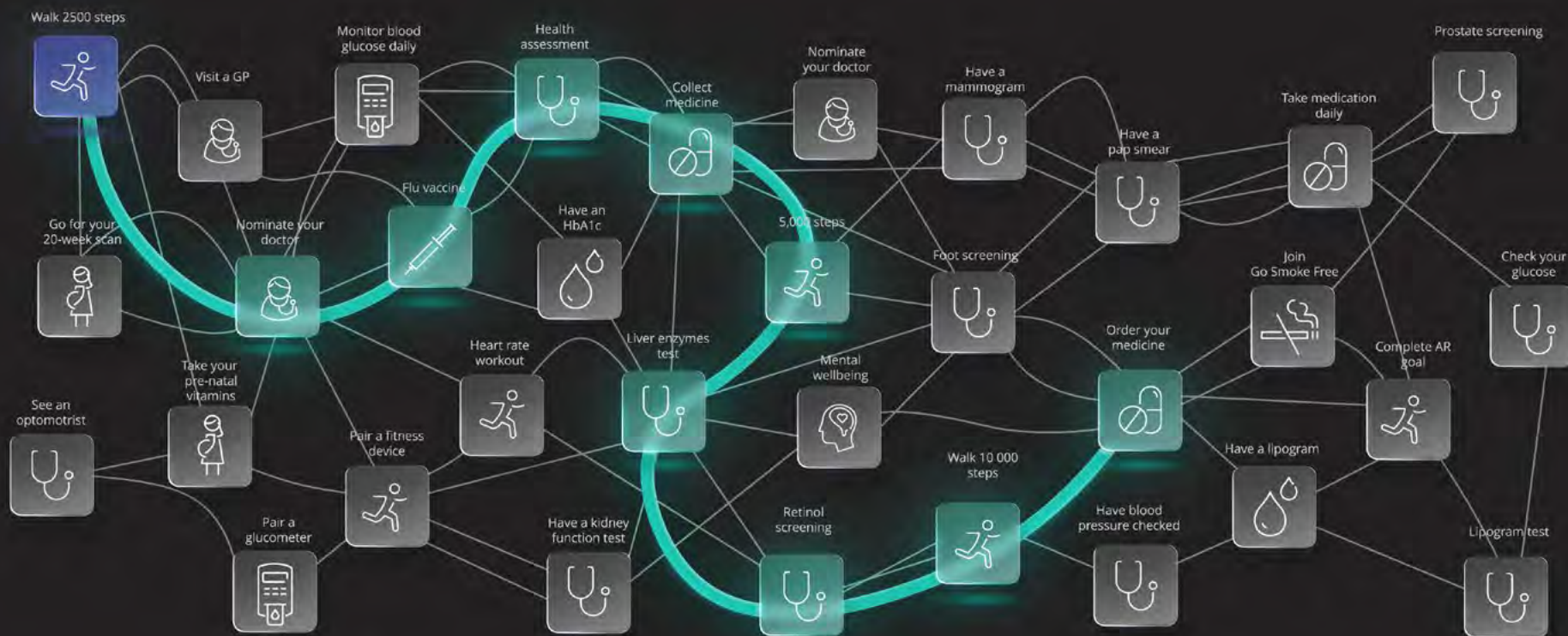


# Personalised and precise actions

Discovery Health has created bespoke and dynamic healthcare pathways for each member, ensuring that every action is precisely targeted and personalised. Engagement is driven by delivering clinically relevant actions at the right moment and in the correct sequence. These actions are tailored to each member's health status and unique engagement patterns, enhancing the overall impact and relevance of the healthcare journey.

With the example of just **12** possible actions there are over **7 million** ways to present a health pathway

Personal Health Pathways can create the most optimal healthcare pathway for each of the **2.2 million** adult lives on Discovery Health Medical Scheme



# Building personalisation requires a science-based approach

Discovery Health has over 30 years of clinical, lifestyle and behavioural data, and uses advanced actuarial analysis, data science modelling, artificial intelligence and behavioural economics to converge multiple clinical and lifestyle actions into a personalised health pathway for every member. Personal Health Pathways are enabled by a number of unique assets and skills, including:

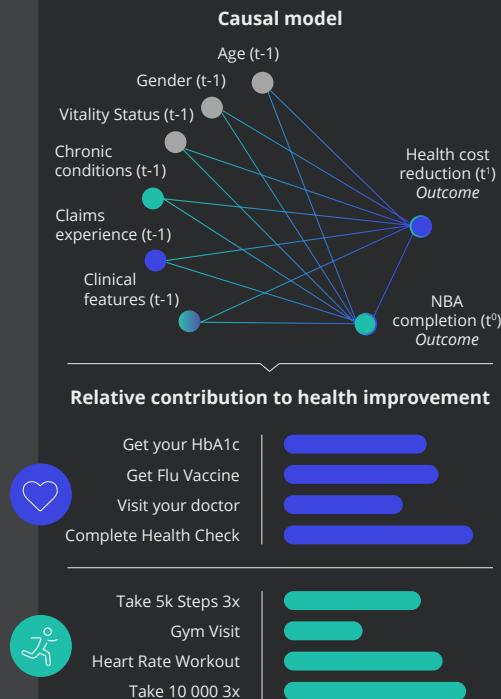
## Unparalleled data set enabling risk segmentation

World's largest lifestyle, clinical and behavioural data set to better understand every member's health risks, preferences and habits.

Age	50
Gender	Male
Vitality Status	Bronze
Registered Conditions	Diabetic
FUB	6
RUB	3
BMI	Overweight
Blood Pressure	Normal
Cholesterol	High
Past NBA Completions	Frequent

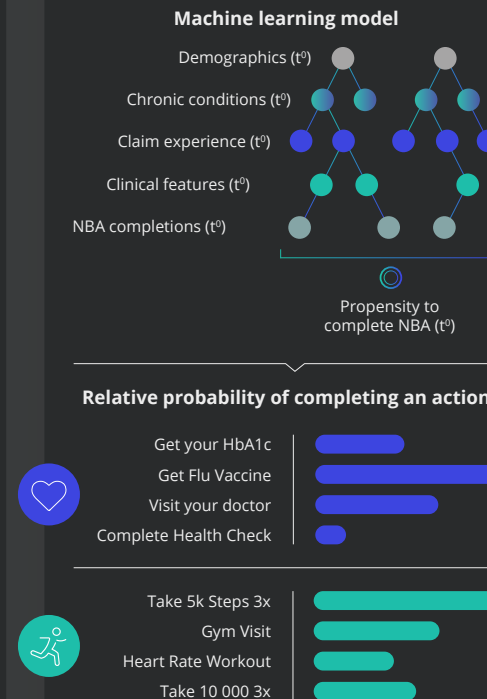
## Value models

Sophisticated causal model to determine the contribution of each action to long-term health improvement.



## Propensity models

Machine learning model incorporating prior engagement data to estimate the probability of a member completing a next best action.



## Personalised Health Pathway

Personalised and responsive pathways that dynamically respond to changing preferences, health status and life stage.

The modelling determines the next best actions to be presented to a member.

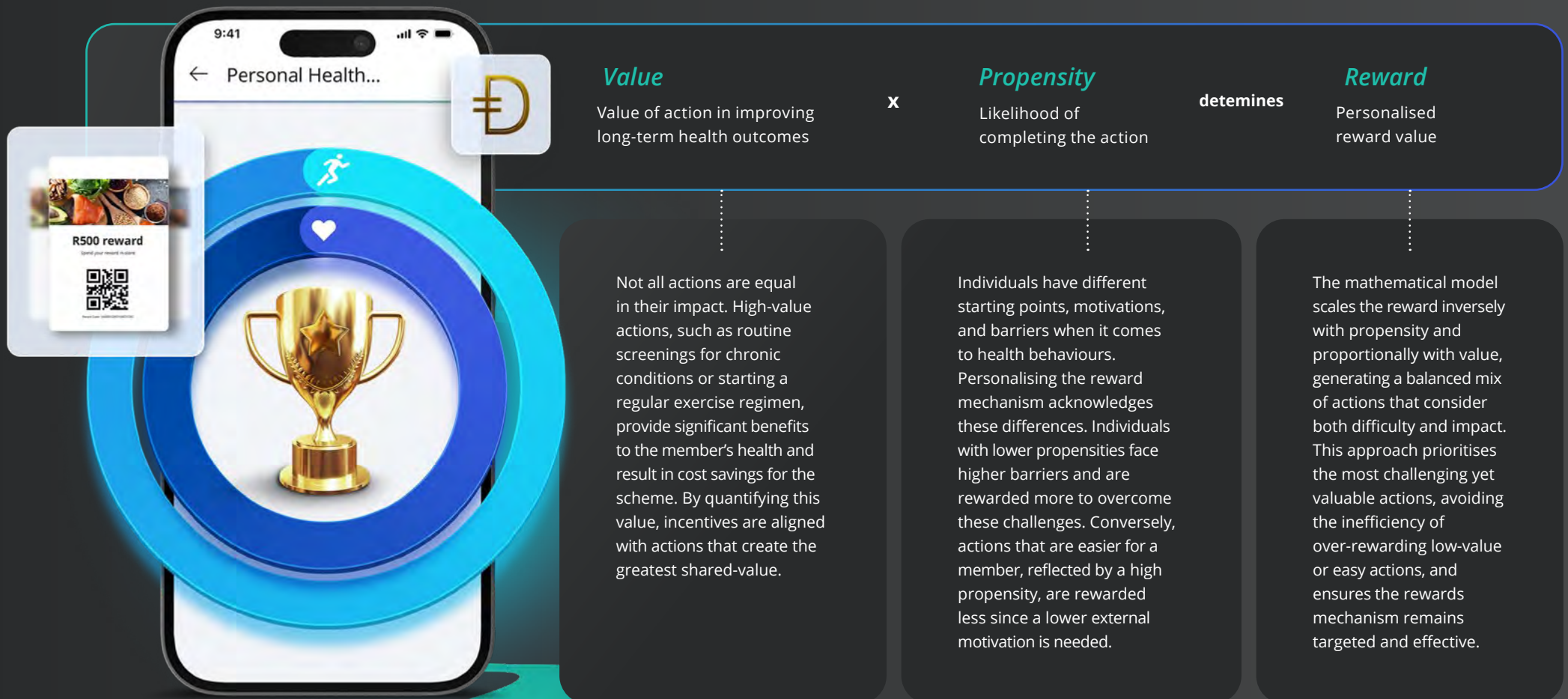
- |                            |                                |
|----------------------------|--------------------------------|
| 01 Get flu vaccine         | 02 Get your HbA1c              |
| 03 Visit your doctor       | 04 Complete VHC                |
| 05 Colon cancer screening  | 06 Podiatrist                  |
| 07 Vitality Age assessment | 08 Mental wellbeing assessment |
- 
- |                                |                                |
|--------------------------------|--------------------------------|
| 01 Take 5k Steps 3x this week  | 02 Take 10k Steps 3x this week |
| 03 Complete heart rate workout | 04 Visit the gym               |

— — — Shown to member

# Personalised rewards

To drive engagement, members are rewarded for completing their next best actions with actuarially-matched, compelling incentives. These rewards are personalised for each member, adjusting dynamically based on the likelihood of completion and the potential impact on the member's long-term health outcomes.

Personalised rewards leverage the dual understanding of the value of the action and the member's propensity to complete the action based on past behaviour. By carefully calibrating rewards, Personal Health Pathways not only motivates members to adopt healthier habits but also ensures that resources are used efficiently to maximise the shared-value between members and Discovery Health Medical Scheme.





# Personalised communication

Globally, personalised communication is essential for building trust and fostering deeper connections with audiences. Messages that acknowledge individual circumstances and speak directly to personal needs are more likely to resonate, driving higher engagement and response rates. This is particularly important in healthcare, where personalised communication can guide members through their health journeys, improve adherence to treatments, and support behaviour change in ways that generic advice cannot achieve.

## Multi-channel engagement approach

To optimise engagement, Personal Health Pathways uses a multi-channel approach to ensure that all relevant stakeholders can access the programme in a way that aligns with their preferences.



**Health App**



**Doctors**



**Bank/  
Corporate App**



**Health Coaches**



**WhatsApp**



**Service Agents**

## Personalised communication

### Personalised channel, timing and frequency supported by sophisticated communication engine

By leveraging available member data, a sophisticated communication engine personalises various aspects of member engagement including the communication **channel, messaging, timing, and frequency.**

By segmenting members into categories such as highly engaged, moderately engaged, or disengaged, channel choices are personalised to match each members' responsiveness and preferences.

There are some members who currently do not interact digitally with Discovery Health's suite of digital tools. Given the proliferation of WhatsApp as a preferred channel of communication, Personal Health Pathways offers members a seamless and intuitive user-experience through WhatsApp. This channel's ease of use makes it ideal for initial interactions, reminders, and nudges. Once a member has engaged on the platform, a glide path strategy guides the member from WhatsApp to the Discovery Health app, ensuring a seamless transition.

Continuous and adaptive optimisation further refines these strategies, ensuring communication remains effective and aligned with member behaviours.

### Leveraging Large Language Models to create hyper-personalised messaging

Large Language Models (LLMs) will enable highly personalised communication by generating contextually relevant and empathetic messages tailored to individual member needs. These models use data from health records, past interactions, and engagement patterns to craft dynamic, context-aware messages that resonate on a personal level, fostering trust and enhancing member engagement. The adaptability of LLMs allows the programme to maintain relevant and supportive communication throughout a member's health journey, ensuring the messages evolve in response to changing circumstances and health requirements.

# 03

## Shared-value impact of Personal Health Pathways

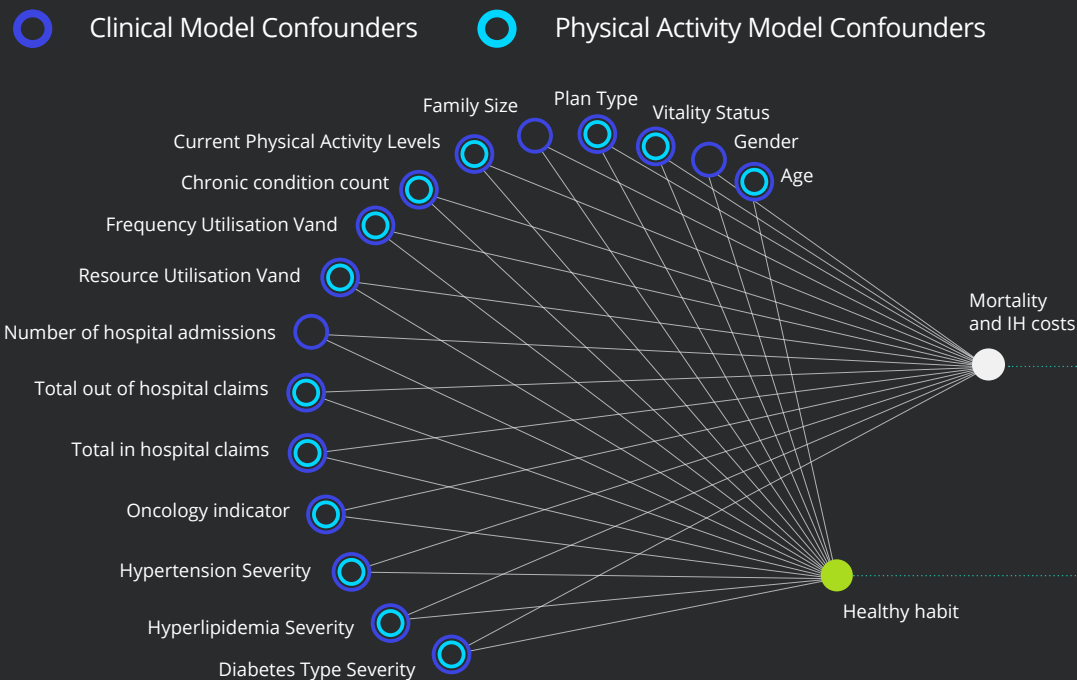
The methodologies and evidence supporting the value of habit changes in improving long-term health outcomes and economic benefits.

△ Habit x △ Personalisation = △ **Health Outcomes**

# Causal modelling methodology to determine the impact of improving habits

Causal modelling within Personal Health Pathways focuses on uncovering the cause-and-effect relationships between factors that impact an individual's health outcomes. This approach helps identify and quantify the interventions that are most effective in enhancing health outcomes over time. Causal modelling provides a structured framework for understanding these relationships, guiding targeted and effective interventions. This approach ensures that interventions consider the complex, real-world factors impacting health outcomes, enhancing the precision and impact of health strategies.

## Causal model



## Outcome

The outcome is the variable that the intervention aims to influence, specifically targeting improvements in morbidity and mortality. Causal modelling seeks to measure how specific interventions lead to these crucial health improvements, whether through clinical changes or behavioural modifications.

## Intervention

In causal modelling, an intervention is an action or treatment designed to affect an outcome. In Personal Health Pathways, interventions are tailored, personalised next best actions. The aim of modelling these interventions is to understand how completing these actions can directly influence health-related outcomes.

## Confounders

Confounders are variables that influence both the intervention and the outcome, potentially distorting the true causal relationship between them. In the context of Personal Health Pathways, a confounder could be disease severity, which might affect both an individual's likelihood of participating in a health intervention and their overall health outcome.

# Significant improvements in **mortality** through healthy habit formation

A retrospective mortality study on the Discovery Health South African book was conducted to determine the impact of clinical and physical habits on mortality.

**156,655**  
observations



**4191 deaths**  
(64,363 unique members  
living with diabetes)

**Study length**



**2013-2019**

Baseline period	2013
	2014
Observation period	2015
	2016
Outcome period	2017

\*timeline repeated for 2014-2018, 2015-2019

**Model used**



**Casual Forest**

## Study results

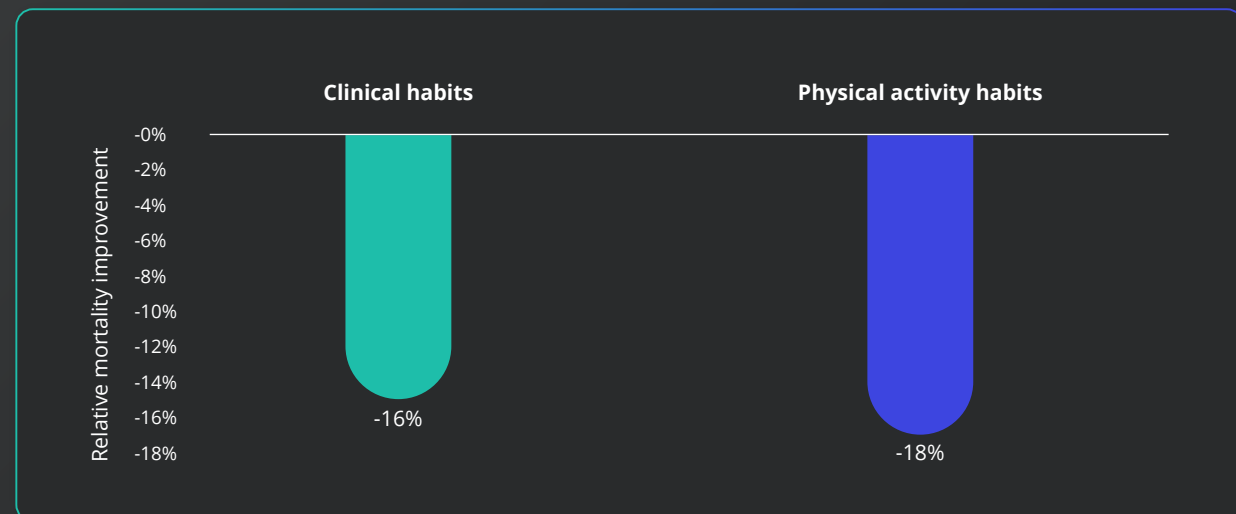


The results show that changing a clinical habit from a poor habit to a strong habit results in a **16% reduction** in mortality.



Changing a physical activity habit from a poor habit to a strong good habit results in an **18% reduction** in mortality.

**Relative mortality reduction moving from a poor habit to a strong habit**



\*PA: excluding strong bad due to low death exposure



# Significant improvements in **morbidity** through healthy habit formation

A retrospective morbidity study on the Discovery Health South African book was conducted to determine the impact of clinical and physical habits on morbidity, measured as in-hospital costs.

**156,655**  
**observations**



(64,363 unique members living with diabetes)

**Study length**



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Baseline period	2013
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\*timeline repeated for 2014-2018, 2015-2019

**Model used**



**Casual Forest**

## Study results

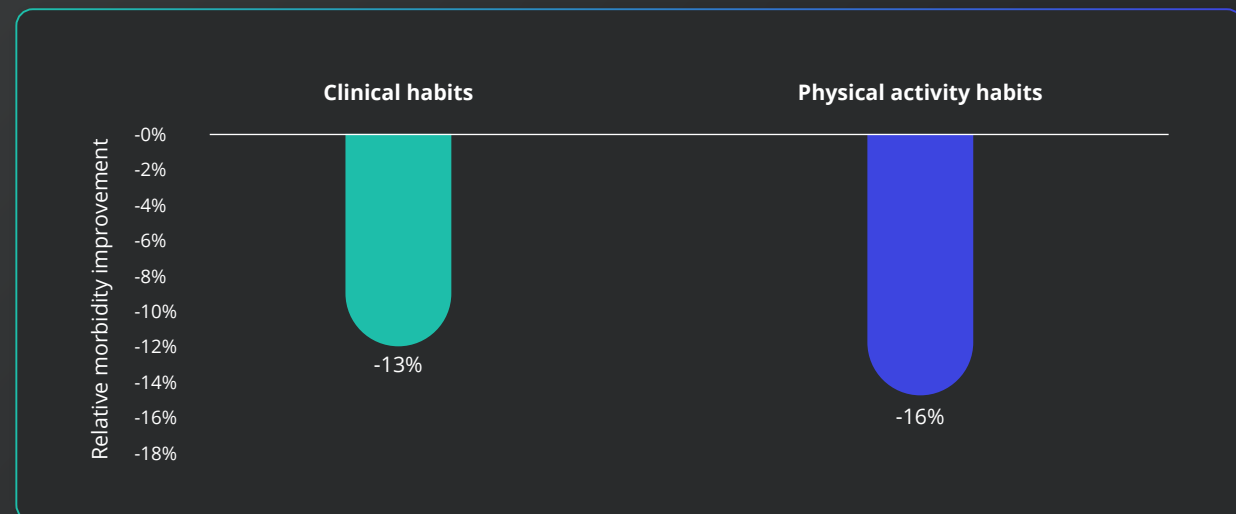


The results show that changing a clinical habit from a poor habit to a strong habit results in a **13% reduction** in morbidity.



Changing a physical activity habit from a poor habit to a strong good habit results in a **16% reduction** in morbidity.

**Relative reduction in morbidity (in-hospital costs) moving from a poor habit to a strong habit**



# Return on investment for Discovery Health Medical Scheme

Investing in Personal Health Pathways, a comprehensive managed care programme focused on disease prevention and management, delivers a significant return on investment for DHMS by driving lasting behavior change and optimising shared-value in healthcare.

## The impact of clinical habits on morbidity (in-hospital costs)

Programme cost



Net Savings for DHMS

Cost of Action Completion

**R1: R2.50**

For every R1 spent on funding clinical habit formation, DHMS will benefit in morbidity improvements of R2.50

Mortality result: relative reduction of 16%, distinct from morbidity savings

## The impact of physical activity habits on morbidity (in-hospital costs)

Programme cost



Net Savings for DHMS

**R1: R3.90**

For every R1 spent on funding physical activity habit formation, DHMS will benefit in morbidity improvements of R3.90

Mortality result: relative reduction of 18%, distinct from morbidity savings

Download the Discovery Health app

Personal Health Pathways is brought to you by Discovery Health (Pty) Ltd; registration number 1997/013480/07, an authorised financial services provider, administrator and managed care provider of medical schemes. Personal Health Pathways is enabled by the combination of Discovery Health's healthcare capabilities and Vitality's incentivised behaviour change expertise. Discovery Health Medical Scheme, registration number 1125, is an independent non-profit entity governed by the Medical Schemes Act, and regulated by the Council for Medical Schemes. Vitality is a separate wellness product, sold and administered by Discovery Vitality (Pty) Ltd, registration number 1999/007736/07. Limits, terms and conditions apply.