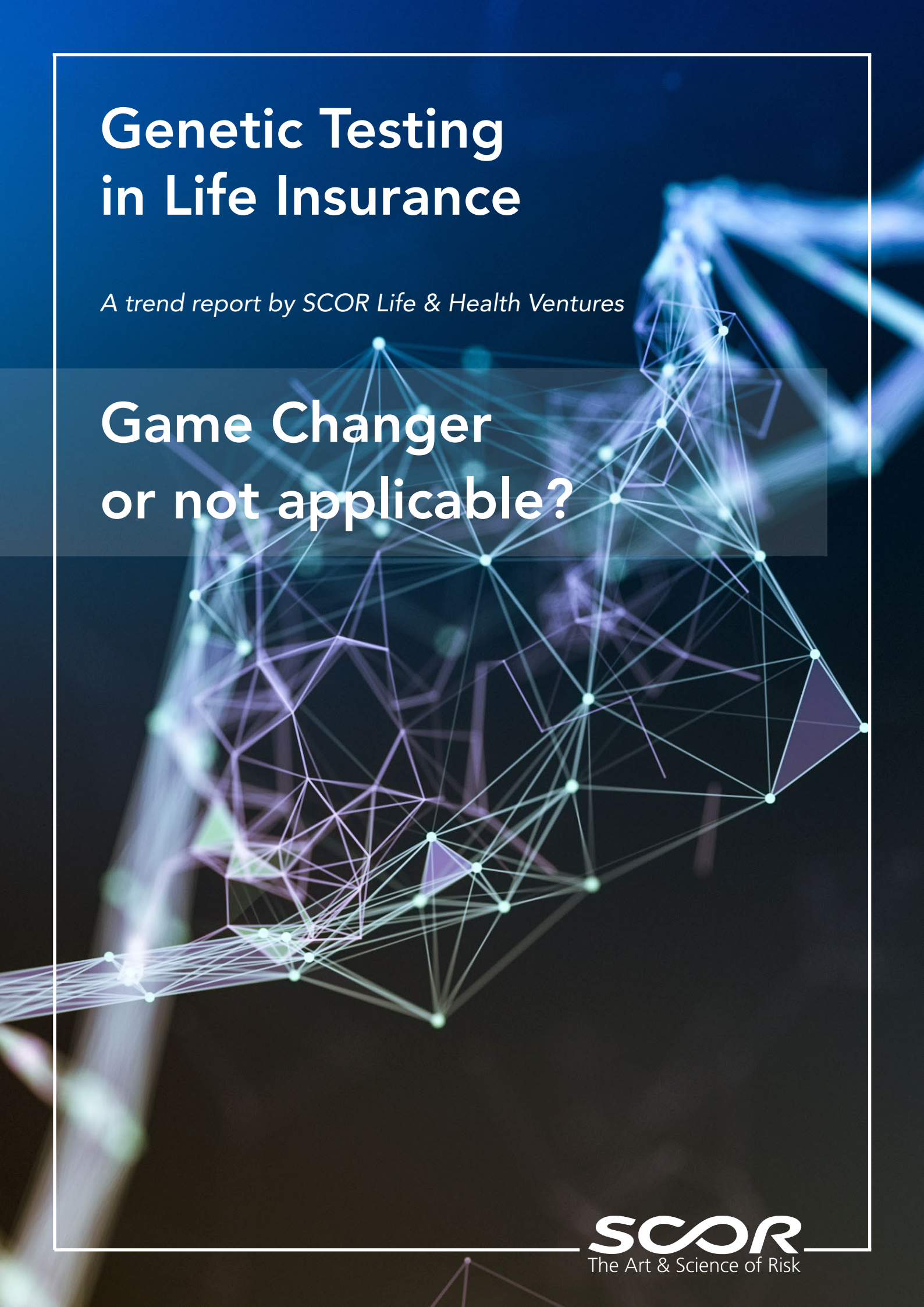
Genetic Testing in Life Insurance

A trend report by SCOR Life & Health Ventures

Game Changer or not applicable?



SCOR
The Art & Science of Risk

A MUCH-DEBATED TOPIC: GENETICS AND EPIGENETICS IN HEALTH AND LIFE INSURANCE

I have worked in the life and health insurance industry for many years. Why? Because I'm driven to help people live healthier, longer lives while constantly pushing back the boundaries of insurability and giving even more people access to coverage. Peace of mind is an integral part of the value proposition. This is precisely where my drive lies.

The constant further development of a customer-centric offering also requires dealing with - perhaps from an industry perspective - unpleasant topics. So, I had no hesitation about participating in an internal exploration pilot on possible fields of application of Genetic testing in our offering. This decision, which is natural and logical for me, may seem strange and incomprehensible to many employees in insurance companies. After all, the topic has been the subject of controversial discussions for years and people have been avoiding an aggressive debate. Too many risks seem to be associated with it, especially in the area of risk classification and data protection.

And at the same time, driven by the pandemic, we find that health is the new wealth for the majority of consumers. This is also confirmed by the 8th Consumer Study of our subsidiary ReMark, "ReConnect Life". In my view, it is therefore not surprising that more and more consumers are taking a closer look at their health in relation to their genetic situation. Offers from 23andme and MyAncestry are booming, and as a result more and more end consumers have a better understanding of their genetic predisposition every day. In case of doubt, they even use testing offers that analyze the entire genome and therefore know more than our classic, medical application process could identify.

A good example is Grail's Galleri test, which detects fragments of DNA in a blood sample via next-generation sequencing. This identifies DNA methylation, distinct patterns of which are associated with particular cancers, potentially allowing early detection of cancer and providing information on its origin. So, we may be facing an adverse selection in the future. But I don't want to be a prophet of doom; I'd rather take a proactive approach to the issue.

For this reason, I was happy to take part in our internal pilot, which aims to learn more about the factors that are influenceable in my DNA. The GenePlanet MyLifeStyle DNA test includes a broad selection of analyses covering all key areas of your lifestyle: sports, nutrition, stress, and sleep. All the health and wellness offerings that the industry has introduced in recent years revolve more or less around these themes. By adding a DNA test on these factors, we can create a truly personalised, customer-centric offering.

I strongly believe that as an industry we cannot shy away from dealing with this topic, and that through "light" offers we can learn – step by step - how such offers are received by consumers and how far they are willing to go to get the best possible life and health insurance coverage and experience. I am very much looking forward to the dialog with our partners on this exciting, forward-looking topic. I hope you enjoy reading this paper!

Pilar Santamaria

Interesting facts about genetics

WHAT IS GENETIC TESTING?

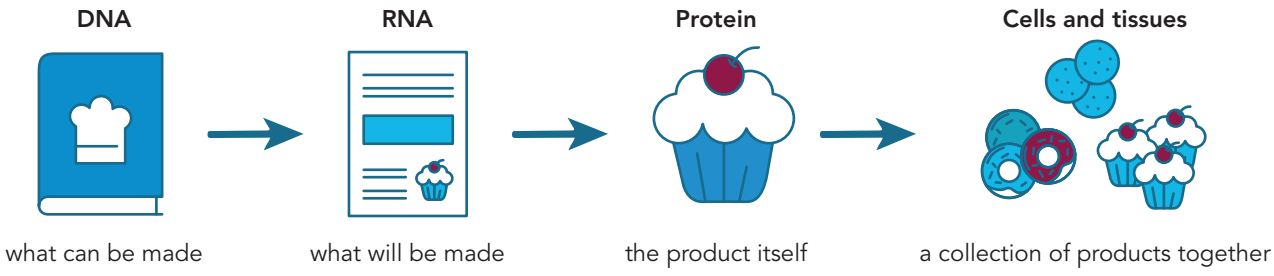
70 years ago, a series of scientific discoveries laid the foundation for modern molecular biology – and for genetic testing. In 1953 Watson and Crick published their seminal paper in Nature where they hypothesized that "the precise sequence of the bases is the code that carries the genetic information" [Link]. Then in 1958, Francis Crick proposed the "Central Dogma of Molecular Biology", which stipulated that information passes from DNA to RNA and then to proteins – but not the other way around.

So, one may think of a person's genome as a comprehensive cookbook, RNA as a photocopy of a particular recipe, and then the protein as the final product itself - the „cake". In less than a decade, scientists have been able to decipher the DNA code, i.e. identify how the DNA letters are translated into proteins [Link]. And that has given them the precise sequence of the protein (or „cake") that will be made from any particular DNA sequence coding this protein (also known as a gene).

DNA code is only comprised of 4 letters (A, C, G, T), and their 3-letter combinations (called codons) encode 20 amino acids – the building blocks of the proteins. The complete set of genetic information of an organism is called a genome [Link].

The Human genome comprises 6.4 billion "letters" (base pairs) spread across 46 chromosomes (23 pairs). All human beings are 99.9% identical in their genetic makeup, and differences in the remaining 0.1% hold important clues about the causes of diseases [Link]. Just imagine: a small typo in the cookbook that tells you to use 1000 g of sugar instead of 100 g, and your dessert is completely spoiled (analogous to a genetic disease in a human)! Or another example: strawberry jam gets replaced with cherry jam (analogous to eye colour) this shouldn't ruin the whole thing but will significantly change the end result. Genetic testing allows us to find the root of these changes, these typos – or variations – that are stored in our genome.

Genomics, on the other hand, is the study of the complete genome which - unlike genetics - considers not only individual genes but also their interrelations and influence on the organism. The study of the genome goes back to the 1970s and 1980s, when Fred Sanger and his research group established the first sequencing techniques,genome mapping, data storage, and bioinformatic analyses.



Genomics harnesses the availability of complete DNA sequences for entire organisms, which was made possble by both the pioneering work of Fred Sanger and the more recent next-generation sequencing technology (NGS).

Despite both terms sounding alike and being used interchangeably, the World Health Organization makes a clear difference: "Genetics scrutinizes the functioning and composition of the single gene and heritage, whereas genomics addresses all genes and their interrelationships in order to identify their combined influence on the growth and development of the organism". Genomics is much younger than genetics, as it relies on high-performance computing and math techniques known as bioinformatics, and genomics researchers analyse enormous amounts of DNA sequence data to find variations that affect health, disease or drug response [Link].

The cost of genetic sequencing has dramatically decreased in the last 20 years — from >USD 50 million per human genome in 2001 to just below USD 1,500 in 2015, and has recently fallen below the psychological limit of USD 1,000 [Link].

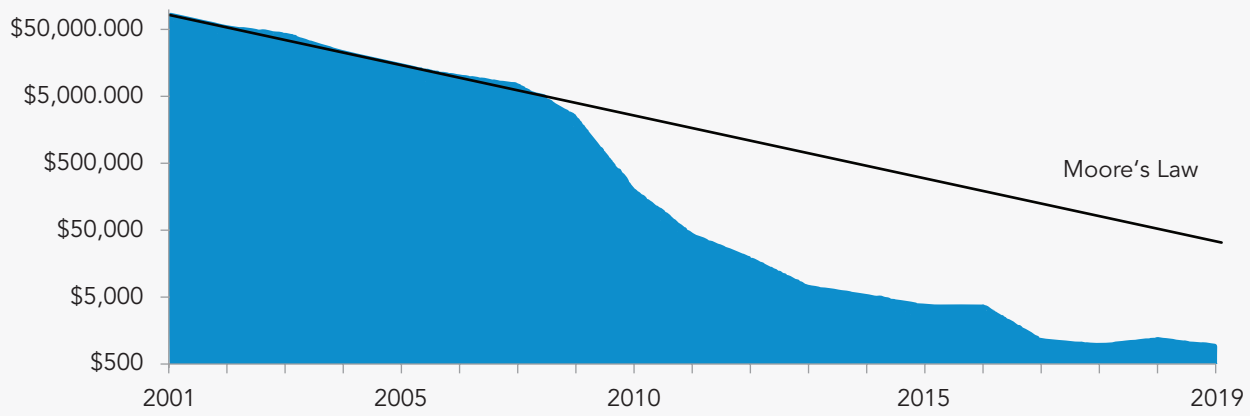
The rise and prevalence of cancer and genetic disorders have created a demand and driven growth for genetic testing, making it a mainstream, affordable and accessible option for individuals.

New approaches such as personalised medicine are also key drivers in the growth of the global genetic testing market, valued at approximately USD 7.8 billion in 2020.

The global D2C test markets encompass over 400 products from over 300 companies, driven by both startups and large enterprises. As of 2019, the United States and Canada had the largest number of genetic testing companies worldwide.

Today, the most popular D2C tests are heritage, lifestyle, and health risks. It is predicted that by 2027, the market will hit USD 21.2 billion.

Cost of sequencing an entire genome



WHAT KIND OF GENETIC TESTS ARE AVAILABLE?

BY COMPLETENESS: GENOME, EXOME, SNP

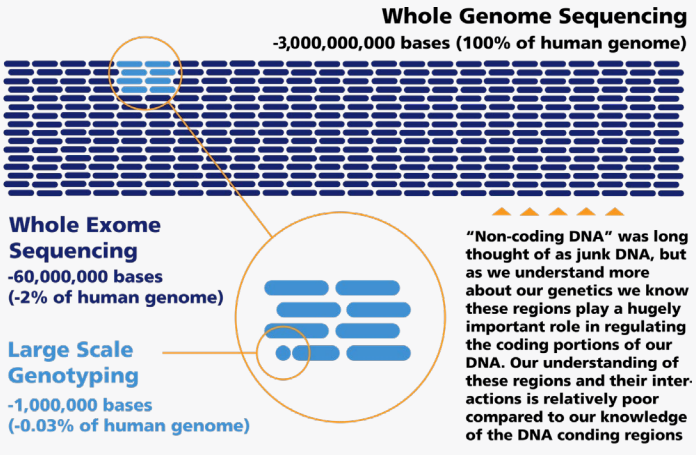
Sequencing the human genome is somehow analogous to reading a book: one can read the whole book, the important chapters – or just keywords. Precise reading would make sense only if one knows which sections are important – and luckily in many cases we do! Only 2% of our genome codes for proteins - and all these "important chapters" together are called the "exome". Sequencing the coding part of the genome is called Whole Exome Sequencing, or WES. The remaining 98% is known as "non-coding DNA".

Originally it was thought to be "junk DNA" but now we know that these regions play a hugely important role in regulating the coding portions of our DNA. Taking a single letter level (approach called "targeted genotyping") doesn't make a lot of sense while reading a book, but is of extreme importance when reading DNA – as some of these single letters are clearly associated with certain conditions and diseases.

Compared to targeted genotyping approaches (e.g. microarray analysis), WGS and WES provide the most comprehensive picture, and are becoming available to consumers due to the decreasing cost of next-generation sequencing (NGS) techniques. However, the data obtained with WGS and WES is much more difficult to process and store (big data), thus targeted genotyping is still quite often the convenient method of choice that already gives a good picture. This will probably change in the very near future as our understanding of the human genome further improves [Link].

GOING DEEPER

Besides the specific region being sequenced, another important parameter of sequencing is sequencing depth, also known as sequencing coverage. Sequencing coverage determines how many times the sequence has been "read" and varies from 30X (for a typical WGS experiment) to >500X for targeted genome sequencing. The sequencing coverage level often determines whether variant discovery can be made with a certain degree of confidence at particular base positions.



Illustrative representation of Whole Genome Sequencing, Whole Exome Sequencing and genotyping. (Source)

BY USAGE: FROM DTC TO MEDICAL

While there is a wide range of genetic tests in the market, they are broadly classified into two different categories based on their depth and specialisation.

MEDICAL GENETIC TESTS

are prescribed by physicians and have clinical validity. These types of tests are used to diagnose or predict disease. Medical genetic tests can provide a diagnosis, support therapy, and look into a wide range of disease categories, including CVD, haematology, oncology, neurology, and reproductive genetics, to name a few. These tests also explore unaffected disease carriers, for example to identify potential life-threatening conditions in newborns. The results are always interpreted by and discussed with a medical geneticist or specialist.

MEDICAL

- **Full Genome Screening** to have a full genetic map of individuals and the relation of their genes and possible conditions or risk.
- **Tests for adult-onset genetic conditions**
  Testing of asymptomatic young adults to identify a genetic condition that will occur later in life, such as Huntington disease.
- **Newborn Screen** to identify highly penetrant genetic disorders that can be treated early in life.
- **Assessment of genetic risk for common complex diseases**
  Testing to identify an increased risk of future health problems, such as heart disease or diabetes.
- **Diagnosis of genetic disease**
  Testing of patient, following indicative clinical findings, to confirm genetic diagnosis.
- **Carrier Screening** to identify unaffected individuals as carriers for specific disease.
- **Tests to predict drug response**
  Testing to identify an individual with less likelihood to response or increased risk of adverse reaction to a particular medication.
- **Prenatal tests**
  Testing to identify a fetus with a generic condition. Testing is usually initiated on the basis of the maternal factors or family history that indicate increased risk. Some prenatal genetic tests are offered routinely; for example, maternal seru screening to identify increased risk of neural tube defects or Down syndrome.

DIRECT-TO-CONSUMER GENETIC TESTS

or DTC are focused on ancestry and general health (areas like nutrition, sports, lifestyle overview) and do not require the mediation of a health professional (genetic counselling however could be very helpful!). Available online, DTC tests have different levels of clinical validation supported by data. Not all companies provide a direct overview as they test for different factors and variants. Some of the most common DTC tests include ancestry, family and genealogy, general wellness, lifestyle, common disease risk, or low-risk medical purposes.

DTC

- **Diagnostic, Confirmatory Genetic Testing** to confirm a specific genetic condition in a symptomatic individual.
- **Predictive and Presymptomatic Genetic Testing** for estimating the risk of developing adult-onset disease or prediction future disease onset.
- **Pharmacogenomic Testing** to guide individual drug dosage selection and response.
- **Nutrogenomic Testing** to study the effect of genetic variations in the interaction between diet and health or on nutrition requirements.
- **Health & Ancestry Testing** offering a broad range of health and lifestyle information.

WHAT ELSE IS OUT THERE?

Genetic testing is only one of many exciting options that have become available thanks to the advances in life science and biotechnology. There are several exciting disciplines and applications close to genetics.

EPIGENETIC SCREENING

It reveals the changes in the way genetic information is interpreted by our cells. Think of it as a volume knob: the melody (DNA) remains constant, while you may want to make your favorite song louder. While genetic code remains constant throughout our life, the way cellular machinery reads it may change over time due to processes such as DNA methylation and histone modification.

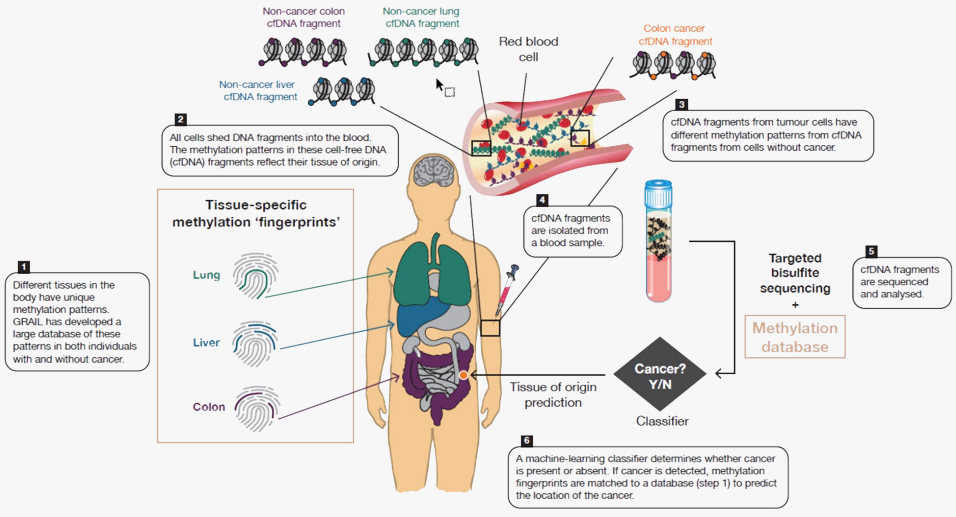
Thus, our epigenetic profile changes throughout our life, and also depends on our environment. Smoking, for example, can result in epigenetic changes.

For example, at certain parts of the AHR gene, smokers tend to have less DNA methylation than non-smokers. The difference is greater for heavy smokers and long-term smokers [Link]. Some companies have recently started selling DTC epigenetic tests: Chronomics, EpigenCare, Muhdo, MyDNAge.

LIQUID BIOPSY

It looks for cancer cells from a tumour that are circulating in the blood - or for pieces of DNA from tumour cells that are in the blood (so called cell-free DNA). It's not genetics-based per se, but many liquid biopsy solutions are based on (epi)genetics. A liquid biopsy may be used to help find cancer at an early stage. A great example of such a test is GalleriTM by Grail. Galleri captures cell-free DNA - DNA fragments released from tumor cells - and analyses their methylation status (i.e. epigenetic changes). Unlike gene mutations, which occur quite rarely and in a small number of sites, there are 30 million DNA methylation sites across the human genome, making them a ubiquitous and rich signal for detecting cancer.

Tracking down tumours using DNA methylation patterns in blood: *A targeted methylation-based multi-cancer early detection test can recognise differences in DNA methylation patterns in cell-free DNA (cfDNA) fragments in a blood sample. These patterns are characteristic of different cell types and abnormally methylated cfDNA can be used to detect cancer and map its location in the body. (Source)*



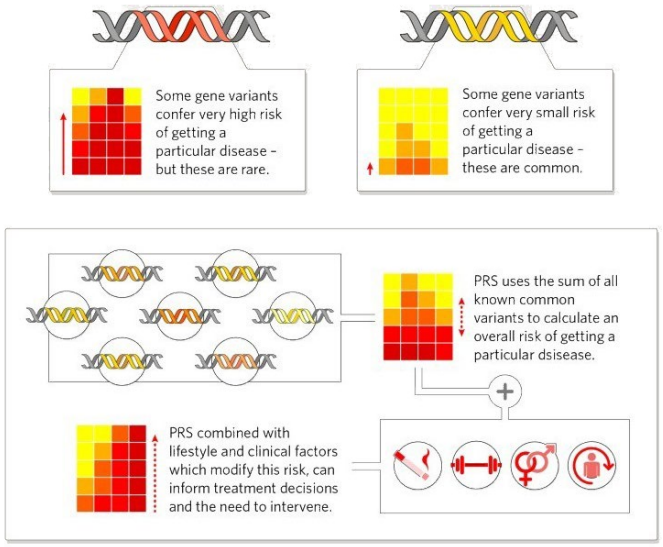
POLYGENIC SCORE (PGS)

Also called polygenic risk score (PRS), is a score that estimates the effect of multiple genetic variants on an individual's phenotype (physical properties of the organism). While in some cases single gene mutation directly affects the risks of disease (like CFTR for cystic fibrosis or BRCA for breast cancer), often it's the combination of substitutions in different genes that affects the person's risk of getting a certain disease. While not as precise as single gene mutations, PRS can facilitate stratification of patients according to their risk group, and persons in the higher risk quartile may have a many-fold increase in the probability of the disease, informing targeted prevention and intervention measures. A good example here is the study by Khera et al, who examined PGS in 250,000 patients from the UK BioBank. They found that 8% of the population tested had such high PGS that it conferred a >three-fold increased risk for coronary artery disease [Link].

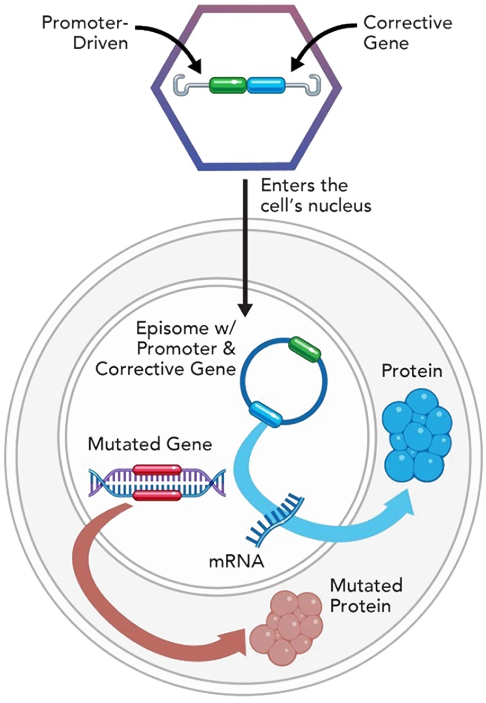
GENE THERAPY

A logical continuation of genetic testing in a sense: as long as we know which gene is faulty, we may want to correct it, and gene therapy is the way to do that. It is the introduction, removal, or change in the content of a person's genetic code with the goal of treating or curing a disease. Gene therapy allows treatment of otherwise untreatable diseases - and very often just after a single shot. An exciting example of gene therapy is Zolgensma - gene therapy to treat the lethal childhood disease Spinal Muscular Atrophy. Without treatment patients slowly deteriorate physically and require permanent ventilatory support, while Zolgensma keeps patients free from ventilatory support for many years. There are only a few FDA approved gene therapies right now, however hundreds are in the clinical development pipeline.

CLINICAL APPLICATION OF PRS



A polygenic risk score (PRS) is calculated from many small genetic variants and can be often modified by lifestyle factors. (Source)



Gene Therapy (Corrective Gene) (Source)

HOW TO MAKE THE MOST OF GENETIC TESTING IN INSURANCE?

Genetic testing is an important and valuable addition to insurance products but still represents a very sensitive topic for the insurance industry.

The legal framework regarding using genetic data for underwriting differs across countries, from a full legal ban in Canada and France to the ability to consider existing test results for Life insurance underwriting in most US states.

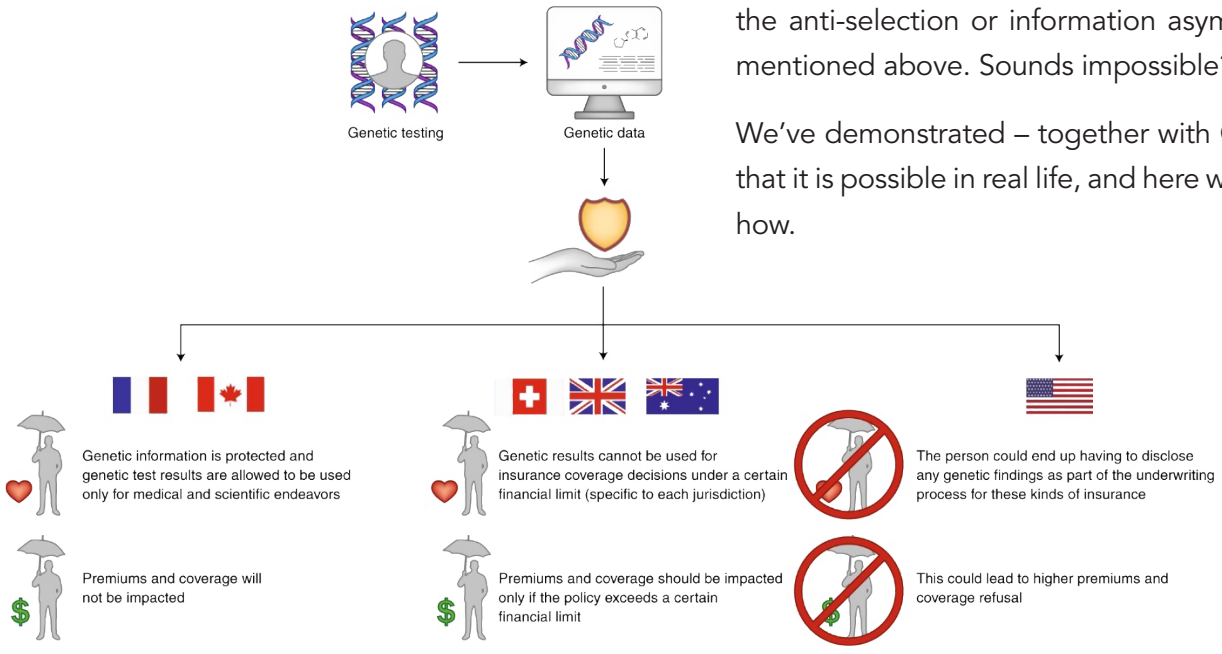
Genetics clearly differs from other UW factors, as it's something that doesn't change during the policyholders' entire life (unlike for example BMI or smoking status) and at the same time gives a clear indication of the mortality and morbidity risks.

As the customer remains in sole possession of this information, risks of negative selection and information asymmetry accumulate on the insurer side: receiving alarming genetic testing data could push many people to think about insuring the risks, as those are "embedded in their DNA".

But – on a positive note – people paying for genetic testing out of their own pocket are likely to be more health conscious than the general population. And, very often knowing the "bad genes" (especially early in life) opens up great opportunities for early detection and prevention. A good example here is the BRCA gene: although mutations in BRCA1/2 genes increase the lifetime risk of breast cancer 4-6 times, the risk of breast cancer actually developing can be dramatically reduced by early interventions such as routine screening, prophylactic mastectomy or prophylactic oophorectomy [Link].

As the price of genetic testing continues to sharply decrease (already below USD 600 for WGS), more and more people are getting tested. And as we gather new data on the gene-disease relationship, the penetration of genetic testing into the life and health insurance industry is also inevitable. It's always better to build the future rather than wait till it arrives. The Holy Grail would be of course to get all the benefits of genetic testing – and steer clear of the anti-selection or information asymmetry issues mentioned above. Sounds impossible?

We've demonstrated – together with GenePlanet – that it is possible in real life, and here we'll showcase how.



Genetic testing and life insurance: legal setup. (Source)

PROCESS AND RESULTS

In order to fully understand the experience, process, and impact of genetic testing, SCOR colleagues went through it first-hand themselves. From September 2020 until January 2021, 71 SCOR employees participated in an internal pilot to experience first-hand the process of lifestyle DNA tests with GenePlanet.

Founded in 2008, the Slovenian company GenePlanet is one of the leading European providers of genetic tests. GenePlanet offers a wide portfolio of genetic tests ranging from D2C-based e.g. MyLifestyle, MyHealth to medical tests e.g. Cancer Screen.

Additional testing includes blood testing as a complementary data point allowing greater personalisation and progress tracking.

The company's testing process relies on saliva-based DNA tests to provide diet advice and lifestyle plans according to an individual's genes, metabolism and health condition. This enables users to improve their health, sports plans, dietary habits, and well-being through a personalised preventive program.

All exams and analyses are performed in fully accredited laboratories and data is handled and processed in full compliance with GDPR and ISO standards.

Today, GenePlanet serves over 30 countries globally. The company came to our attention through exploration work and a thorough due diligence process, and the team decided to pursue the pilot development together with the participation of a selected number of SCOR employees.

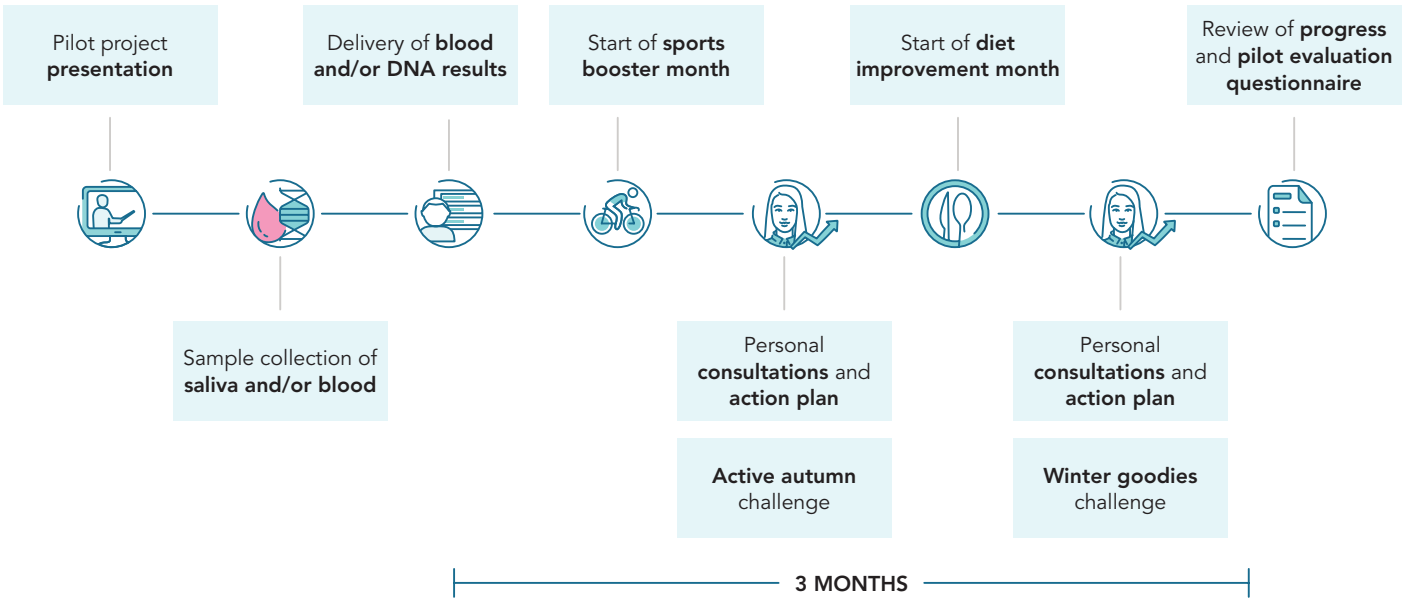
The pilot was designed to include several points such as legal framework, data protection, anonymity, sample details, process, onboarding dynamics, contest, results, platforms and app usage, and closure of the pilot.

It is relevant to highlight that participation was heavily influenced by the legal frameworks of participants' countries and by the possibility of having a fully anonymised process where only GenePlanet would see the personal information and results of participants, and where individuals could ask GenePlanet to delete all their information at the end of the pilot if they wished.

The pilot started in September 2020 with 71 participants in 6 countries, where each location had country ambassadors in charge of finding local participants: Canada, Ireland, Germany, Spain, Hong Kong, and Singapore. All participants would complete a saliva DNA test, and only participants based in Europe would complement their results with a blood test. Due to shipping restrictions and sample quality, only Europe-based participants had access to the blood test.

We organised GenePlanet onboarding calls and a voluntary MS Teams community to facilitate communication during the pilot. Through the GenePlanet app and website, participants had direct access to their profiles, results, and insights. Within the first month, all colleagues had completed the tests and received initial results with dietary and lifestyle recommendations.

PILOT TIMELINE



SAMPLE COLLECTION

Collection kits were shipped directly to the locations desired by study participants.

For the genetic sample, participants received a small box which included a tube where a small saliva sample should be deposited.

For the blood sample, participants received a small device (TAP), which was placed on the upper arm. With the simple press of a button, a microneedle would pierce the surface layer of the skin and painlessly collect a small blood sample. As blood samples need to be processed more quickly in the lab, logistics and sample quality meant that only European participants were able to supplement their DNA results with the blood test.

THE RESULTS

Within six weeks, all participants received their results, which were compiled in a general health score and included genetic results, blood results, self-reported body measurements, and habits. Each of these categories expanded further into subcategories.

OVERVIEW OF ALL GENEPLANET RESULTS

Metabolism & Lifestyle
- Alcohol addiction
- Nicotine addiction
- Alcohol metabolism
- Caffeine metabolism
- Gluten intolerance
- Lactose intolerance
- Managing stress
- Sleep cycle

Diet & Body Weight
- Weight-loss regain
- Satiety and hunger
- Response to carbohydrates
- Response to monosaturated fats
- Response to saturated fats
- Risk of being overweight
- Perception of sweet taste
- Response to polyunsaturated fats
- Sweet treat intake
- Diet type
- Perception of
- bitter taste

Blood Test
- Focused on heart and cardiovascular health
- Tested biomarkers linked to the risk of cardiovascular diseases

Markers included:
- Total cholesterol
- HDL cholesterol
- LDL cholesterol
- Triglycerides
- TG/HDL ratio
- HbA1c
- Hs-CRP

Skin Health & Aging
- Skin elasticity and firmness
- Skin hydration
- Cellulite
- Stretch marks
- Varicose veins
- Glycation protection
- Antioxidant capacity
- Inflammation sensitivity
- Biological ageing
- Omega-3 metabolism
- Vitamins B2, B6, B9, B12, C, D, E
- Selenium

Sports performance
- Muscle structure
- Strength training
- Fat-burning gene
- Soft tissue injury
- Inflammation sensitivity
- VO2 max – aerobic potential
- Post-exercise recovery
- Heart capacity
- Muscle volume
- Warrior gene
- Lean body mass
- Gene for lactate removal

Heart Health
- Blood sugar
- Omega-3 metabolism
- Omega-3 and triglycerides
- Insulin sensitivity
- Adiponectin
- C-reactive protein (CRP)

Vitamins and minerals
- Iron
- Sodium (salt)
- Potassium
- Zinc
- Selenium
- Oxidative stress
- Vitamins B6, B9, B12, C, D, E

The results also included a short description of the item and the gene and SNP (single nucleotide polymorphism) variation, which the test takes as a reference based on clinical research per individual category.

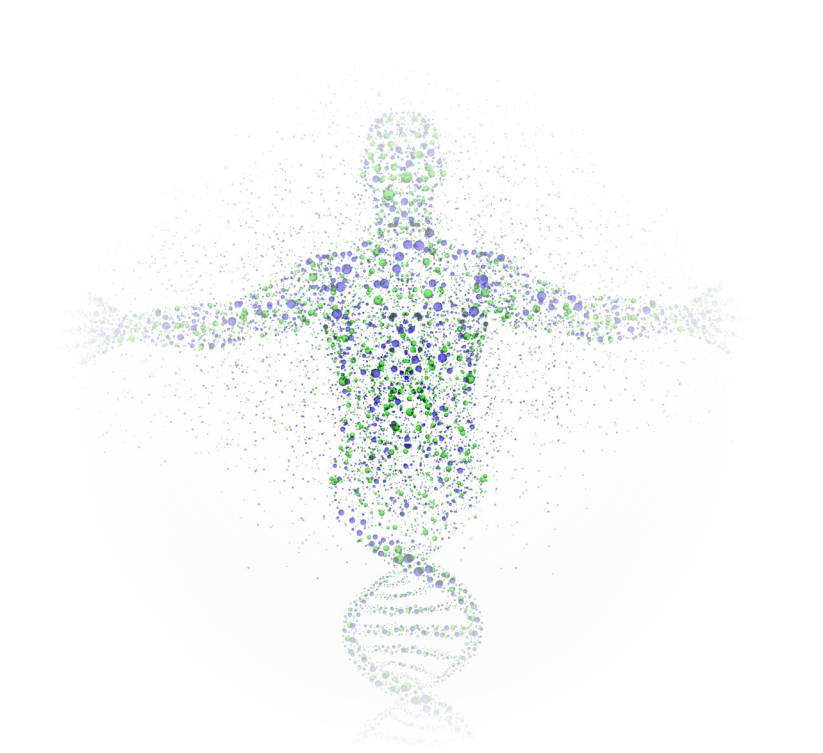
For example, in the 'Diet and Body Weight' category, one of the items is 'risk of being overweight' with a lower risk indicator. Nine genes were considered to provide this particular result (e.g. MC4R, TNF, PCSK1, etc.), with dietary recommendations such as to limit animal fats, consume fibre-rich foods, and to stimulate digestion with walks.

The insights were always complemented with a personalised call with a specialist, who gave further insights and tailored the results. During the sessions, the participants explored their results with the guidance of an expert, who would explain the meaning and impact of the most relevant items.

These calls were highly praised due to their personalised nature, as some colleagues asked questions about their own routines and lifestyle.

Two challenges kept participants engaged with their results and insights. The autumn challenge aimed to activate and motivate participants, who had recently learned about their sports predispositions, and invited them to capture their sport adventures. Participants shared inspiring photos of their sports activities after learning about their own bodies.

The winter challenge focused on nutrition and invited participants to share their favourite recipes to make a SCOR cookbook. From tacos to pizza and salmon, our colleagues did not disappoint and shared a sneak peek into their favourite meals. After online voting during each of the challenges, winners received diverse prizes, including sports equipment, wearables, and personalised sports coaching programmes.



FINAL SURVEY AND RESULTS

Once the pilot came to an end in January 2021, we embarked on collecting feedback to understand the experiences and thoughts of our colleagues. In total, we received 50 responses for the final internal survey, representing 70% of all participants. Below are some of the most relevant facts and discoveries:

In total, 71 individuals had their DNA analysed and 32 had a chance to complement their results with a blood test from GenePlanet (the number of blood tests was reduced due to geographical limitations).

50 participants answered the survey, and the majority of those (27) performed blood testing.

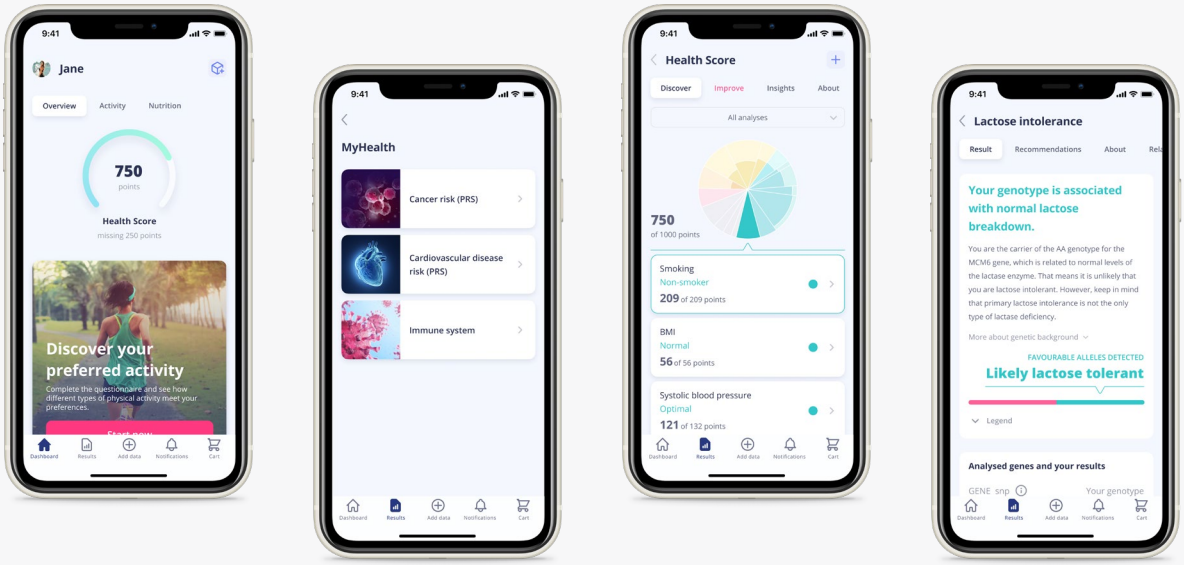
As a general observation, around 2/3 of the participants had a positive experience with GenePlanet, found value in the insights and would like to continue the process as it added value to their lifestyle and wellbeing; the remaining 1/3 shared a rather neutral or slightly negative experience and did not make any significant changes to their lifestyle after our pilot.

92% of respondents described the saliva-based DNA collection process as relatively easy.

Out of the total respondents, 80% reported having very healthy or healthy lifestyles prior to the pilot, so we can safely infer that the pilot participants do not represent the traditional population health of insured individuals. It is extremely important to identify this in order to read the results in context.

LOOKING DEEPER

2/3 of respondents found the results and recommendations extremely or somewhat useful. At the same time, around half of the respondents reported adopting these recommendations, with 52% of them reporting making significant or general changes. This signals a positive impact based on the personalised recommendations which were provided to each of them individually after their DNA/Blood tests and is also closely related to the sample pool of health-aware individuals, who are physically active and care about their lifestyle.



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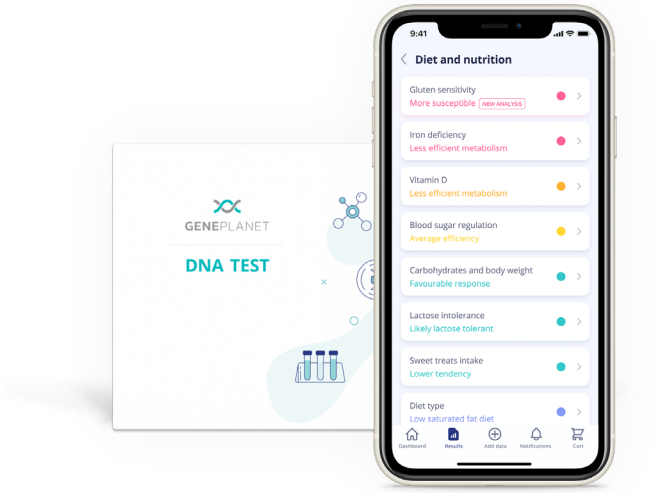
Before embarking on the study, we identified that the majority of the participants were mostly interested in Heart Health, followed by Diet and Body Weight (see the graph below). Skin Health and ageing as well as Vitamins and Minerals were not of big interest.

Probably such ranking is specific to the professional background of trial participants - as we all know that heart health and excessive weight bear health risks.

Additionally, respondents reported specific features, findings, and recommendations as the most impactful for their lifestyle: from knowing how food affects one's body, to identifying numerous risk factors, and understanding sports performance levels thanks to the personalised consultation, to name a few.

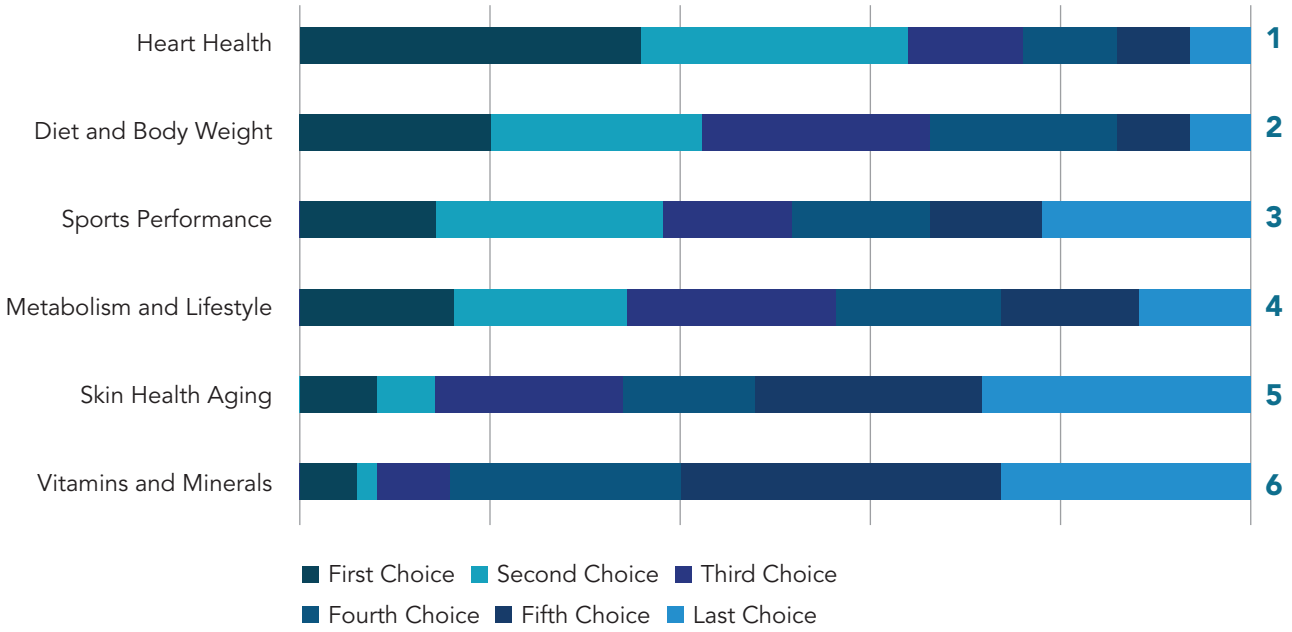
About these recommendations, 70% reported they are 'very likely' and 'likely' to follow the GenePlanet recommendations in the future, and 64% explained that that follow-up lab tests and/or individual consultations would help them to follow the recommendations on a long-term basis.

This analysis should be taken with caution as the pilot has several limitations. First, the number of participants is rather limited, and thus in many cases the numbers behind the % are rather small. Secondly, the background of participants doesn't accurately represent the general or insured populations. Finally, the period of observation was quite short, and the long-term effects were not fully captured.



RANKINGS

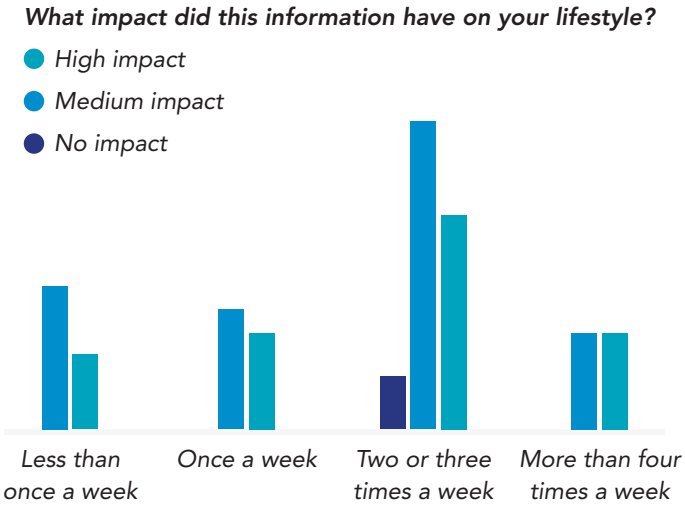
Rankings of Features (from most appealing to least appealing) prior to the pilot



EASY SPITTING

Out of our 50 survey participants, 27 complemented their DNA tests with blood exams from GenePlanet. Collection of the DNA samples was flawless for the vast majority of the participants – only 8% reported that it was somewhat difficult. Conversely, blood collection was more challenging for over half of the respondents.

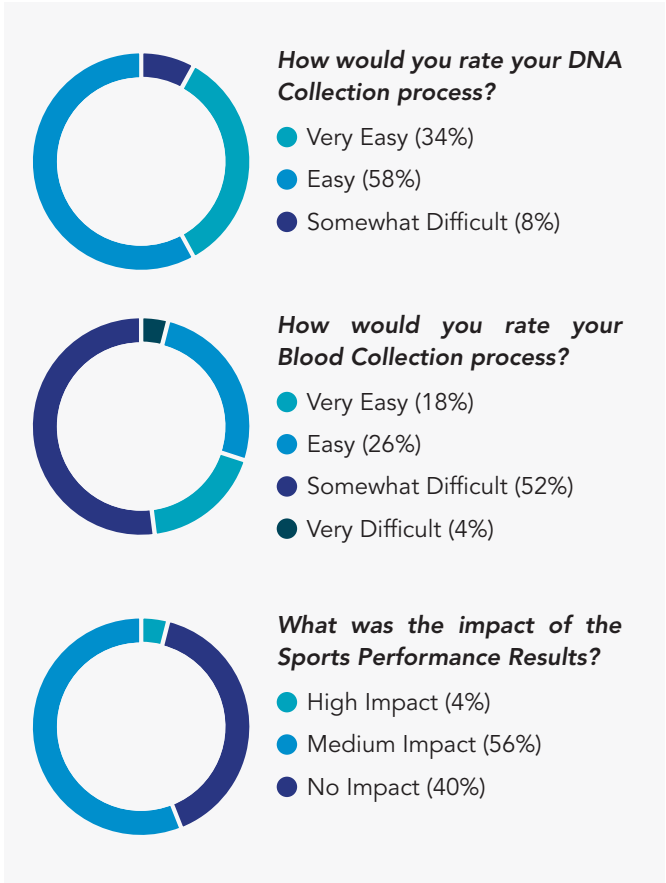
This was rather expected as the technology of DNA collection was relatively easy (essentially collecting a saliva sample in a tube), while the collection of the blood sample required individuals to use a specific self-collection device to perform blood sample collection at home.



SPORTS WE KNOW BETTER

Sports recommendations did have a significant impact for 60% of participants, whilst 4% claimed to experience a high impact. This is aligned with the characteristics of our participants, who are generally healthy and health-aware individuals, exercising frequently and caring about their routines. We hypothesized that the Sports performance results were probably less impactful for people who were exercising less frequently vs those who did sports often.

However, it turned out to be not the case – a similar distribution of the level of impact was observed independently of the frequency of exercises. The data demonstrates that receiving the sports results had a positive impact across all groups regardless of activity or frequency of training. There were no other clear correlations identifiable between the level of impact and gender/age of respondents.



PERSONALISATION IS IMPORTANT

Participants were clear in their responses that personalised lifestyle recommendations can play a large role in supporting health & wellbeing and adding value to the insurance customer experience.

70% of respondents highlighted that they were likely or very likely to follow the GenePlanet recommendations. DNA testing has proven to be insightful and revelatory to participants in understanding their uniqueness. This response was even greater in participants who complemented the DNA test with blood testing, indicating that the combination of DNA and blood testing can add additional value.

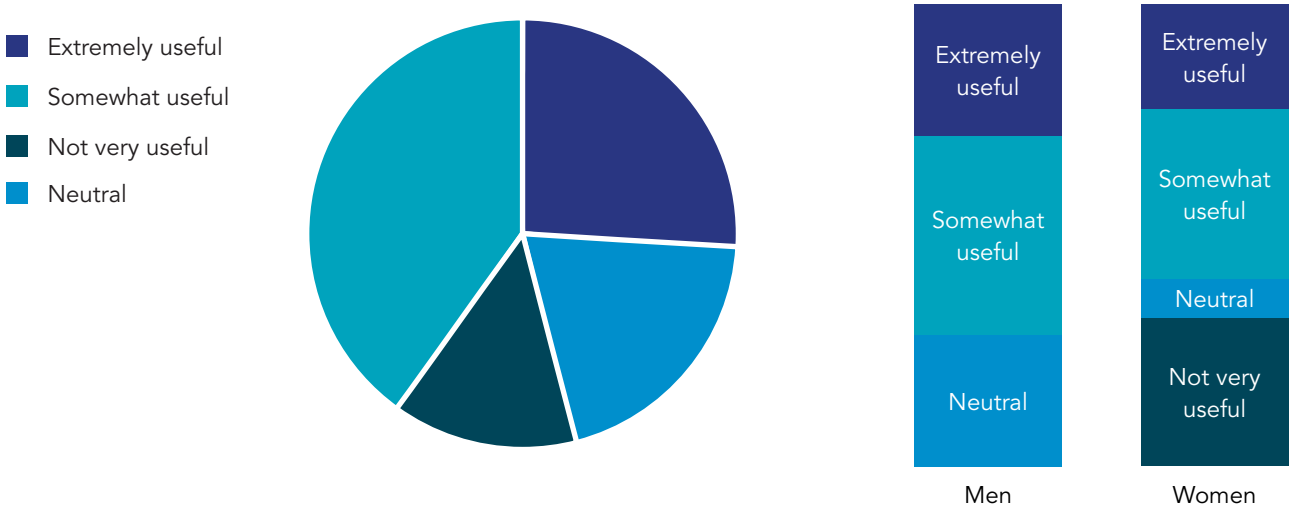
Personalisation is integral in engaging and steering customer behaviour and lifestyle choices. The novel findings participants learnt from their genetics, complemented with the results of blood tests which are well-known and commonly used, represent an all encompassing holistic preventive proposition. Blood test data coupled with GenePlanet's Health Score adds additional information that is time-dependent and better reflects the dynamic health status of individuals.

In addition, the majority of participants (64%) stated that follow-up lab tests/individual consultations would help them increase and maintain the positive behavioural changes, suggesting that long-term monitoring and progress feedback would generate greater engagement and positive lifestyle changes.

LESS USEFUL FOR WOMEN

Surprisingly to us, all participants who found the results and recommendations not very useful were women. The same distribution was also observed for general satisfaction with the survey results (78% of men were satisfied vs 63% of women). We have not been able to find any good explanation for this finding – as women who reported this level of dissatisfaction were quite diverse in terms of health status, age, and sport frequencies.

How useful did you find the results and recommendations of GenePlanet?



MORE IMPACT FOR OLDER PARTICIPANTS

Age seems to be a determining factor when it comes to the general perception of results and recommendations. The older the responders were, the larger the level of impact of recommendations and test results on their lifestyle. While 50% of young participants (20-35) reported that there was no impact at all, for 50+ participants no impact was declared only by 18%. One possible explanation here could be that the younger group of respondents are generally healthier and lead a health-aware and healthier lifestyle – and therefore have a smaller incentive to change their habits.

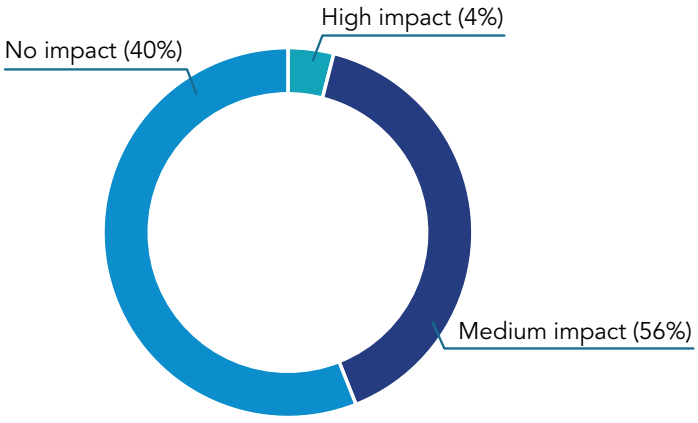
IMPACT OF RECOMMENDATIONS

Many participants noted that recommendations related to diet, nutrition and supplements were the most impactful. Recommendations on training, skin and aging were next on the list. At the same time, some participants also stated the same categories as least impactful. When diving deeper into the recommendations, many complained that these are hard to follow due to their busy lifestyle or simply because they are too general. Skin aging was among the features most frequently reported as least impactful.

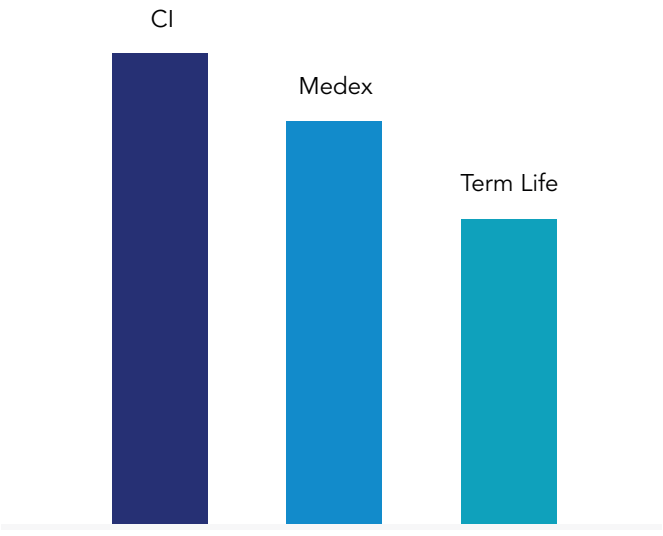
VALUE OF POLICYHOLDERS

As genetic testing services such as GenePlanet could be rolled out to policyholders, it was of the highest importance for us to understand whether it could bring additional value to them. Almost 2/3 of respondents answered positively, indicating a significant potential for such an additional offering. 18% of participants provided detailed and constructive feedback (marked as "Other" in the chart). Major comments were related to the lengthiness of the process, the high level of recommendations and the fact that few incentives were offered for following them. When asked about linking GenePlanet and similar propositions to insurance products, participants gave a wider response, with 34 and 29 respondents respectively identifying CI and Medex as the most relevant products to connect to genetic testing. Term Life (22) and Disability (21) received almost equal votes. Only 14 said they would link it to LTC.

What was the impact of sport performance results?



Can you Imagine linking this product to specific Insurance Coverage?



PARTICIPANT COMMENTS

"DO YOU HAVE ANY THOUGHTS OR OBSERVATIONS ABOUT GENEPLANET YOU WOULD LIKE TO SHARE?"

1. I found the whole piece revelatory! The health score and impact of variables (e.g. how long I spend sitting in the day) on my overall health was really shocking. It was more detailed than any previous health check I have done and it helped really cement the realisation that what I do now impacts my future.

2. I think one of the biggest benefits I received from participating in this is the sense I had that the folks who worked for GenePlanet TRULY cared about my wellbeing. This was a catalyst to start doing more to care for myself which is an invaluable gift.

3. I wonder if there will be a personal long-term impact. After some really valuable insights from the tests, I would not expect any kind of evolution.

4. The time to embrace genetics into insurance is now. There is a clear change in the global landscape for consumers who are rapidly adopting genetic testing as a tangible accessible tool; for regulators to embrace and control usage of genetic testing in insurance; and for payers to understand the best ways to proceed and add value to policyholders with genetic testing. This is a great tool, and we should move forward where it's possible.

5. What I have found helpful is having a complete report of my findings and GenePlanet's recommendations which I can easily refer back to. There was a lot of information provided, but I find the format very cumbersome, having to click on one result at a time. It would help to have all the information in one place that I could easily look at in its entirety.

"OF ALL THE FEATURES, FINDINGS AND RECOMMENDATIONS OF GENEPLANET, WHICH ONE DO YOU FIND THE MOST IMPACTFUL?"

1. For me, the consultations were a game changer, I had used similar products like GenePlanet but always felt a bit lost with the amount of information I had. With GenePlanet, the consultants guided me and explained the most important features, how to work around my own health for the best outcomes and answer questions I had about every single point on the list.

2. To understand myself better, what I'm lacking or what I need to pay attention to.

3. Knowledge (insight) into my "weaknesses" or "vulnerabilities".

APPLICATIONS OF GENETICS IN LIFE INSURANCE

Genetics can be broadly applied across the life insurance value chain, all the way from pre-sales to customer engagement and claims support. We see genetics more as a valuable and efficient tool to manage health rather than for collecting additional info for UW. It gives the policy holders interesting indicators of the things they should be aware of and allows them to take actions.

GenePlanet has a huge experience of bringing the value of genetic testing to life and health insurers.

GenePlanet had direct experience of integrating its genetic testing services into life, health and other insurance protection products since 2013, for both retail and group risk clients. Initially, the solution was positioned purely as a complementary value added service to increase sales and differentiate the insurer's customer proposition - every insured receives a preventive benefit regardless of a claim. The evolution of GenePlanet's solution to include a new modular digital platform allows a more holistic approach incorporating genetics, blood, body measurements and smart device data. The upgrade of testing to Whole Genome Sequencing (WGS) enables greater engagement and the ability to deliver new analyses to all customers throughout their journey.

These enhancements also enable the further integration within the protection customer journey and potential for customer rewards for achieiving positive behavioural change.

Pre-Sales		Sales		Post-Sales
Lead generation	Advice	Underwriting	Engagement	Claims
Promoting Life and Health insurance across DTC genetic tests customers Raising awareness of Life insurance among parents during newborn screening	Offering specific insurance product BEFORE doing medical genetic test	Genetic test results facilitating more targeted & dynamic propositions Medical UW adjustments based on (epi)genetic test results	H&W genetic testing offerings including rewards for positive behavioural change Targeted prevention and intervention based on genetic disease predisposition Genetic-based disease screening	Genetic testing as additional benefit for finding optimal treatment Lower claims cost due to earlier intervention and personalised support

CASE STUDIES OF ACTIVE GENEPLANET INSURANCE PARTNERSHIPS

1. Integral part of accident insurance rider

Insurance company was looking to increase sales of their accident insurance riders (their most profitable package). GenePlanet's solution was awarded (free gift) to all clients who added accident insurance to their new or existing life insurance policy.

Result: Sales increased by 23% year on year

2. Life insurance package integration

GenePlanet's digital platform and premium DNA pack was offered to customers purchasing a life package. As part of this package customers could choose 2 optional riders (accident and/or critical illness) when purchasing their policy.

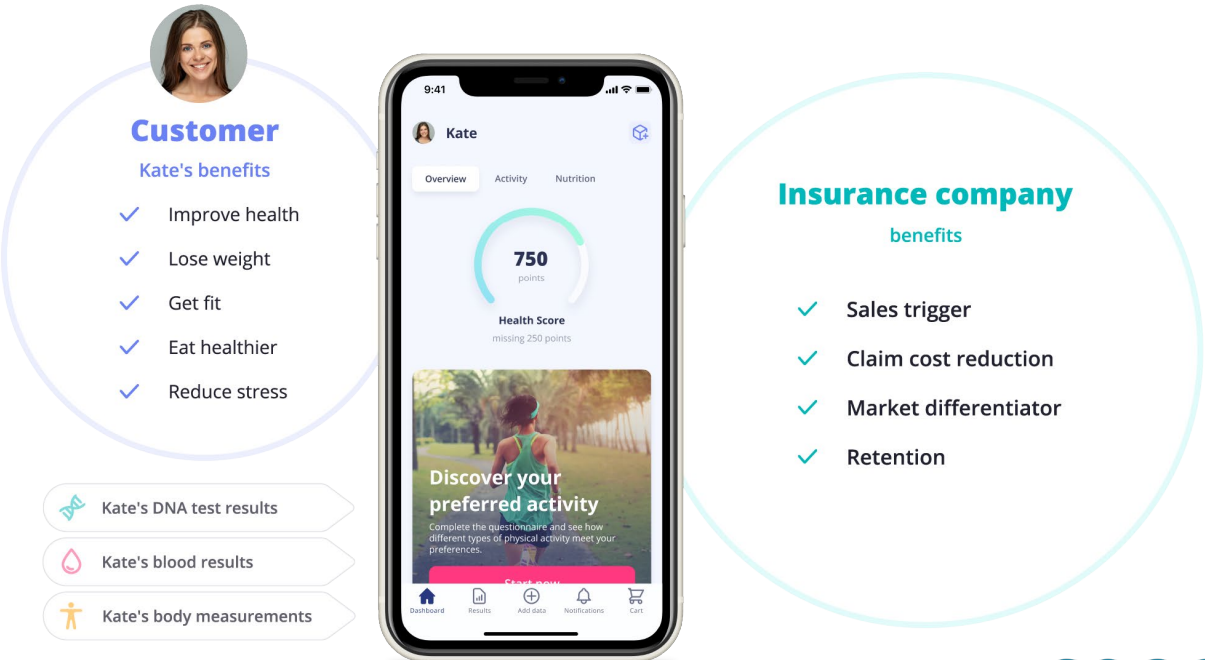
Results: Increased sales

- Increased sales of life package by 30% during 1st sales quarter.
- Increased percentage of customers choosing optional rider.
- Accident rider sales increased from 97% to 98.5% and CI sales increased from 25% to 43.4% following inclusion of GenePlanet's DNA testing Influence sales – the GenePlanet offer positively influenced buying decisions.

Customer Feedback

84.6%
of customers highlighted that GenePlanet's solutions positively impacted their buying decisions.

96.6%
indicated they valued it as part of their insurance package.



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