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Connected Insurance Reshaping the Health Insurance Industry

Andrea Silvello and Alessandro Procaccini

Abstract

The role of today's insurer is changing toward a more preventive and digital or connected approach. In this context, connected health insurance has the potential to contribute toward the health and the general well-being of the population. New technologies like e-health and wearables employed by the insurance industry might even help deal with major issues related to the rising number of people, of chronic disease patients, and of elders while keeping them healthier and at the same time protected by insurance. The aim of this chapter is to briefly illustrate the concept of "connected insurance" with specific focus on "connected health" and "wearables" and to present two case studies: Discovery's Vitality program which aims to create healthier lifestyles for its customers through the use of wearables and rewards and ICS Maugeri's MOSAIC project based on AI and predictive models aimed at helping with the management of treatment and quality of life in type 2 diabetes patients.

Keywords: e-health, health, connected insurance, wearables, IoT, diabetes

1. Introduction

The current role of the insurer is extremely different according to country-specific health and welfare policies. Nevertheless, health insurance could contribute to improve current conditions or even solve dilemmas such as how to cope with a rising number of people while keeping them in a good health state and at the same time protected.

The World Health Organization's new 5-year strategic plan addresses what they have identified as the major ten threats to global health in 2019—including noncommunicable diseases, such as diabetes, cancer, and heart disease which are collectively responsible for over 70% of all deaths worldwide [1]. The plan aims to ensure that 1 billion more people benefit from access to universal health coverage, 1 billion more people are protected from health emergencies, and 1 billion more people enjoy better health and well-being. To reach this goal, different types of solutions are required, and all means and mediums available should be employed.

Insurers play an important role in the health-care system and could effectively contribute to such an objective as the one set by WHO toward the benefit of the global health. Though it may seem perhaps altruistic to associate insurers with such a noble scope, the reality is that they, insurers, would also be benefiting from such a scenario. Some forward-looking companies worldwide have understood this opportunity, and so there are examples of insurers that have started to use the "insurer as partner" approach which implies an active role in prevention rather than just being reactive and paying claims when an undesirable event occurs. This new approach

has been made, in great part, possible by what we now call “connected insurance” which encompasses Internet of things (IoT), wearables, and other monitoring devices. The reshaping of the insurance industry has already begun, and it will continue based on new technologies at hand. The aim of this chapter is to briefly illustrate the concept of “connected insurance” with specific focus on “connected health” and “wearables” and to present two case studies: (1) Discovery’s Vitality program presented in parallel with Matteo Carbone’s “five value creation levers” insurance model and the company’s aim to create healthier lifestyles for its customers through the use of wearables, gamification, and rewards and (2) Maugeri’s MOSAIC EU-funded project based on AI and predictive models aimed at helping with treatment management, reducing complications, and improving quality of life in type 2 diabetes patients.

2. Connected health insurance and wearables

Connected health insurance presents great potential for both insurer and insured. But let us define the term in a more accurate way. Connected health, as defined in a paper by Deloitte [2], is the convergence of health technology, digital media, and mobile devices and has the aim of helping patients, caregivers, and health-care professionals to access data in a swifter way while improving the outcomes of health and social care. Connected insurance on the other hand refers to an evolution of the insurance business model based on the adoption of IoT technologies which allow the direct connection between all actors of the ecosystem: customers, insurers, and players from other industries [3]. Based on the above, we can say that connected health insurance is a mix of different types of technologies used in health insurance in order to collect data, determine patterns, and create effective incentives and engagement programs aimed at reducing costs related to healthcare and at improving the quality of life of the insureds.

The potential of connected health insurance can be harnessed in a profitable way by properly measuring the risks associated to the clients and presenting them with an improved, better-priced value proposition that may also contribute to improve their general health conditions. For this to happen, the insurance company will have to seek partners from both the technological innovation sphere and medical providers, keeping in mind that its role in the health system is changing from “payer” to “pivot.”

If creating partnerships in order to get more specialized is something that many insurers do nowadays, matters are completely different when it comes to big data analytics and creating efficient customer experiences. There is so much space for innovation, but legacy systems certainly play their role in making the task of innovating more difficult.

2.1 How do wearables fit in the connected insurance scenario?

The technologies range from consumer-driven devices, such as Apple Watch and Google Glass, to those developed specifically for certain applications, such as wrist-worn sensor for measuring the onset of seizure and so on [4].

The uses of wearables are many, but while some are more immediate and easier to apply, others need more time and research to show how they can influence major health issues worldwide. Wearables can be a noninvasive underwriting evidence source thanks to the capacity to collect data and assess risk based on this data in a shorter period compared to a full medical exam. They can also help people improve their lifestyles and habits and at the same time provide added customer value beyond insurance protection. On a more serious note, wearables can reduce

the incidence of early deaths from chronic conditions such as diabetes and heart disease, but it can also empower people to manage chronic disease better and even act as early identification system for diabetes and heart disease.

The impact of wearable devices is closely related to statistics and life habits: “the only way to move from a palliative health approach to a preventive model is by increasing the volume of data generated and feeding it with algorithms capable of interpreting them” [5].

The big tech players have also been deeply involved in creating innovative connected health solutions and ecosystems.

Google, for example, aims to build headphones that can track one’s health. The company was granted a patent in July 2018 titled “in-ear health monitoring,” which combines auditory experiences with health tracking. The aim is to use in-ear devices to collect data on users’ health as they listen to their favorite music via their smartphones, tablets, or smart watches. While playing the content, the device would also capture users’ body temperatures, effectively creating a database of temperature norms. Over time, the device would be able to compare a person’s daily reading against his or her baseline and recognize unhealthy variations in temperature. In the patent description, Google claims that such a feature could lead to “early detection of a contagious disease or other malady” with global health implications, even keeping under control disease outbreaks such as Ebola and swine flu [6]. Nest, who merged with Google, has recently carried out acquisitions such as Senosis, a spinoff from the University of Washington working on health monitoring systems using a smartphone.

Apple recently unveiled an API for application developers to use data stored in its health application so that with the appropriate level of supervision, people can share data with doctors, hospitals, etc. and receive reminders to follow treatment and other administrative tasks [5].

Virtual assistants are an evolved form of e-health, and it’s estimated that this type of service could save the health-care industry \$20 billion annually. Since virtual nurses are available 24/7, they can answer questions, monitor patients, and provide quick answers. Most applications of virtual nursing assistants today allow for more regular communication between patients and care providers between office visits to prevent hospital readmission or unnecessary hospital visits [7]. If virtual assistants may ease the workload of doctors, another major part of the connected health trend are virtual medical visits performed by real doctors. According to a survey by Mercer, a typical charge for a telemedicine visit is \$40, compared to \$125 for an office visit, in the USA [8]. When presented with the opportunity, health-care consumers would use virtual care for a variety of activities—from e-visits to diagnosis to group therapy. According to a survey by Accenture, nearly three-quarters of health-care consumers (73%) would use virtual care for an after-hours appointment, and about two-thirds (65%) would use it for a follow-up appointment after seeing a doctor or other health-care professional in person [9].

Amazon is also a heavy investor in healthcare. In 2017, it invested into genomics cancer detection company GRAIL. In addition, Amazon’s recent partnership with JP Morgan and Berkshire Hathaway to provide employees with better health insurance signals broader ambitions to upend traditional healthcare [8].

The question remains, how can connected health insurance transform the insurance company from a simple payer of premiums to a proactive player in the customer health journey? Insurers need to stay profitable, and that is perfectly achievable with such a model (insurer that takes “care” of the customer and not just help with the “cure” after a person is ill). There are five main value creation levers to take into consideration according to the theory proposed by Carbone and explained in the book *All the insurance players will be Insurtech* [10, 11].

2.2 Risk selection

Enhancing the underwriting phase with a temporary monitoring based on dedicated devices. As far as the risk selection layer is concerned, connected devices can be indirectly or directly used to select risks at an underwriting stage resulting in low-risk customer acquisition and connected reduction in fraudulent intents.

2.3 Loyalty and behavior modification programs

Loyalty and behavior modification programs lead the client toward risk-free behavior. Behavioral programs are basically approaches that exploit information gathered on behavior to direct clients toward less risky solutions. To this scope a reward system that stimulates safer client behaviors is a key element in this evolved insurance landscape, and programs based on innovative gamification approaches are a must in order to keep clients engaged.

2.4 Value-added services

In other words, developing client-tailored ancillary services allows the insurer to play as an omnichannel medical concierge.

Value-added services consist in the proposition to clients of policy-related services that have a double aim: on the one hand to guide clients toward desired behavior and, on the other hand, to offer perceived value through services to clients. Some ancillary services are proposed to the insured clients in order to exploit relevant data detected; these services could be directly supplied by the insurance company or by means of specialized partners.

2.5 Loss control

Connected insurance allows to use registered data in order to limit the portfolio loss ratio, and it enables the development of claims management processes that permits the insurance company to act more proactively and make the whole process faster and more efficient.

2.6 Risk-based pricing

Risk-based pricing consists in developing insurance policies with pricing linked to client behaviors. Monitoring the “quantity” and “level” of risk exposure during coverage period has become possible. In this sense, the risk can be calculated based on gathered information monitoring with a direct impact on pricing applied to the single customer.

Insurers are beginning to use wearable technology and health apps to reduce risk and improve technical results. Some are educating customers on looking after their own health resulting also in higher customer engagement. Big data gathering and analysis sit at the base of an improved design and product pricing which in turn can encourage clients to adopt a healthier lifestyle. Finally, the very effectiveness of medical treatments can be improved through technology.

Insurance companies have begun to have a more proactive approach by staying in contact with their customers even when they are in completely good health and not only when they seek help themselves. This can be done using innovative systems like wearables and reward schemes. Thanks to the integration between intelligence, connectivity, and better usability, wearable devices can offer interesting opportunities in health and activity monitoring, tracking, personal notifications, and virtual assistance.

3. Discovery's Vitality use case

In order to better grasp the actual benefits for clients and not just for insurers that adopt such an innovative approach, we should take a closer look at the South African insurance player Discovery that can be considered the benchmark when it comes to engaging members and improving their quality of life. Its Vitality program has managed to create a system that not only raises the loyalty of customers but improves their lifestyle and overall state from a health point of view. They apply the five value creation levers mentioned above in a way that brings concrete results for the company and for the insured.

3.1 Loyalty and behavior modification

In the case of Vitality, it is applied as a reward system that stimulates safer client behavior through gamification to keep customers engaged. The gamification strategy used by Vitality is run with the support of an extended network of partners and with the help of wearables and smart objects alongside the well-known smartphone. They create mini challenges related to shopping for food, physical and sporting activities, medical checkups, and so on that if accomplished are rewarded with cash-back, discounts, or other types of incentives. As a consequence, the individuals end up having a more active life (engaged Vitality members exercise 25% more than non-Vitality members), and according to a study released by Discovery [12], they live longer than non-Vitality members: to be more precise, the average life expectancy of an insured South African is 67 years, while the average life expectancy of an insured Vitality member is 81 years. Incentivizing behavior change has led to improved health and lower risk—and as a result lower premiums—for members and improved lapse and claim rates for Discovery. Lapse rates for Vitality status are as much as 67% lower than for those policy holders who do not engage with Vitality, while mortality risk is 72% lower for Vitality Gold and Diamond members who are physically active at least twice a week [13].

3.2 Customer loyalty

Customer loyalty is also intertwined, in Vitality, with value-added services. Vitality offers extra services linked to the insurance cover, which have a double aim: on the one hand to guide clients toward desired behavior and, on the other hand, to offer perceived value through services to clients. Very often these services are provided by means of specialized partners. Clients are also rewarded for making healthier choices through PayBack benefit, which has paid out a total of R 2.4 billion to healthier clients since launch.

3.3 Risk selection

Although it is easier to apply this lever to telematics-based auto insurance where monitoring objective data about driving style is relatively easy, the method can also be used when referring to health insurance. The use of connected devices gives the insurer (Discovery) precious data on people's lifestyle and health condition. This helps create a clearer segmentation and thus the ability to select risk in a more effective way. But maybe even more important, the Vitality program attracts younger and healthier people to start with, precisely because this category is proportionately more attracted by the technological, more digital insurance.

3.4 Risk-based pricing

Monitoring the “quantity” and “level” of risk exposure during the coverage period has now become possible. In this sense, the risk can be calculated based on collected information with a direct impact on pricing applied to the single customer. We do not have enough data to confirm that this is being applied through the Vitality program, but it is becoming a standard practice for telematics-based car insurance where the object of the insurance coverage is easier to evaluate than in the case of a living breathing person.

3.5 Loss control

By using connected devices with their customers, Discovery possesses an “early warning” mechanism that can anticipate serious health problems and more expensive claims.

According to Discovery, Vitality Gold status members with heart disease have 41% lower risk claims than members with no Vitality membership. If we are to look at data regarding diabetics, it seems that Vitality Gold members living with this condition have 53% lower risk claims [14].

Another interesting claim coming from a recent presentation by Discovery Vitality at DIA Amsterdam 2018 deserves our attention. According to the results, there is an 18% reduction of hospital and chronic claim costs for the batch of Vitality members that use the Vitality Active Rewards (VAR) alongside the Apple Watch, compared to the group of insured who do not use an Apple Watch. VAR is a smartphone application based on fitness points, which is designed to encourage Vitality members to increase their activity levels by setting weekly personalized physical activity goals and then rewarding users for achieving them. Nevertheless Discovery specifies that the above data are based on a cross-sectional view of the relative claim experience, and it is premature to show the improvement over time given the lower frequency of health claim events. In any case, I show that certain wearables together with the right reward system may have significantly positive results but have yet to be observed over a longer period of time. This is backed up by the data presented by Discovery regarding Apple Watch owners enrolled in the program. It seems that these users are 35% more active than prior to getting the watch. Since the VAR system was launched, there has been a 36% increase in physical activity [14].

The data are very telling, and the implications for ensuring healthy lives and promoting well-being are significant. The Vitality model should be further investigated in order to understand if and how it could work for the general population, not only for specific segments, and to see to what degree innovation driven by insurers and technology companies can be used to benefit citizens in general. The transition to a “prevention-centered” approach is actually a pragmatic decision for insurers because in time, the portfolio tends to change its structure, passing from a majority of so-called “sick” clients to a majority of relatively “in good health” clients [15, 16].

4. ICS Maugeri’s MOSAIC case study and its application for the insurance sector

Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces. In 2014, 8.5% of adults aged 18 years and older had diabetes. In 2016, diabetes was the direct cause of 1.6 million deaths, and in 2012, high blood glucose was the cause

of another 2.2 million deaths [17]. It is estimated that diabetic patients worldwide will be 629 million by 2045 [18].

Diabetic patients have significantly higher risk to develop severe complications generated by the evolution of the pathology compared to nondiabetic patients. Complications arising from the evolution of this disease are peripheral neuropathy, retinopathy, nephropathy, and cardiovascular diseases.

It is well known that insurers either do not cover diabetic patients or, if they do, they require a significantly high premium. This is due to the difficulty to measure the probability of the occurrence of risks associated to these clients.

Therefore, the insurance sector is leaving uncovered a market that is becoming more and more relevant.

ICS Maugeri is a major group of hospitals specialized in rehabilitation medicine offering a multidisciplinary approach in treating diseases and disabilities. ICS Maugeri's research team has developed, in partnership with the University of Pavia, an instrument called MOSAIC aimed at improving the clinical management of patients affected by diabetes mellitus type 2 (T2DM) that can calculate the risk of developing complications related to T2DM in different time scenarios.

MOSAIC uses AI and machine learning which is based on algorithms able to learn patterns and decision rules from data. These machine learning algorithms have been embedded into data mining pipelines, which can combine them with classical statistical strategies, to extract knowledge from data. Within the EU-funded MOSAIC project, a data mining pipeline has been used to derive a set of predictive models of type 2 diabetes mellitus (T2DM) complications based on electronic health record data of nearly 1000 patients.

Based on the results expressed in the research paper, the team has been able "to predict the onset of retinopathy, neuropathy, or nephropathy, at different time scenarios, at 3, 5, and 7 years from the first visit at the Hospital Center for Diabetes (not from the diagnosis). Considered variables are gender, age, time from diagnosis, body mass index (BMI), glycated hemoglobin (HbA1c), hypertension, and smoking habit." The final models are thus able to provide up to 83.8% accuracy in predicting the probability for a diabetic to develop the three main complications and are easy to apply in clinical practice.

It is furthermore demonstrated that intensive multifactorial pharmacological intervention (compared to conventional therapy) leads to significant improvements [19]:

- Additional 7.9 years life span compared to cases where conventional treatment is applied.
- First complication appeared 8.1 years later than in patients with normal treatment.
- General reduction of microvascular complications.

In insurers' terms, this shows that not only risk associated to diabetes can be estimated but also that a proper management of diabetic patients could lead to significant reduction of the risk itself. The question is how can insurers make sure that diabetic patients follow the required therapeutic path?

In fact, diabetic patients are required to follow a rigorous clinical, diagnostic, and therapeutic path in order to manage and control their pathology and try to limit and/or slow down the consequences of this chronic disease. This path involves periodic medical checks, diagnostic tests, as well as continuous and intensive drug therapies, requiring significant effort for patients and their caregivers. Most of the time, the scheduling of such periodic checks must be autonomously managed by

the patient, resulting in a progressive reduction of adherence to the required clinical paths. This may lead to severe deterioration of the health state of diabetic patients.

The MOSAIC project has developed algorithms that allow to predict the onset of diabetes-related pathologies, and furthermore, it has developed a platform that allows a real-time monitoring of main risk factors (e.g., hypoglycemia). As part of the program, a face-to-face general examination with a medical doctor is carried out at least yearly, to estimate main risk factors and to identify a personalized clinical, diagnostic, and therapeutic program. The patient follows the prescribed program and is monitored through wearables and telemedicine; this allows to (i) personalize, update, and modify pharmacological treatments, (ii) identify and update the diagnostic path to be performed in order to monitor and reduce the risk of complications, and (iii) identify on-time criticalities that may require timely investigations.

The patient follows the indicated diagnostic-therapeutic program and is also monitored through wearables and telemedicine. As a consequence, this approach allows a significant risk control and, potentially, reduction, allowing the insurance to update the premium yearly.

5. Conclusion

We are all witnesses to a major shift in the way that medical services are delivered. The insurance industry is slowly passing from a one-size-fits-all approach to a personalized approach that looks at individuals and their habits, needs, and their environment. As the World Health Organization predicts a 13 million doctors' deficit at worldwide level by 2035 [20], it's essential for connected health and connected health insurance to evolve in such a way that will allow primary health-care providers to be much more versatile and flexible in reaching their patients. Clearly, the new paradigm in connected insurance will face several challenges posed by rate of adoption, cost barriers, resistance to change, and privacy aspects, but nevertheless the potential benefits could be significant based on Discovery Vitality case study, for both insurance companies and customers alike. On the one hand, insurance carriers could be able to reduce their costs and at the same time positively influence the health state of their customers. On the other hand, citizens will have improved access to better medical care and health advices at a convenient cost. Further research needs to be done: (1) of Discovery Vitality programs worldwide in order to understand how results vary over time and from country to country and (2) of similar connected insurance programs promoted by other insurance companies with the objective of understanding how changes in the rewards/engagement system reflect on the results.

According to the World Health Organization, just four decisions, physical inactivity, poor nutrition, smoking, and alcohol use, lead to four illnesses—cancer, heart and artery diseases, lung disease, and diabetes—that cause around 60% of global deaths [21]. Based on this information, one can argue that Discovery's model combined with a predictive system such as MOSAIC's could have an even greater impact on avoiding unhealthy behavior and more specifically keeping under control diabetes type 2 cases worldwide by ensuring that patients are correctly managing their condition. The insurer would be increasing its insureds base while helping diabetic patients take control of their chronic disease while also keeping costs in check.

The concept of loyalty and behavior modification programs utilized by Carbone and discussed above could be an evolution or add-on to MOSAIC's approach when applied by an insurer like Discovery. A reward-based system could work as an additional incentive toward keeping diabetics effectively engaged. Taking for granted

that diabetics will follow a program step by step and change their behavior toward a desired goal is not something an insurer should do. Here comes the reward as an element that can help in reaching that goal and at the same time give the insureds something to look forward. Even if the real stake for diabetics in such cases is their own life expectancy—which should be motivation enough—the reward element could be a good and fun extra incentive for reaching health goals.

As estimated costs with lifestyle-related conditions (including diabetes) will be 47 trillion by 2030 [22], insurers, the health-care systems, clinical providers, and patients could all benefit in some way from such a program. It would be interesting to look at how this approach could be extended to other chronic diseases and what the state of research is in these other fields.

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