Health ecosystems
towards an integrated and seamless patient experience
Consumer willingness to share data is a given – the burden is now on the insurance industry to deliver value to the customer.

Evangelos Avramakis, Head Digital Ecosystems R&D
In the field of healthcare, ecosystems present opportunities that can improve health outcomes, prevent premature mortality and enhance quality of life for many. The rising prevalence of lifestyle diseases and behavioural risks are leading to higher costs and poorer health outcomes, especially if care provision is inefficient. Wellness platforms and devices are already becoming important conduits for data exchange between consumers and service providers. In future, healthcare will involve using so-called digital ecosystems to promote, maintain and restore patient health by providing superior care anywhere and anytime.¹

Insurers need to leverage these ecosystems to help consumers manage risk and prevent premature mortality or adverse health incidents. The growth of data and tools to analyse data within ecosystems can help obtain useful consumer insights and provide individuals with what feels like a bespoke experience. Better consumer outcomes could result if underwriting processes and products embrace the modifiable nature of L&H risks. This is something that will be possible with well-integrated, explicitly connected ecosystems. However, we seem to be still quite far from this Utopian ideal.

Yet the landscape is showing signs of change; consumers are evolving from passive purchasers to active health managers, seeking more engaging and personalised experiences connected and relevant to their lifestyle. They are also living longer lives. But longevity in poor health is no gift. Digital ecosystems are helping consumers manage their lifestyles better. The insurance industry has been a pioneer in health data investigation and evaluation, and insurers will soon have the ability to connect with digital ecosystems through real-time services enabled by application programming interfaces or APIs.

For insurers, there are a number of crucial questions. How should they support consumers in maintaining or improving their health? How should they assess key modifiable risks, dynamically over time? How can they develop more engaging and inclusive products for all consumers, and what should they do to attract and reward those willing to proactively manage their health? How best should insurers engage with governments and regulators on topics such as competition and privacy?

It is not enough to simply understand trends. Collectively, the insurance industry must be a few steps ahead to keep our offerings relevant. The sector is uniquely positioned to lead that change by harnessing new advances that change the mode and type of engagement with customers, for a start. Insurers are agents of change, with a duty to help everyone live their best lives.
Trends reshaping the digital health landscape

Key trends

Digital health is the use of data and technology to treat patients, conduct research, educate healthcare professionals, track diseases, monitor health, and facilitate healthy lifestyles through prevention. Different macroeconomic and technology trends are impacting the landscape. Use of digital health tools, big data and analytics, consumer focused regulation and modifiable risk factors are all trending, many with overlapping qualities. These developments in health present an opportunity for insurers to reinforce their relevance.

Table 1
Overview of key trends leading to and impacting digital ecosystems

<table>
<thead>
<tr>
<th>Trends</th>
<th>Opportunities</th>
<th>Key Challenges</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data proliferation via sensors and high-end technology</td>
<td>Smarter collection and aggregation of data through wearables, implantables and other technologies. Health data volumes up by 48% annually.</td>
<td>Data reside in silos, governed by disconnected frameworks.</td>
</tr>
<tr>
<td>Decentralisation of care delivery</td>
<td>Telehealth and direct-to-consumer (DTC) value propositions emerging. Ecosystems play key role in vetting process.</td>
<td>Data ownership and exchange among parties. Privacy and security.</td>
</tr>
<tr>
<td>Advent of digital therapeutics and treatment</td>
<td>New tech-enabled health providers offering alternative treatments, prevention and monitoring programmes as well as mitigating risk conditions.</td>
<td>Change management and evidence of efficacy is needed for this new field of services to be applied and adapted to daily routines within healthcare practices.</td>
</tr>
<tr>
<td>Consumers demand superior experiences</td>
<td>More informed and empowered consumers due to information and community access. Data combined to deliver services customised to individuals.</td>
<td>Personalisation of content to individual needs is becoming a key relationship driver.</td>
</tr>
<tr>
<td>Demographic shifts and lifestyle risks</td>
<td>Solutions designed to prevent disease, reward good lifestyle practices (eg, no smoking), and smooth out uncertainties in retirement.</td>
<td>Behavioural risks are becoming as important as biomedical ones.</td>
</tr>
<tr>
<td>Growing relevance of machine intelligence</td>
<td>With data widely available, AI used in developing new personalised healthcare products and services applied throughout the disease journey.</td>
<td>Standardisation of data streams needed for data and insights to be exchanged among different stakeholders in healthcare.</td>
</tr>
</tbody>
</table>

Source: Swiss Re Institute

Data proliferation through sensors and high-end healthcare technology

This decade has seen a boom in the collection and aggregation of healthcare data. International Data Corporation (IDC) estimates that health data volumes are growing at 48% annually, at which rate the volume of global healthcare data will balloon to 2 314 exabytes (EB) by 2020, from 153 EB in 2013. However, much of these data currently reside in silos and are governed by disconnected frameworks and standards. Curating and integrating the data is a tall order. Data are available in multiple structured sources, such as claims, clinician data, electronic health records (eHR), pharmacy and laboratory data, as well as non-traditional, non-clinical forms of data, like social media; or local, geographic data, such as transportation, environment, food, crime, and safety. (See Figure 1 for examples of health data collated by ecosystems via IoT enabled sensors as well as electronic health records.) Standards must be developed, and data harmonised into common models to be fully utilised. Data must be pulled in through an interface to enable replication of a real person into a digital person (also called digital twin – see Figure 2). As more and more people create digital twins, much more modelling becomes possible. Figure 1 shows how digital twin data (steps etc) can be combined with medical evidence data available from eHR. Combining data will provide augmented intelligence to consumers and should work well in a digital ecosystem.

2 An exabyte (EB) is a unit of digital information storage used to denote the size of data. It is equivalent to 1 billion gigabytes (GB). See Driving data growth in healthcare, EMC2, 2014, https://www.emc.com/analyst-report/digital-universe-healthcare-vertical-report-ar.pdf
Internet of things (IoT)-enabled technology is often used to monitor a user’s health. A number of activity and near field trackers enabled by the IoT (electronics, software, sensors, and connectivity) enable objects to exchange data through the internet with a manufacturer, operator, and/or other connected devices, without human intervention.

**Applications:**
- Simultaneous reporting and monitoring
- End-to-end connectivity and affordability
- Data assortment and analysis
- Proactive tracking and alerts
- Remote medical assistance
- Patient engagement

EHRs may include a range of data, including demographics, medical history, medication and allergies, immunisation status, laboratory test results, radiology images, vital signs, personal statistics like age and weight, and billing information.

**Application**
- Contains all personal health information belonging to an individual; from the first admission or attendance at the hospital;
- Is entered and accessed electronically by healthcare providers over the patient’s lifetime; and
- Extends beyond acute inpatient situations including all healthcare providers at which the patient receives care.

Source: Swiss Re Institute. Swiss Re Institute, adapted from Electronic Health Records – Manual for developing countries, World Health Organisation, 2006; and Internet of things in healthcare: applications, benefits, and challenges, Peerbits, 8 August 2019.
Figure 2
Wearable and implantable technologies

Sensor/biosignal (selection)
- Blood oxygen
- Blood pressure
- Blood sugar
- Brain activity
- Circulation
- Electrocardiogram (ECG)
- Electrodermograph
- Electromyograph (EMG)
- Electroencephalogram (EEG)
- Energy consumption
- Eye movements
- Heart frequency
- Nutrition/weight/size
- Obesity
- Respiratory rate
- Skin pressure
- Skin temperature
- Sleep levels
- Stress levels
- Sweat

Activity parameter (selection)
- Gradient
- Speed
- Orientation
- Direction
- Route
- Movement
- Acceleration
- Breaking
- Locality
- Altitude
- Distance
- Type of activity

Harnessing these data could deliver significant improvements in healthcare outcomes while reducing cost and waste. Data exchange and care coordination platforms will leverage complex governance and policy enforcement to harmonise the data and make them available to downstream consumption platforms, applications and analytics. For example, by maximizing value not only for the platform itself but also for service providers eg, by passing on insights from consumers. These platforms are expected to automate data ingestion from all recognised and authorised sources; provide tracking and auditability; and govern identity, compliance and security.³

**Decentralisation of care delivery**

This wide range of digital health effort creates a fragmented service landscape. Relatively low barriers to market entry have spurred a proliferation of tools from innovative small and medium-sized companies often new to the health market. Global venture capital investment in healthcare in the first half of 2019, at USD 5.1 billion, is the highest amount ever raised in the first six months of any year to date.⁴ These tools need rigorous testing and validation, especially when used in diagnosis and treatment. Industry stakeholders have called for peer reviews of the algorithms underpinning the technologies and asked that the data be made available in the public domain. Ecosystems can play a key role in participating in this vetting process.

**Digital therapeutics and treatment**

Digital therapeutics are tech-based programmes that use evidence-based therapeutic interventions to prevent, diagnose and treat medical conditions. They can be broadly defined as treatments or therapies that use digital and web-based tools to cause changes in patient behaviours. The effectiveness of digital therapeutics is based on large amounts of clinical data, research and trials which also need to be tested for efficacy of results. (See box on measuring the effectiveness of digital health technologies.)

Further developing and deploying digital therapeutics in an ecosystem environment has the potential to significantly enhance customer benefits. A recent study in the BMJ (formerly, the British Medical Journal) on the benefits of digital management programmes noted that patients are increasingly open to digital interventions. According to the study, patients value the flexibility as to location and time, the absence of waiting lists, and the option of daily interaction with a therapist.⁵

Understanding these behavioural patterns will be critical for insurers in leveraging ecosystems to retain existing customers and attract profitable new business.

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³ Hype Cycle for Healthcare Providers, 2018, Gartner, July 2018
⁵ A. Cronström, L.E. Dahlberg, et al. “I would never have done it if it hadn’t been digital: a qualitative study on patients’ experiences of a digital management programme for hip and knee osteoarthritis in Sweden”, BMJ Open, 2019, https://bmjopen.bmj.com/content/9/5/e028388

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**Platforms are taking the first steps to combine data for downstream consumption by applications and analytics.**

**Ecosystems seek to stitch together many products and integrate them into a coherent care delivery programme.**

**Ecosystems enhance advantages of digital therapeutics and can spur changes in behaviours.**

**Evidence suggests that consumers are beginning to see value in digital health management programmes.**
Measuring the effectiveness of digital health technologies

There is no clear evidence framework for clinicians and policymakers to rely on to distinguish effective digital products from those that fail short. Randomised controlled trials (RCTs), the highest level of evidence, are seldom used in digital medicine, in part because such trials are expensive to run and do not lend themselves to the iterative nature of digital product design. Other areas of medicine have faced the same conundrum. For example, RCTs are very difficult to run in surgery, in part because each surgeon has a uniquely different style and skill. As a result, the IDEAL recommendations for surgeons emerged from conferences between surgeons and methodologists and are now used to evaluate surgical innovation and research.

The American Psychiatric Association (APA) has created a model to evaluate the efficacy and security of digital health apps and recently announced an expert panel to review apps and guide patients and clinicians. Likewise, a working group led by the Digital Health & AI Clinical Lead at the UK’s National Health Service (NHS), involving the UK National Institute for Health and Care Excellence (NICE), has developed guidance so that innovators can benchmark themselves against evidence based standards for effectiveness and economic impact of digital tools.

Consumers demand digital health experiences on a par with other industries

Consumers expect high-quality digital health experiences on par with standards set in other industries. In general, health systems need to make significant progress in improving customer service and customising experiences to individual needs. Clinicians and healthcare executives in a recent survey reported by the New England Journal of Medicine (NEJM) said an improved customer experience is the top area in which healthcare can learn from other industries (selected by 57%), followed by customisation to individual needs and preferences (35%).

Consumers also desire greater transparency and demand engaging experiences, flexibility and value. Sensor data can be combined with traditional data to deliver services customised to individual needs. Patient empowerment is crucial but requires engaging content combined with consumer-focused interfaces and communication channels. For example, Livongo, a US digital health service, allows diabetics to test blood sugar levels, have results analysed remotely and be told via an app what they need to do immediately. Figure 3 shows a data-powered, digitally enabled customer intervention and the desired outcomes it aims for, such as recommending a walk for improved disease management when a patient’s blood sugar levels are elevated. Tech giants like Google have started moving in the similar direction.

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7 Acronym for idea, development, exploration, assessment, long-term study.
11 Livongo Health, Inc. - SEC.gov, see https://www.sec.gov/Archives/edgar/data/1639225/000119312519851599/d731249ds1.htm#toc731249_12
12 See Google Fit worked with the World Health Organization (WHO) to develop two activity goals based on WHO’s physical activity recommendations shown to impact health - Move Minutes and Heart Points, see https://www.google.com/ln/
Trends reshaping the digital health landscape

**Figure 3**
Sensors can enable a range of health-related consumer services (e.g., for diabetes)

<table>
<thead>
<tr>
<th>Data stream</th>
<th>Consumer/patient</th>
<th>Analytics and content stream</th>
<th>Desired outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Data</strong></td>
<td></td>
<td><strong>Health content</strong></td>
<td><strong>Decreased costs</strong></td>
</tr>
<tr>
<td>- Open data</td>
<td></td>
<td><strong>Data analytics</strong></td>
<td><strong>Improved diagnosis and treatment</strong></td>
</tr>
<tr>
<td>- Social media data</td>
<td></td>
<td><strong>Clinical evidence</strong></td>
<td><strong>Improved disease management</strong></td>
</tr>
<tr>
<td>- Environmental data</td>
<td></td>
<td></td>
<td><strong>Remote monitoring of chronic diseases</strong></td>
</tr>
<tr>
<td>- Other data (i.e., 3rd party)</td>
<td></td>
<td></td>
<td><strong>Enhanced patient experience</strong></td>
</tr>
<tr>
<td><strong>Alternative data</strong></td>
<td>Non-medical</td>
<td></td>
<td><strong>Improved drug management</strong></td>
</tr>
<tr>
<td>- Vital parameters</td>
<td>Therapy related parameters and biomarkers (i.e., medication)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Activity parameters</td>
<td>Health related products</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Nutrition parameters</td>
<td>Health related services</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Medtech and the Internet of Medical Things, Deloitte 2018, Swiss Re Institute

Tailored healthcare experiences may help identify healthcare inequities.

Consumers driving better, tailored healthcare experiences has led to the identification of healthcare inequities

Women have been underrepresented in healthcare data sets, which has led to adverse healthcare outcomes. Women’s heart attacks present differently and yet this is not widely known. Furthermore, some conditions specific to women have a long latency, such as endometriosis, which is excruciatingly painful and can severely impact quality of life — and takes an average of seven years to diagnose. Researchers have found sex differences in every tissue and organ system in the body, but little evidence of different approaches to male and female patients. For example, there are sex differences in lung capacity, even when normalised to height, and among men and women who smoke the same number of cigarettes, women are 20–70% more likely to develop lung cancer.13

Seismic shifts in demographics and increasing lifestyle risks

Demographic changes such as ageing populations and changes in societal behaviours are contributing to a steady increase in costly long-term health issues. As a result, healthcare costs are expected to grow across countries, in most cases exponentially (see Figure 4). Global increases in life expectancy paired with falling fertility rates mean that the over-65 population will be growing rapidly in coming decades, in both advanced and emerging economies. Currently, the financial services industry has products to help address risk in the accumulation phase of life, but fewer solutions to deal with needs during retirement.

As well as ageing populations, we see demographics shifting with migration. Relocation of large population groups has an impact on healthcare trends. Conditions surrounding the migration process can increase vulnerability to ill health. However, several health controls can be put in place. In 2011 the prevalence of tuberculosis (TB) in London was 15.6 per 100 000 people; by 2017 it had fallen to 9.3 per 100 000. The decline was due to a number of factors, including screening of migrants from high-burden countries, and roll-out of the Find and Treat service specifically targeting underserved sections of the population, among them vulnerable migrants, homeless people, and the formerly incarcerated.14

Non-communicable diseases (NCDs) account for 71% of all deaths globally.\textsuperscript{15} Between 1990 and 2017, the overall disease burden – expressed as DALY rates or the number of years lost due to ill-health, disability or early death – increased by 40% for NCDs, but decreased by 41% for communicable diseases.\textsuperscript{16} The majority of premature NCD deaths are linked to four causes: cardiovascular diseases, cancers, respiratory ailments and type 2 diabetes (T2D).\textsuperscript{17} In the US, T2D and ischaemic heart disease have the highest impact on DALYs and total health spend (see Figure 5).

Behavioural risks are becoming as important as biomedical ones. In the UK, for instance, 80% of heart attacks and strokes are believed to be preventable if people were to adopt healthier lifestyles.\textsuperscript{18}

\textbf{Trends reshaping the digital health landscape}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure5.png}
\caption{Relationship between disability-adjusted life years (DALYs) and total health spend(ing) for key diseases (US)}
\end{figure}

Source: Tracking personal health care spending in the US, Institute for Health Metrics and Evaluation (IHME) and University of Washington, 2015.

However, insurers have yet to fully harness the power of ecosystems for dynamic approaches that reward good behaviours.

Healthcare spending and DALY impact society in many ways, such as where people cannot afford healthcare due to high premiums and coverage exclusions, as a result of which more costs need to be funded by out of pocket, and/or by employer and individual health insurance. Insurers are aware that healthy lifestyle choices like eating well, exercising, managing stress and proper sleep can help mitigate the risks associated with lifestyle diseases. However, insurers lack integrated tools to show clients how these different health factors are linked. They will need to harness the power of ecosystems to develop a dynamic, personalised pricing approach that rewards good behaviours (see box on genetic testing going mainstream).

\textsuperscript{15} Noncommunicable diseases Fact Sheet, WHO, June 2018, https://www.who.int/news-room/fact-sheets/detail/noncommunicable-diseases
\textsuperscript{16} DALY or the disability-adjusted life year is a measure of overall disease burden, expressed as the number of years lost due to ill-health, disability or early death. One DALY can be thought of as one lost year of “healthy” life. See “A systematic analysis for the Global Burden of Disease Study 2017”. Lancet, November 2018, https://www.ncbi.nlm.nih.gov/pubmed/30415748
Genetic testing going mainstream

The number of people taking genetic tests is increasing dramatically. A Swiss Re survey in the US found that more than 20% of those surveyed said they had taken a genetic test, either to diagnose or predict disease (14%) or as a direct-to-consumer (DTC) test (6%). Those who took a medical genetic test and whose results showed an increased health risk were four times more likely to buy life insurance. Guided by country-specific regulation, insurers may or may not be allowed to take genetic results into account when underwriting. In the aforementioned US survey, about 80% of respondents declared their willingness to share genetic information with their insurer in return for a premium reduction or a health management benefit.19

Genetic tests motivate people to make lifestyle changes or take healthy actions. Inspired by these findings, insurers are exploring ways to offer customers genetic testing services as a way to improve long-term health outcomes. Several companies are developing consumer tests that could potentially drive the development of products and services that are linked with test outcomes, such as personalised medicine. However, the health benefits offered through predictive genetic testing should be balanced against the risk of potential anti-selection, adverse claims experience and increased exposure to legal and reputational challenges.

The rise of machine intelligence

Machine intelligence is increasingly being used to develop new products and services for the healthcare market (see Table 1). Insurers can process and clean large amounts of heterogeneous data to build strong foundations for modelling, and leverage text mining and natural language processing algorithms to extract insights from unstructured data sources. Research from John Brownstein’s team at Boston Children’s Hospital demonstrates that analysis of social media data can be as effective as traditional methods of analysing population health data.20

## Table 2
Examples of digitally enabled interventions in key diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>DALYs US (mn)</th>
<th>Discovery, prevention and wellness</th>
<th>Diagnosis and treatment</th>
<th>Recovery and reintegration</th>
<th>Sample metric tracked</th>
</tr>
</thead>
<tbody>
<tr>
<td>Neuropsychiatric condition</td>
<td>13.3</td>
<td>Mental wellness apps</td>
<td>Boutique meditation studios</td>
<td>Mental wellness apps</td>
<td>Medication use, activity, communication</td>
</tr>
<tr>
<td>Heart disease</td>
<td>10.4</td>
<td>AI could enable accurate screening for atrial fibrillation. New tool to monitor for cardiac arrest remotely during sleep</td>
<td>Smartphone app in cardiac assessment. Augmented reality to plan and perform complex procedures</td>
<td>E-tattoo for uninterrupted heart monitoring. Web-based cardiac rehabilitation for patients dropping out</td>
<td>Medication use, activity, blood pressure, heart rate, weight</td>
</tr>
<tr>
<td>Cancer</td>
<td>8.3</td>
<td>Evidence-based, personalised dietary interventions. AI improves accuracy of imaging tech to screen for breast cancer</td>
<td>Treatment design using AI, early diagnosis using Google DeepMind, Freenome etc.</td>
<td>Coaching and lifestyle management. Fitness trackers in monitoring. Computer modelling supports therapy</td>
<td>Weight, exercise, heart rate, body temperature, blood in urine</td>
</tr>
<tr>
<td>Diabetes</td>
<td>1.6</td>
<td>Identify at-risk patients. Eg prediabetic, digital eye scan for accurate picture of patient’s general health</td>
<td>Detect complications eg retinopathy, kidney failure. AI and radar technologies could help manage disease</td>
<td>Digital therapeutics. Cells engineered to produce insulin via smartphone</td>
<td>Medication use, exercise, weight, foot ulcers, HbA1C, protein in urine, heart rate, blood pressure</td>
</tr>
</tbody>
</table>

Source: Swiss Re Institute

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22 Jihye Jang, Cory M, et al. Three-dimensional holographic visualization of high-resolution myocardial scar on HoloLens, 8 October 2018.


24 "Web-based cardiac REhabilitation alternative for those declining or dropping out of conventional rehabilitation: results of the WREN feasibility randomised controlled trial," BMJ, 23 May 2018, https://openheart.bmj.com/content/5/2/e000860


26 Maria Pires Pacheco, Tamara Bintener et al. Identifying and targeting cancer-specific metabolism with network-based drug target prediction. EBioMedicine, 2019

There are many algorithms that physicians follow and automating many of these algorithms into tools could be promising. Early stage startups are leveraging artificial intelligence techniques to check someone’s symptoms based on their responses to questions and help users appropriately triage and answer their own medical-related question. Artificial intelligence techniques are used to analyze large datasets in order to pinpoint risk and improve diagnostics and treatment. However, standardization of data streams, data and insights exchange among different stakeholders in healthcare remains a challenge.


33 Jiawei Shao, Shuai Xue, et al. “Smartphone-controlled optogenetically engineered cells enable semiautomatic glucose homeostasis in diabetic mice,” Science Translational Medicine, 2017

34 “Web-based self-management support for people with type 2 diabetes (HeLP-Diabetes): randomised controlled trial in English primary”, BMJ Journals, 27 September 2017 carehttps://bmjopen.bmj.com/ content/7/9/e016009
Health ecosystems will put the patient at the very centre of a digital-enabled partnership that will save lives without costing the earth. Insurers have a golden opportunity to be a key player in this revolution or be left in the wake.

Dan Ryan, Head Insurance Risk Research, Swiss Re Institute
The rise of digital health ecosystems

Digital ecosystems bring together enterprises, people and technology around a standardised digital platform for a mutually beneficial purpose. In healthcare, these ecosystems host a variety of digital health products and make them available to providers and patients alike. Multiple stakeholders like hospitals, pharma companies, tech and solution providers, universities, transporters, and retailers come together to provide these products and services. Ecosystem sponsors help in setting standards that make these services interoperable and also play a key role in assimilating them with traditional care delivery. \(^{35}\) (see Figure 6 I and II).

### Figure 6 I
Difference between disconnected providers and connected ecosystems

**“Disconnected”**

**Consumer journey**

- Offline
- Online

**Consumer**

- Wellness
- Prevention
- Diagnostic/therapy
- Reintegration

**Customer jobs**

- Primary care
- Pharmacy & diagnostics
- Secondary care
- Health tech provider
- Insurer
- Information marketplace

**Involved ecosystem parties**

- Potential frictions

**Source:** Swiss Re Institute

A diverse set of players seeks to capitalise on these trends but lacks integrated health delivery capabilities.

### Healthcare delivery needs to be an integrated service.

Unlike less complex areas such as online retail, healthcare has no single app that can interact with consumers. Consequently, the many digital health products that could be accessible through a common platform would need to be unified into a cohesive offering (see Figure 7 for a possible process scenario). In addition, there are other non-healthcare players, such as banks and insurers, that need to be integrated as well. There is the additional challenge of coordinating across offline care teams that span different organisations, industries and communities. Figure 7 illustrates how a digital ecosystem could integrate different types of entities.

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\(^{35}\) L. Chin, J. B. McCormick, et. al., *Convening a Digitally Enabled Ecosystem to Address the Chronic Disease Burden of an Underserved Community*, Project Diabetes Obesity Control (DOC); The University of Texas System, 28 September 2018, https://catalyst.nejm.org/digital-health-platform-ecosystem-chronic-disease/
**Figure 6.** Difference between disconnected providers and connected ecosystems

<table>
<thead>
<tr>
<th>Consumer journey</th>
<th>Consumer</th>
<th>Phases</th>
<th>Customer jobs</th>
<th>Interface applications (access)</th>
<th>Involved ecosystem parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offline</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Online</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&quot;Connected&quot;</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Figure 7.** Representation of value provided by digital ecosystems

<table>
<thead>
<tr>
<th>Consumer journey</th>
<th>Life cycle phases</th>
<th>Interface applications (access)</th>
<th>Involved ecosystem parties</th>
</tr>
</thead>
<tbody>
<tr>
<td>Offline</td>
<td>Wellness</td>
<td></td>
<td>Employers</td>
</tr>
<tr>
<td>Online</td>
<td>Prevention</td>
<td></td>
<td>Communities, families</td>
</tr>
<tr>
<td></td>
<td>Diagnostic</td>
<td></td>
<td>Wellness &amp; prevention providers</td>
</tr>
<tr>
<td></td>
<td>Therapy</td>
<td></td>
<td>Retail/ nutrition, drugs</td>
</tr>
<tr>
<td></td>
<td>Reintegration</td>
<td></td>
<td>Analytics, tech</td>
</tr>
</tbody>
</table>

Source: Swiss Re Institute
To provide better health outcomes, digital ecosystems help to construct a complete picture by combining informal health and fitness data from patients with official records from health professionals. Poor interoperability and data silos currently prevent users and health professionals from getting a unified view of health and fitness data and result in a fragmented and inefficient patient journey (see upper panel of Figure 8). Information about a patient’s state and care plan is often lost as a patient moves across various health care providers. In a recent survey, nearly one-third of individuals who had been to see a doctor in the prior 12 months reported a breakdown in information exchange. About one in 20 reported having had to redo a test or procedure because their prior data was missing, and about one in five had to carry previous test results with them to appointments.36

Ecosystems can help address this inefficiency with a data-driven seamless journey by linking formal and informal data silos and playing an important role in the aggregation process. Once implemented accordingly, ecosystems will allow patients to control their data and provide permission-based access to what they want to share. This will help reduce process inefficiencies and add value to the patient experience by enabling faster access to appropriate care. Further benefits include early detection and intervention, as well as contextual and behavioural guidance. (See lower panel of Figure 8.)

Digital ecosystems help in wellness, discovery and prevention

Wellness need not be just a discount for steps counted using a wearable device. It can be an entire ecosystem that guides and incentivises customers towards their health goals. Most risks people face evolve over time and health outcomes can be influenced by individual behaviours. Behavioural factors play a role in all 12 leading causes of death.37 Current underwriting by insurers relies on a single point-in-time risk assessment, and insurers usually have little knowledge of how their policyholders’ health is evolving. Informed by behavioural psychology, insurers can leverage ecosystems to offer customers personalised wellness programmes that link to a system of points, rewards, feedback and recognition, and access data about how policyholder health is evolving.

There are several areas where insurers can leverage ecosystems for wellness, discovery and prevention.

Identifying at-risk diabetes patients: Digital tools could help identify people with prediabetes or symptoms of early prediabetes. Digital diabetes prevention programmes (DPP) have produced clinically meaningful outcomes even three years after the programmes ended. A study published in 2017 demonstrated significant long-term reductions in body weight and A1c in a digital DPP.38 Additional complications can also be tracked. For example, a recent study suggests that diabetes-related heart-rate variability changes can be detected via consumer, off-the-shelf wearable heart-rate sensors using deep learning.39

Fragmented, inefficient and ineffective patient journey

Integrated, effective and efficient patient journey

Source: Swiss Re Institute
The rise of digital health ecosystems

Cardio vascular disease diagnosis: The accuracy and fidelity of data collected by mobile electrocardiograms (ECGs) is improving rapidly. New wearables can help consumers get an ECG, share it with doctors and receive feedback on a recurring basis. For example, consumers can now receive a notification if their heart rate appears to be too low. The Apple Watch is approved by the US food and drug regulator (FDA) and can screen the wearer’s heart rhythm in the background and send a notification to the watch if it detects an irregular rhythm (which could point to atrial fibrillation). While the device cannot diagnose the issue, it can alert the wearer, who can then consult a doctor.40

Mental health early intervention: Mental illness accounts for 32.4% of years lived with disability (YLDs) globally and 13.0% of disability-adjusted life-years (DALYs) globally.41 A large proportion of mental health issues can be addressed earlier or prevented altogether. The potential of digital tools to improve quality and increase access to mental health care is increasingly clear.42 In Hong Kong, The Brightly Project uses a game to monitor facial expression and reactions in students. The product can screen for slower cognition, which is an indicator of mental health deterioration. It also looks at language, for changes in pronoun use – from the group we or us to the singular I or me – to track withdrawal or social isolation, another indicator.43

Creating a framework and covering the costs of some of the above interventions could help policyholders and also reduce more serious long-term claims. Making referrals to mental health services automatic following diagnosis of rare, severely life-limiting or terminal conditions may help stop the development of mental health comorbidity, or mental disorders and physical conditions occurring together. This would help patients cope better and provide a more holistic service as they come to terms with their changing mental health needs. The fragmentation of mental health services and the insurance needed to access them is also a barrier to people seeking help. Prior authorisation, although common for many conditions, is particularly difficult for mental health patients to obtain.44

43 The Brightly Project, see https://www.thebrightlyproject.com/
44 “Insurance Companies Set An Unreasonable Bar For Mental Health Coverage”, Huffington Post, 9 May 2018, https://www.huffpost.com/entry/opinion-barnett-mental-health-insurance_n_5a51d1b1e4b00a3224ee6d42
Diagnosis and treatment

**Early diagnosis of diabetes complications:** Diabetic retinopathy is a diabetes complication that causes vision to deteriorate. In 2018, the FDA approved AI software that screens patients for diabetic retinopathy. It correctly identified patients with “more than mild diabetic retinopathy” 87% of the time, and those who did not have it almost 90% of the time. It was the first time the FDA authorised a device that makes a screening decision without a qualified medical expert needing to be involved in the interpretation. A number of firms are also working on identifying patient sub-populations at high risk of developing diabetic nephropathy, which can cause kidney disease.

**Treating several mental health disorders:** In severe mental health disorders such as bipolar disorder, schizophrenia and psychosis, there have been key developments on the diagnosis and treatment front. The Wellcome Trust announced its Psychosis Flagship, one of five key areas the research charity will be focusing resources on over the next five years to find ways to better identify not only psychotic but also subpsychotic symptoms that may develop into full psychosis, and to improve treatment. There is evidence that digital interventions help deliver long-term savings for mental illness, although their wider adoption will also depend on the upfront costs of developing them.

At Massachusetts General Hospital, Dr Jordan Smoller is developing an algorithm that can be used as a clinical support tool, based on longitudinal eHR data sets. It is able to identify whether a patient is at an increased risk of suicide and help clinicians stage more proactive interventions. To arrive at a patient risk score, the algorithm studies 30,000 variables, including some that will be obvious to a clinician, such as mental health conditions or substance abuse, but also some that may seem less intuitive, such as certain infections or a history of specific orthopaedic fractures.

**Early stage cancer detection:** Cancer algorithms can now detect tumours more accurately than human pathologists, as shown by recent research on metastatic breast cancer published by Google’s Deep Mind division. Another study found that conventional screening approaches can miss signs of lung cancer in 20–30% of cases. Doctors looking at chest x-rays and magnetic resonance imaging (MRI) scans may struggle to detect small nodules hidden behind ribs or organs, but algorithms can run detailed searches for cancer patterns to reduce the likelihood of false negatives or undetected cancer. Machine learning can be used to expedite the process to decide where radiotherapy should be employed. Tech firms are already partnering with hospitals that submit cancer data.

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47 Wellcome Flagships will focus on five health innovation challenges, Wellcome Trust, 4 September 2018, https://wellcome.ac.uk/news/wellcome-flagships-will-focus-five-health-innovation-challenges


Recovery and reintegration

After active treatment, a plan can be developed to monitor for recurrence or spread and to schedule both follow-up and management of health problems. These services include routine examinations and/or tests. Reintegration is needed after intense treatment is completed. Examples of lifestyle support for mental health include access to childcare and eldercare support for people juggling family (children and/or ageing parents) and work demands. A recent study showed that fitness trackers prove helpful in monitoring cancer patients by providing ongoing, timely and objective data about their physical status during therapy.

At times, adherence to conventional rehabilitation programmes is low because patients lack motivation and experience frustration about their slow progress. Companies are seeking to fill the gap by positioning digital products as an engaging way for patients to meet therapy goals. Digital ecosystems can enable a community of disease survivors online to improve motivation levels and help with the social aspect to recovery. For example, a number of companies like Flint, Neofect and Cognivive are hoping to improve stroke rehabilitation through the use of technology – such as devices and games – as digital therapeutics in stroke recovery.

Given the increase in chronic illness expected over the next few decades, it is essential to find new ways to deliver cost-effective interventions. A recent study found that supervised in-home rehabilitation therapy delivered via telemedicine can be as effective as in-clinic rehabilitation programmes for stroke survivors. In another study, digital interventions improved patient recovery time, engagement and quality of life, as compared to conventional rehabilitation. Specifically, it was found that AI-powered digital physical therapy tools more effectively improved recovery among patients recuperating from knee surgery.

Summary

A digital ecosystem can facilitate data sharing, target key outcomes and bring digital health tools to ecosystem participants to support key phases in the healthcare value chain – 1) wellness, discovery, and prevention, 2) diagnosis and treatment, and 3) recovery and reintegration. Ecosystems can connect the ever-expanding array of wearables, eHR and other applications that currently reside in their own isolated silos. Many of these tools target niche areas or shortcomings in the current system but are not integrated with the broader healthcare infrastructure.

A trusted interoperable data exchange framework enabled by digital ecosystems will help insurers and healthcare providers securely access clinical and claims data and leverage predictive analytics – for example, to identify which policyholders and patients are more likely to develop diabetes or advanced cancer. High-quality interoperable data will make machine learning algorithms more accurate and enable proactive intervention, including to help identify members at risk of adverse events requiring hospitalisation.

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53 7 Technological Innovations for Those With Dementia, Alzheimers.net, 9 January 2019, https://www.alzheimers.net/8-22-14-technology-for-dementia/
Insurers can act as active ecosystem orchestrators, monetizing new technologies & services, and accessing new revenue pools.

Jonathan Anchen, Head SRI Research & Data Support, Swiss Re Institute
Contrasting perspectives on value within health ecosystems

The responsibility for improving healthcare outcomes is shared among multiple stakeholders. A recent survey showed that although hospitals and health systems (chosen by 95% of respondents) and clinicians (94%) top the list for responsibility, government (88%) and patients (83%) are fairly close behind.\(^7\) This suggests that healthcare is a collaborative enterprise, with no single participant/entity notably more responsible than others, including also for the aspect of lowering costs.

<table>
<thead>
<tr>
<th><strong>Table 3</strong></th>
<th><strong>Representation of value provided by digital ecosystems (selected stakeholders)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Challenges</strong></td>
<td><strong>Benefits</strong></td>
</tr>
<tr>
<td>Consumer</td>
<td>Inadequate access to diagnosis, therapy and care</td>
</tr>
<tr>
<td></td>
<td>High cost of healthcare and insurance</td>
</tr>
<tr>
<td>Healthcare Provider</td>
<td>High cost of testing and running trials</td>
</tr>
<tr>
<td></td>
<td>Lack of targeted solutions, eg. female care, rare diseases</td>
</tr>
<tr>
<td>Payer</td>
<td>Growing cost of healthcare</td>
</tr>
<tr>
<td></td>
<td>New risks, eg. overdiagnosis</td>
</tr>
<tr>
<td>Government/ regulator</td>
<td>Growing concerns about privacy and misuse of consumer data</td>
</tr>
<tr>
<td></td>
<td>Lack of trusted stakeholders to verify emerging digital health claims</td>
</tr>
<tr>
<td>Ecosystem Sponsor</td>
<td>Fragmented data</td>
</tr>
<tr>
<td></td>
<td>Lack of evidence-based standards and frameworks</td>
</tr>
</tbody>
</table>

Source: Swiss Re Institute, adapted from *Adopting AI in healthcare – Why change*, PwC, 2019

Consumer perspective on demand for integrated health

Informed by their experiences of other products and services, consumers approach healthcare expecting the same seamless, personal and unique feel. Empowered with choice and information, they are smarter and more self-directed than ever before. Consumers play a prominent role. And yet, they are not always best positioned to make decisions about costs because of the industry’s intransparent pricing and billing and complex reimbursement policies and procedures. Also, while more consumers take an active interest in their health than ever before, many have low health literacy, which significantly increases their odds of suffering an adverse health event or outcome.

Consumers’ willingness to share data with various stakeholders depends on the value being provided in exchange (see Figure 9). They are more willing to share data with physicians because of the higher value they perceive from the interactions. Many tech platforms rely on end-user licence agreements (EULAs) and privacy policies that govern rights to share user data. Although consumers are expected to read and understand these policies, most do not. One study showed that 97% of users agreed to privacy policies but spent only 70 seconds or so to skim them when their content would normally take about 30 minutes to read.58

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Healthcare providers’ perspective on supply of integrated healthcare

Healthcare providers connected to an integrated digital ecosystem would be able to view multiple vetted products, which should reduce the amount of time, effort, and expertise they invest in choosing digital tools, and moving to more modern tools as they become available. Participants would also become digitally interconnected, benefiting from lower technical barriers to data sharing. Moreover, digital ecosystems could be useful to providers in resource-constrained situations, such as rural providers who lack the initial capital and expertise to choose between technologies.

Consumers will soon demand more detailed privacy protections for connected technologies enabled by healthcare providers. In one controversial case, a device manufacturer shared patient compliance data from its devices with insurers, who then denied patient claims on the basis of supposed adherence gaps. Consumers will however value additional services such as access to their own data (see Figure 10 for a representation of services); in many countries, patients face long queues and extensive paperwork. Players like Ping An and Apple help customers access a holistic view of their data. Others enable transportation to hospitals or test centres, by organising and coordinating transport. For example, Uber Health is used by hospitals to pick up and drop customers at their homes – visits are booked through a simple phone call (no smartphone required).

Figure 10
Consumer services provided by Ping An’s digital health ecosystem

Source: Swiss Re Institute

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In some cases, the sponsor pays API connection fees to intermediaries in exchange for connection to affiliated hospitals. In other cases, the sponsor pays API connection fees.

Online pharmacy sales, advertisements and shopping cards.

Offline medical services, Hospitals can cooperate directly with the sponsor to link appointment systems.

Offline medical services, Ping An has a network of offline clinics.

Third types of advertisements are offered, namely, display, search and sponsored stories. Advertisers choose to pay primarily based on cost per thousand impressions, cost per click, or cost per day.

Enables payment transactions on the platform.

Cross-selling insurance: If the patient is a policyholder, priority access to inpatient arrangement services is also offered at some hospitals in the network.

Preliminary symptom collection, smart routing, consultation, recommendation via dedicated in-house medical teams, standardised consultation protocols, self-developed, scalable AI-Assistant.
Example of a diagnostic service: consultation and prescription in a digital health ecosystem

As part of its digital health ecosystem, Ping An has introduced a medical consultation and prescription service for customers. This service is valuable because getting an in-person appointment with a doctor can be challenging given the lack of quality primary care facilities, overcrowding in hospitals and long waiting times. Ping An’s platform offers consumers a menu of online and offline workarounds. As a first step, patients log into Ping An’s Good Doctor app and, after describing their symptoms via a dialog box, are directed to a recommended list of physicians on Ping An’s payroll (with names, qualifications, expertise, etc).

Online consultations with a listed physician are free for the first 15 minutes and can be extended for another 15 minutes on payment. Ping An’s AI diagnostic technology enables physicians to offer a range of services: (1) write an electronic prescription; (2) direct patients to get tested and upload results for follow-ups; and/or (3) refer patients to an offline primary care clinic (affiliated with Ping An) or a specialist in (usually) a state-run hospital.

Additional services and quality assurance

If referred to a hospital, patients can make an appointment on the Good Doctor app, which integrates online and offline services. The app recommends a set of hospitals based on users’ location and specific disease. Depending on the extent of system integration with hospitals, users are either limited to choosing available slots from a doctor’s online profile page, or they can speak with medical assistants at the hospital to complete the appointment process. Users then receive a ticket number from the system as proof of the appointment, and pay the registration fees at the hospital. For now, Ping An does not charge users for hospital appointment services.

To offer this comprehensive service, Ping An has integrated a range of participants (hospitals, third-party intermediaries, primary care clinics, insurers and advertisers; see Figure 10) into its ecosystem. At the end of the user experience, patients can provide feedback through a user-review system, creating incentives for medical teams to improve their quality of care.

How the service is monetised.

1. Patient fees: first-level online diagnosis is free; online triaging physicians have sufficient experience to handle small health issues, but patients can choose to pay more to speak with a more experienced doctor online.
2. Corporate fees: corporate subscription plans are available to provide employees with online consultations.
3. Online pharmacy sales, advertisements and shopping cards. According to 2017 data, two-thirds of Ping An customers who use family doctor services also use paid wellness services (weight loss, personal care and fitness).
4. Offline medical services: profit-sharing and commission agreements with the 63,000 primary care clinics on its platform.
5. Cross-selling insurance: policyholders get free access to 60 online consultations and three priority inpatient services if diagnosed with a critical illness.

63 In 2017, on average 65.5% of users who used family doctor services during a month also used wellness services. Ping An Healthcare and Technology, Initiate at Buy/1H: Game-changing Internet Healthcare Platform, Citi Research, 6 June 2018.
Payers’ perspective on supply of integrated healthcare

As the digital health industry matures, some new solutions will address specific technology challenges such as improved health risk identification and delivery of precision treatment. However, innovations like early cancer diagnosis via low-cost and DTC tests pose new threats. For example, minor changes like reimbursement of thyroid ultrasounds has led to massive overdiagnosis in South Korea and could change the calculation for an insurance portfolio.64

Overdiagnosis risk reflects scenarios driven by advances in diagnostic technology combined with changes in behavioural factors such as increased take-up rates for health screenings. For instance, liquid biopsies are a new molecular technology being explored for its use in helping to detect and treat cancer. While the new test could ultimately benefit cancer patients and improve survival outcomes, it also creates new risks and exposures for life and health insurers, particularly for critical-illness and cancer products.65 Over-prescription and increased use could also drive up healthcare costs.

However, there are benefits to payers as well in terms of reduced costs and opportunities for better customer engagement. Health insurer Oscar estimates that using telemedicine in lieu of in-person visits reduces healthcare spend by 75% on minor superficial injuries and on episodes of pink eye and asthma.66 Some companies are exploring housing and proximity to care. For example, asthmatics are particularly prone to hospitalisation if they live in a building with asbestos issues. Additionally, many appointments are missed because patients are unable to get to a hospital. Insurers are beginning to realize that they can save on their members’ total healthcare costs by targeting these issues proactively.67

Regulatory perspective

Regulators worry that time-to-market imperatives could induce digital health companies to skimp on the overall app development process without spending sufficient time on rigorous testing and obtaining adequate input from medical experts. A study published in the Lancet found that high false-negative rates reported for some apps could lead to false reassurance, delayed diagnosis and ultimately worse patient outcomes.68

The dilemma for insurance regulators is to protect consumers yet ensure fairness in risk pooling for insurers.
Ecosystem sponsor’s perspective

Ecosystem sponsors must manage multiple dimensions of complexity in disease management. A recent study of top-funded digital health companies found that few measured their impact in terms of key health metrics such as clinical outcomes, costs or access. Researchers have argued that digital tools should be held to the same standards as other health-care technologies, including drugs and medical devices, because they compete for the same scarce resources as non-digital interventions. In this context, the NHS in the UK in partnership with other institutions launched an Evidence Standards Framework for Digital Health Technologies. This framework provides standards for evidence of effectiveness and economic impact for digital health interventions.

Ecosystem openness and governance

How insurers play in ecosystems will depend on factors such as local circumstances and regulatory frameworks. Potentially, health ecosystems can be controlled, governed and managed through different parties that change the overall influence and role of the insurers. Who owns or controls critical points in the ecosystem can steer or impact other stakeholders.

Government steering: The role of the government is usually to define and steer policy but not necessarily to “control engagement”. Governments steer policy on matters such as who is going to own the data and what data are allowed to be shared as well as competition. Many governments also offer subsidies, which can shape patient and provider decisions and influence pricing. While the details vary by country, strong government support can nourish research and development (R&D) and information technology infrastructure and create a favourable climate for innovation that healthcare digital ecosystems can benefit from.

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70 M. McCartney, “Innovation without sufficient evidence is a disservice to all”, BMJ, 2017.
Figure 11
Ecosystem governance impacting L&H insurance role and influence (selected players)

Engagement controlled by
- **Government**
- **Ecosystem players**
- **Healthcare providers**
- **Insurers**

Health systems: towards an integrated and seamless patient experience
Contrasting perspectives on value within health ecosystems

Some ecosystems can be steered by the health tech players who design the interface.

At times, care providers design their own ecosystems and manage digital assets and interactions.

In some cases, insurers direct the ecosystem and steer the set of services available to members.

**Ecosystem player/sponsor steering:** Some ecosystems can be steered by the health tech players that designed the interface. Governments would continue to exert influence, but primarily at the local level. As ecosystem sponsors define how data are exchanged between parties, they define sector standards. Firms like Apple, Haven (an Amazon, Berkshire, JPMorgan healthcare venture) and Sharecare can take on such steering roles, which will involve working to change systems, technologies, contracts and policies, and helping providers, employers and health plans effectively scale health and wellness solutions across their entire populations.  

**Healthcare provider steering:** Healthcare providers can design their own ecosystem and manage all digital assets through it. For example, integrated managed care consortiums of for-profit and not-for-profit entities play a key role in some markets because of their joint role as payers and providers. Providers like Kaiser Permanente can influence and manage end customers, thus generating more loyalty by offering more services.

**Insurer steering:** One insurer can play different roles. For example, Ping An not only owns the ecosystem but also steers many of its activities. They understand the financial streams, provide personalised services to customers, manage who gets access and get insight from every interaction that happens. They have a holistic view extending beyond insurance. Over the past five years, Ping An has built its own cloud and created a set of software services to work with it, which it markets to thousands of smaller financial institutions, hospitals, and medical clients. This reflects the breadth of Ping An’s ambitions.

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73 Kaiser Permanente. See https://healthy.kaiserpermanente.org/

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Country</th>
<th>Type of ownership</th>
<th>Which parties are being connected</th>
<th>Primary steering</th>
<th>Overview</th>
<th>Key Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York healthcare ecosystem (NYeC)</td>
<td>US</td>
<td>Not for profit and government</td>
<td>New York eHealth Collaborative, New York State Department of Health</td>
<td></td>
<td>Coordinates creation of the Statewide Health Information Network of New York (SHIN-NY), a network to connect healthcare providers statewide</td>
<td>NYeC works to develop policies and standards, to assist healthcare providers in making the shift to electronic health records.</td>
</tr>
<tr>
<td>Estonian Connected Health Ecosystem</td>
<td>Estonia</td>
<td>Science and business campus</td>
<td>Various tech companies</td>
<td></td>
<td>Research and business campuses to bring scientists and entrepreneurs together and provide suitable conditions for realisation of breakthrough business ideas</td>
<td>Supports adoption of promising new technologies and accelerates the growth of technology-based companies.</td>
</tr>
<tr>
<td>DigitalHealth, London ecosystem</td>
<td>UK</td>
<td>Government and academic partners</td>
<td>MedCity and London’s three Academic Health Science Networks</td>
<td></td>
<td>Digital Health is a collaborative programme set up in response to the London Health commission’s recommendation to put London at the centre of the global revolution in digital health by creating a “digital health hub”: a marketplace where digital health solutions are traded.</td>
<td>Improve patient outcomes and experience by solving problems in care delivery using digital solutions. Generate economic growth by supporting innovators to develop and market digital health solutions. Contribute to a strong evidence base of the health and economic benefits of digital health.</td>
</tr>
<tr>
<td>Portuguese Ecosystem on Smart, Healthy and Age-Friendly Environments</td>
<td>Portugal</td>
<td>Private, not for profit</td>
<td>Cáritas Coimbra (Carina Dantas) and Coimbra Nursing School (João Apostolo)</td>
<td></td>
<td>Brings together a wide range of organisations committed to promoting a joint agenda for the creation of inclusive environments for all ages, with a particular emphasis on the areas of health, social services, ICT and infrastructure</td>
<td>Foster collaboration between research/academia, public authorities, business and civil society/citizens to address and find common solutions to national challenges in these focus areas</td>
</tr>
<tr>
<td>PingAn</td>
<td>China</td>
<td>Private; insurance/tech company</td>
<td>PingAn</td>
<td></td>
<td>Endeavours to become a world-leading personal financial service provider upholding the belief of “technology-driven financial services for a better life”, focusing on “big financial assets” and “big health care”</td>
<td>Boost efficiency, cut costs, improve experience, strengthen risk management</td>
</tr>
</tbody>
</table>

Source: Echalliance Ecosystem - https://echalliance.com/ecosystems/, Ping An, Sharecare, Kaiser Permanente, SMA, Clalit Health Services, Swiss Re Institute
## Table 4 (continued)

<table>
<thead>
<tr>
<th>Ecosystem</th>
<th>Country</th>
<th>Type of ownership</th>
<th>Which parties are being connected</th>
<th>Primary steering</th>
<th>Overview</th>
<th>Key Objectives</th>
</tr>
</thead>
<tbody>
<tr>
<td>ShareCare US Private</td>
<td>US</td>
<td>Private</td>
<td>Communities, healthcare experts, health organisations (content producers) selling solutions to employers, health plans, health systems, advertisers</td>
<td></td>
<td>Social content platform curates the collective knowledge of vetted medical experts “to help each person (…) build a longer, better life by enabling health transformation at the individual, organisational and community level”</td>
<td>Enable people to go from assessment to action, and connect to the personalised information, evidence-based programmes, benefits, community resources and health services they need to live their best lives</td>
</tr>
<tr>
<td>Kaiser Permanente</td>
<td>US</td>
<td>Consortium of for-profit and not-for-profit entities</td>
<td>Kaiser Foundation Health Plan, Hospitals and regional Permanente Medical Groups</td>
<td></td>
<td>Operates in eight states (Hawaii, Washington, Oregon, California, Colorado, Maryland, Virginia, Georgia) and the District of Columbia, and is the largest managed-care organisation in the US</td>
<td>Coordinate care seamlessly by making doctors, specialists, and health plans part of connected teams</td>
</tr>
<tr>
<td>Smart Health Assist (SHA)</td>
<td>Singapore</td>
<td>Government</td>
<td>Patients, healthcare providers, telehealth providers, hospitals</td>
<td></td>
<td>Explores the use of technology to support new models of care, in both home and community settings, with telehealth – long-distance delivery of clinical care via electronic communications – being one such key focus area</td>
<td>Provide comprehensive yet affordable medical treatment</td>
</tr>
<tr>
<td>Clalit Health Services</td>
<td>Israel</td>
<td>Government, not-for-profit entities</td>
<td>Patients, health plans (universal health cover), primary care, hospitals</td>
<td></td>
<td>Israel’s leading and largest integrated healthcare organisation (owns and operates primary care clinics, hospitals, acute care hospitals). Electronic health records (eHR), clinical and administrative data since 2000</td>
<td>Move from reactive, therapeutic care to proactive, preventive care. Replace a paternalistic paradigm with participatory and patient-centred care delivery</td>
</tr>
</tbody>
</table>

Source: Echalliance Ecosystem - https://echalliance.com/ecosystems/, Ping An, Sharecare, Kaiser Permanente, SMA, Clalit Health Services, Swiss Re Institute
Customer centric, integrated healthcare systems are the need of the hour, and many diverse set of players seek to capitalise on this need.

Aakash Kiran Raverkar, Research Analyst, Swiss Re Institute
Building blocks for digital health ecosystems

Key infrastructure

Evolution of mobile networks to 5G technology is expected to enhance and augment healthcare service delivery. In 5G, user devices will have multi-connectivity capabilities including WiFi and new radio frequencies for more flexible and reliable connections. This will allow wider adoption of healthcare services such as robotic surgery, real-time remote monitoring of health and smart medication. However, 5G systems also make greater use of virtualisation and cloud services and can pose security risks due to their many-sided attack surface. Accordingly, the imperative to safeguard patient health information has been identified as a significant barrier to 5G adoption in digital health ecosystems. To address these security challenges and meet regulatory requirements, new security mechanisms need to be developed for digital health ecosystems.

Standardisation will be a key building block to improve record systems and data sharing in the future. Sponsors of digital ecosystems would do well to leverage the work by independent not-for-profit organisations in Europe and other developed markets – such as Digital Health Europe, EuroRec and Fast Healthcare Interoperability Resources – that are promoting the use of interoperable applications and high-quality eHR systems. For example, EuroRec has experience, methodologies, tools and a criteria repository to support country and multi-national quality assessments and certifications of eHR systems.

Several consortia are developing tools for standardisation and their work can be leveraged.

Data, and “intelligence”

Standardisation and transferability of data is the key challenge because of the multiplicity of providers. Ecosystems add value by gathering data that reside in silos across healthcare and technology providers and making the data interoperable to provide better insights. Figure 12 shows a sequence of different stages in data collection, modelling and insight generation. Several functions and services such as monitoring and interventions can be enabled based on these modelling insights, and customers can choose the set of services that best deliver value.

All this is possible only if countries invest in the development of national health data assets. Over the last decade, most healthcare systems have made a good deal of progress in getting their eHR systems technically and operationally ready (see Figure 13). However, many countries report legal constraints that allow data sharing only for medical treatment purposes (i.e. direct patient care) and not for secondary purposes such as monitoring or research. Many legal frameworks protect patient privacy while still allowing data to be extracted for approved research purposes. Ecosystems may be able to play the role of gatekeeper to track who is granted access to the data and for what purposes.

Data from multiple providers via open Application Programming Interfaces (APIs) may be combined to enable different business models.

Countries need to invest in the development of national health data.

76 Security architecture for a 5G mHealth system, Global Health Innovation, May 2019, https://doi.org/10.15641/ghv/v2i1.765
Figure 12
How sensor and other data translate into insights for healthcare management

<table>
<thead>
<tr>
<th>Sensors/EHR/Genomics</th>
<th>Data collection</th>
<th>Modelling</th>
<th>Monitoring</th>
<th>Personalization</th>
<th>Intervention</th>
<th>Autonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensors built into wearables or implants enabling data collection for specific health-related parameters.</td>
<td>A variety of data sources being collected across a range of parameters by means of technology.</td>
<td>Analytics and data modelling enabling examination of health behaviour patterns to determine how health can be improved.</td>
<td>Monitoring of digital and externally enriched data to enable analysing and optimising user health behaviour.</td>
<td>Algorithm-assisted checks on health behaviour to enable personalising functionality based on the underlying health functions and models.</td>
<td>Using analytical tools and evidence-based algorithms to enable health interventions to further optimise user behaviour.</td>
<td>Linked digital health functions/health models communicating with, interacting with and regulating each other.</td>
</tr>
</tbody>
</table>

Source: Swiss Re Institute, adapted from How Smart, Connected Products Are Transforming Competition. Harvard Business Review

Figure 13
Data governance and technical/operational readiness to develop national information from EHRs

Source: New Health Technologies: Managing Access, Value and Sustainability, OECD, 15 January 2017
Domain expertise

Ecosystems need to bring in technologies that are adjacent to their existing core competencies. Entrepreneurs should focus on must-have products (which deliver benefits the target market is willing to pay for) rather than nice-to-have products (which do not). Research has shown how even basic digital tools, such as Skype for remote consultations, can have low user adoption rates when tested in hospitals, despite being accepted in proof-of-concept studies. More complex digital tools may be unable to deal with real-world complexity and be poorly integrated. Also, tools that are meant to optimise data and efficiency often result in increased workloads for clinicians and staff.

Digital health startups are increasingly establishing themselves to operate as B2B companies, which should help them plug into digital ecosystems. Entrepreneurs in digital health have found that B2B is easier to scale. A recent survey showed that 34% of digital health firms started with a B2C business model, but most (61%) shifted their business model to either business-to-business-to-consumer (B2B2C, 45%) or B2B (16%). Only 14% of companies still operated a B2C business model.

Some startups like San Francisco-based Driver shut down after making large bets on B2C. Driver had developed an app to match clinical trials to cancer patients who could not access experimental trials. The startup marketed directly to consumers rather than prioritising hospitals and other businesses.

Regulation

Regulation will be a major factor determining the health ecosystem landscape. Regulators could enforce new privacy constraints to build customers’ trust on how their data are used to provide a continuous and personalised experience. Regulatory guidelines should take into account the breadth and risks of likely use cases. For instance, technology should require a different level of evidence for programmes recommending a diet for people at risk of developing high blood pressure than for programmes recommending treatment options for patients in intensive care. AI-specific guidelines are not yet detailed enough to define which level of evidence is needed in each classification.

In addition, the dilemma for governments and regulators is how to play a balancing act to protect consumers. On the one hand, consumers need to be nudged (and where necessary, forced) to adopt better health behaviours. On the other hand, their purchasing power and freedom need protecting, too. For example, society carries the growing cost of managing non-communicable diseases, but society cannot reverse the trend without individuals better managing their health. How do governments empower (or motivate, or get) individuals to take ownership again of managing their own health? What combination of “carrot and stick” may be most effective in achieving better outcomes for both individuals and society? So-called sin taxes such as a tax on added sugar in food and drink have already been introduced in dozens of countries around the globe.

Some studies are sceptical about adoption of new digital tools, even those that show promise in rigorously designed, randomised controlled trials (RCTs).


Regulatory architecture will play an important role in shaping the adoption of new health models.

The dilemma for governments is having to uphold consumer rights while protecting the same consumers from themselves and their actions.

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81 ‘We ran out of money’: High-profile startup seeking to connect patients with clinical trials shuts down, STAT, 12 November 2018, https://www.statnews.com/2018/11/12/driver-startup-shuts-down/
Roles for public-private partnerships and global insurers

In developing countries, access to healthcare and the quality of the health system are limited by a dearth of private and public financial resources. According to a WHO and World Bank report, 400 million people lack access to essential health services, mostly in Africa and South Asia. Poor access and quality, and low levels of digitisation have negative implications for key health outcomes. Wider collaboration between digital health stakeholders is needed as individual entities do not own the full set of resources and capabilities required. In Africa, developing Asia and Latin America, public-private partnerships will be required to move from a disjointed approach to a well-rounded digital health model.

Healthcare is a very local business because of regulatory, reimbursement and population issues. Developing solutions that can scale globally is a challenge which the big tech companies are trying to tackle, such as Babylon, which offers a layered approach to online and offline medical consultation. Moreover, reimbursement can be a challenge if payers are local. This is an area where global insurers may have a role to play.

84 Scaling digital health in developing markets, GSMA, June 2017, https://www.gsmaintelligence.com/research/?file=c581aa43dbdb7d7d236bb937698c2d8f6d&download
85 Babylon Health, https://www.babylonhealth.com/about
Health ecosystems in their mature state would help identify protection gaps (new risk pools) and ways to insure them.

Jonathan Anchen, Head SRI Research & Data Support, Swiss Re Institute
Implications for re/insurers

The implications of the advance of digital health ecosystems for insurance will depend on how the sector’s risk-absorbing capabilities and regulatory frameworks evolve. It could be that digital ecosystems foster further incremental changes similar to past technological developments yet broaden the scope and affordability of insurance to more consumers and households. Alternatively, ecosystems could prove more disruptive if some of the typical hurdles to innovation can be overcome, especially in relation to the capture and analysis of information to assess risk more accurately. New risk categories could emerge as the overall complexity of ecosystems rises, giving rise to new exposures and associated insurance opportunities (see Figure 14).

Emerging risks

New protection gaps: As users have more digital health interactions, there could be unintended side effects. For example, digital device overload has been linked to obesity risk. Research from Rice University in the US suggests that individuals switching between digital devices may be more prone to weight gain because they become more vulnerable to food temptations and lack of self-control. Passive consumption of social media – also known as lurking – is correlated with depression and poorer mental health. In another example, results of an experimental study published in the Journal of Social and Clinical Psychology shows a causal link between time spent on these social media and increased depression and loneliness.

Figure 14

Examples of emerging risk in health ecosystems

1. New protection gaps: eg. private individuals engaging with social media and developing mental health issues, etc
2. Cyber risk: eg. analog systems and processes being converted to digital, resulting in more businesses being exposed to breaches and hacks
3. IoT risk: eg. connected devices collecting personal information and/or interacting with critical infrastructure, thereby exposing both to risk
4. Counterparty risks: eg. anonymous entities interacting with each other due to increasing digital integration, thereby exposing the ecosystem to weak-link risk
6. System failures: eg. fast pace of technology change rendering systems obsolete, resulting in failures


87 R B Lopez, T F Heatherton, et al. Media multitasking is associated with higher risk for obesity and increased responsiveness to rewarding food stimuli, Brain Imaging and Behavior, 2019.
Implications for re/insurers

Healthcare is particularly exposed to cyber risk concerns.

Cyber risks: Healthcare is the only industry globally for which the biggest threat to data breaches comes from internal sources.\(^9\) In 2017, 46% of breaches were due to employee behaviour (such as clicking on infected links in e-mails, being negligent, or abusing access to data).\(^9\) Recent research from Michigan State and Johns Hopkins Universities found that more than half of breaches of personal health data were the result of internal issues with medical providers, not activities of hackers or external parties. Of the external breaches, theft accounted for 33% of cases, and hacking for just 12%.\(^1\)

IoT increases the range of vulnerabilities.

IoT risks: A recent study published in the American Medical Association’s JAMA Network Open journal suggests that given the rapid progress in artificial intelligence, current laws and regulations fall short in keeping people’s health status private. In this particular study, researchers were able to use AI to identify and track specific individuals by learning daily behavioural patterns from devices like activity trackers, smart watches and phones, and linking these data to demographic data.\(^2\)

The growing numbers of participants have security implications for consumers in an ecosystem.

Counterparty risks: As digital integration grows, entities interacting with each other could expose an ecosystem to weak-link risk. Already, most health apps fail to provide transparency around data sharing practices. Research published in the BMJ found that most health apps shared sensitive health data with third parties, and that a small number of commercial firms even possess the ability to aggregate and potentially re-identify anonymous user data.\(^3\)

Risks go beyond corrupted data and include loss from damage to reputation and business interruption.

Business interruption: Worries about the costs of a cyber attack or security breach are no longer confined to dealing with corrupted or lost data. There is also growing corporate concern about possible damage to reputation, and about the costs of business interruption due to breakdown in essential infrastructure, for example, operational issues at a key supplier.

Failures of outdated systems and lapses in cyber hygiene can pose risks.

System failures: The rapid pace of technology changes render systems obsolete. An obsolete IT system at hospitals could put health ecosystems at risk. Similarly, devices no longer used but still online (such as legacy CCTV cameras) present opportunities for hackers to enter a network. Some ecosystem partners may access the internet using outdated tools like older versions of web browsers, which may be vulnerable to new spyware, malware and viruses.

Despite the rapid growth of ecosystem risks, the role of insurers is still small.

In this context of growing hazards, widening sources of vulnerability and heightened regulatory pressure, we expect that demand for insurance protection within digital ecosystems will increase. To broaden and deepen the market, close cooperation between ecosystems sponsors and insurers will be necessary.

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\(^2\) L Na, C Yang, et al. Feasibility of Reidentifying Individuals in Large National Physical Activity Data Sets From Which Protected Health Information Has Been Removed With Use of Machine Learning. JAMA Network Open, 2018

Ecosystems are more than just an engagement tool for insurers

Digital ecosystems open up rich new data streams between customers and their insurers. But the benefits of such ecosystems go beyond data collection. They give insurers the power to understand risk more dynamically and engage with customers based on actual risk and health needs, thereby transforming engagement data into biometric risk data. In Figure 15 we see how the three different stages of disease have different risk exposures; the risk increases at each stage. The question is whether the way insurers assess and manage risk is appropriate today, given the influence individuals can have through their diet and lifestyle. The goal of an insurer should be to engage with policyholders early enough to improve quality of life and manage overall costs.

Some insurers have started to explore opportunities to engage with consumers to incentivise them to improve their health. However, sizable challenges remain. Individuals with noncommunicable diseases undergo a prolonged and tedious underwriting process. The consumer currently derives little value from an insurer’s risk assessment, and discounts and rewards may also not be enough to incentivise engagement. Insurers must evolve and offer more personalised and digital insurance experiences that are relevant to customer lifestyle and health ambitions and incorporate a fair value exchange.

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The aim of the health ecosystem is to help generate modelling insights to support these personalised experiences while maximising customer equity and customer lifetime value (CLTV). At the initial stage (labelled “potential” in Figure 16) the goal is to attract healthier people, or even customers with controlled risk exposures that could be underwritten, such as well-managed diabetes. Some providers have begun empowering consumers in innovative ways. For example, Health IQ handles the initial customer interaction and screening on behalf of insurers in a very user-friendly, engaging manner. It quizzes individuals to determine whether they live healthy lifestyles, and then partners with insurers to offer discounted life insurance to selected people.95

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95 Health IQ: Insurance for the Health Conscious, see https://www.healthiq.com/
At the second stage (wellness), insurers try to keep profitable customers loyal. This can only be accomplished through engagement, which is why the engagement platforms are so important — the customers share their personal data but also receive value. Some insurers are now selling life insurance in combination with wearables. By interacting with their customers from an early stage, their customers benefit from better health while the insurers themselves enjoy lower retention costs, greater customer loyalty, increased differentiation and access to valuable data. For example, Discovery, the pioneer of the well-known Vitality wellness insurance programme, has become a textbook case of innovation in the industry. Its business model extends beyond that of a mere provider of traditional insurance, offering a one-stop shop for wellness care.

Unfortunately, many consumers may enter the third stage (prevention) where they develop early indications that their health might worsen in the future. The challenge for insurers is to decide how to encourage those customers to behave in a certain way. The fast-growing discipline of behavioural economics indicates that more effective interventions can be deployed to improve lifestyle choices to prevent or reduce the risk of lifestyle diseases. Trusted relationships are critical, and behavioural economics play a fundamental role in nudging people to adopt healthier habits.

The last stage (disease) deals with consumers who are already very ill. Insurers can use ecosystems to ensure that treatment paths for patient are efficient and co-ordinated. As patients move across many providers, costs increase and information is lost. There is a need for a clear and dedicated treatment path, and for advice on collaborating with specific partners to ensure that the treatment is effective. These choices have some implications for insurers’ value proposition to their customers. For example, should insurers prescribe which doctors their customers should see, or are customers free to see a doctor of their choice? The role of the insurer might change — how does the insurer add value for customers but also reduce costs in an efficient way, by not just paying claims but also intervening in and steering patient journeys?

This may lead to a new role for insurers, one that extends their value proposition to include disease management (see Figure 17). In this role, real-time data from consumers are collected via smart interfaces and aggregated to identify population health patterns. These modelling insights are then used in combination with evidence-based results from medical trials to generate insights within the ecosystem. The insights can be fed back to the models to create a virtuous learning cycle.

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96 Discovery, https://www.discovery.co.za/portal/individual/vitality-home
Implications for re/insurers

Impact on the insurance business model and value chain

**Product composition**

Insurers may need to consider developing personalised aspects to their products, meaning that as risk exposures change, products should be structured to reflect dynamic changes. The process would likely depend on the local regulations in each country because the core product may also have to change. In addition, there are operational constraints. For example, most dynamic pricing mechanisms operate on an annual basis, which may be too long a time interval and may not be compelling as an effective source of real-time feedback and incentive for policyholders. Consumers may be more attracted to products where premiums can move up and down more frequently based on primary modifiable risks such as blood sugar levels (HbA1c), blood pressure, cholesterol or body mass index (BMI).

Another area where insurance products need to evolve is the integration of care with the insurance product. Here, insurers could seek to guide or even require patients to follow best care guidelines agreed between the insurer and healthcare providers. Firms like Kaiser Permanente and public health providers adhere to this integrated model combining care provision and payment. To be sure, designing products with disease management services should also involve building in behavioural incentives and motivation. Successful insurers would tend to attract those lives most motivated to control diseases and most likely to have good outcomes.
With access to this information, insurers can generate insights in several areas (see Figure 18), such as how the patient is feeling or who the stakeholders are. Insurers can then combine such customer and other behavioural insights with insurance outcomes, claims handling and loyalty data. This is much more valuable than the current situation where the only source of data that insurers have on policyholders after underwriting is claim outcomes. Matching the breadth of patient and provider behaviours with proprietary information available to the insurer can assist in generating insights that help influence policyholders and model risk and price better.

Intelligent marketing and distribution

Analytics could identify those customers most likely to purchase products based on different risk sub-segments. Life stages and other milestones can act as triggers for providing offers using data captured from the platform and device ecosystem, where the underlying protection need has changed because of personal or family situations. Distribution may have to change with a greater focus on B2B models. Coverage may be incorporated into other products and/or services, possibly distributed via new channels.

These innovations could affect the number of policies sold through traditional agents and direct channels. Insurers will need to identify the capabilities required to deliver their services and determine whether ecosystem interactions are the best way to gain these new capabilities. There are a number of startups working in this space and allowing insurers to apply technology in areas like artificial intelligence and digital marketing to free up insurance agents’ time.98


All this information can be shared and matched with insurance outcomes to model risk and price better.
Implications for re/insurers

Smart underwriting and dynamic pricing
Insurers need to embrace the dynamic nature of life and health risks. It is behaviours that modify the risk, among them dietary habits, physical activity, tobacco use, alcohol use, sleep quality and stress levels. Insurers can incorporate new risk factors to measure behaviours that drive material risk outcomes (such as BMI, versus exercise and diet), and integrate an interactive service model into continuing risk assessments. However, insurers are faced with the key question of how to guide and support consumers in making permanent shifts to a healthier lifestyle. In addition the risk of anti-selection needs to be carefully managed.

Dynamic underwriting is one way of motivating people to stay healthy. It is the opposite of “once and done underwriting”, which has been the industry standard. Dynamic underwriting refocuses risk assessment to help individuals manage their health and prevent future health problems, all the while keeping the focus on improving risk before increasing the price. Pricing is dynamic based on objective health statistics, and people are rewarded for taking action to improve their health. This could result in positive selection: those with healthy behaviours are more likely to buy insurance.99

Predictive claims and prevention
Live data streams allow ongoing monitoring of claim risk, providing early warning signals of impending illnesses. This allows insurers to manage and prevent diseases by providing incentives to take appropriate action. With portfolios of different diseases, the key question for insurers is how to manage costs – if costs are growing, premiums may be inadequate. With proper disease-based risk steering in a health ecosystem, insurers could identify patients that cost above the average for a given disease type. (See Figure 19 for a comparison of how costs differ for morbidity groups with and without risk steering.) Better outcomes are possible because an ecosystem would provide access to granular information on multiple factors such as the disease development path, the cost of each disease, the parties involved and transparency on the clinical outcomes.

As more government-led ecosystems collect and digitise data on population health, insurers may be able to use these data to benchmark their own claims and disease costs to assess if their portfolios are at greater risk than the population health benchmark. This will help insurers understand the behaviours of all stakeholders and also intervene so that risk behaviours can be steered in the right way. However, this is not an easy task as it forces insurers to expand beyond their traditional role within healthcare.

With deeper integration into ecosystems, insurers may need to reinvent themselves and focus on preventing negative events and on improving quality of life for clients through advice. To do this, insurers may need to work with tech providers and business partners, in close collaboration requiring rigorous process management. In some cases, insurers could even go a step further and develop (make or buy) new proprietary services within their own business model. This is why we may see more vertical integration with tech and healthcare providers in specific areas. Smaller insurers may benefit from scalability if they join forces to manage these services. Key conditions that could improve based on behavioural change would include pre-diabetes and type 2 diabetes, heart disease and stroke, as well as smoking-related lung cancer. Insurers can offer tools that support healthy behaviours, offer personalised nudges to encourage change, and send risk alerts when health or behaviour shifts negatively. This calls for closer interaction with clients and more touch points, a challenge for some insurers.
Implications for re/insurers

Adapting the re/insurers business model

Insurers who possess only limited knowledge of the end consumer and typically sell a standard set of offerings through another company may be able to transform from suppliers into modular producers (see Figure 20). Modular producers can offer white-labelled products or niche underwriting capabilities to third-party health ecosystems. Such producers would need to offer plug-and-play solutions, constantly innovate products, and rapidly adapt to newer ecosystems as they emerge. The decision to act as white-label providers depends on local market circumstances. Most health insurers today follow an omnichannel approach and are well established with strong local brands. They do not yet need to sell products as white-labelled offerings. However, as ecosystems grow more influential and play a bigger role in consumers’ lives – especially in healthcare – insurer brands may not be strong enough or inspire sufficient trust. At that stage, some may be forced to offer white-labelled solutions.

Insurers who “own” (that is, control every aspect of) their customer relationships and currently operate as omni-channel businesses with an integrated value chain could go a step further. They could design their business as ecosystem bundlers, with modular and flexible product/service aggregation capabilities (see the middle panel in Figure 20). Insurance would remain the core product, but insurers could create relationships with other suppliers who offer complementary health services, represented by the red lines in the middle panel of Figure 20.
More aggressive insurers could aspire to be ecosystem owners — in other words, sponsors who provide a branded health platform and leverage their customer knowledge and data to match customer needs with third-party providers. They would act as active ecosystem orchestrators, monetising new technologies and services, and accessing new revenue pools through proactive interaction based on a continuous flow of personal and behavioural data.

Where and how to play: a strategic decision for re/insurers

Insurance involvement in digital health ecosystems could take a number of forms. Insurers testing the waters could begin with early-stage experiments and, once they see results, progress to more advanced roles in the nascent and formative stages (see Figure 21).

**Early stage:** At this stage insurers have loose ties or engagement with customers and experiment with simple loyalty pilots. These pilots digitally link the insurers with end customers to target generic outcomes — for example, to support healthy behaviours and wellness. At this stage they are not disease specific. The goal is to develop trust through gradual introduction of new services and to get customers comfortable with the idea of exchanging data with their insurer.

**Nascent stage:** Here the insurers start taking gradual steps to target outcomes for specific diseases, such as reducing HbA1c for type 2 diabetics or lowering cardiac risk markers. The first disease-specific services and pilots are introduced, for diabetes and depression, for example. The insurers may start these as standalone pilots, meaning that the disease programmes are not integrated — although they could be eventually, if successful. Any existing engagement or loyalty schemes will become more elaborate and to some extent linked directly with these newly introduced disease programmes. Healthcare providers have to be brought on board, but the insurer plays the role of a control centre. Eventually, data and insights will need to be shared with selected healthcare providers that are part of the disease management programme.

**Formative stage:** At this stage standards are introduced. The majority of engagement and disease programmes begin to be formalised, managed through standardisation of data and interfaces. For example, all programmes focused on metabolic syndrome are combined into a platform where risks can be managed simultaneously in a standardised way. Standalone disease programmes are aligned with such standards so that data and insights can be exchanged among different parties within the health ecosystem.

**Mature stage:** Health ecosystems are established through data and insights market standards that can be shared among all players within the ecosystem. As the insurers maintain and govern critical control of the ecosystem, they gain more power to influence, collaborate and partner with their customers, patients and selected healthcare providers.
Figure 21
Example evolution from an insurance perspective

Early stage

Nascent stage

Formative stage

Mature stage

Source: Swiss Re Institute.
Highly digitally integrated health ecosystems will allow better outcomes, and higher quality for lower costs.

Evangelos Avramakis, Head Digital Ecosystems R&D
Roles that re/insurers can play in an ecosystem

Financial services ecosystem play

A re/insurer health ecosystem platform allows participants such as banks, service providers, healthcare providers and others to access bespoke white-labelled insurance solutions (see Figure 22). These participants would manage the sale, marketing and distribution of insurance covers while re/insurers, as modular producers, take care of policy administration, underwriting and claims services. In some cases, the partners could jointly design products and pricing together with the re/insurers. The more open a re/insurer’s platform in terms of application programming interfaces (APIs), the better it can plug into partner apps or websites. In addition to white-labelled insurance solutions, re/insurers may also aggregate a variety of health-related financial services offerings from other players into the platform, thereby acting as a modular bundler within the financial services ecosystem.

Functional ecosystem play

Alternatively, re/insurers could engage in functional ecosystems that focus on health services. Discounts and rewards are only one step in the journey to break down barriers to sales and promote engagement. The end vision is to achieve true engagement in health ecosystems and offer products that meet customers’ expectations. Re/insurers should become part of health ecosystems where the focus is on measurable health outcomes, not actions.

Holistic ecosystem play

Insurers able to aggregate information from multiple functions and develop a deep and well-rounded understanding about how consumers and corporations behave would be able to consider a holistic industry ecosystem role. Holistic risk insight would be a key prerequisite, whereby customer behaviour is deeply understood and products/services are tailored accordingly. This would be the hardest space to play in because re/insurers would have to operate in ecosystems that are almost purely digital, driven by high-frequency interactions and transactions.
Technology has had an impact on customer expectations - individuals are now used to on-demand, digital experiences. Services enabled by digital ecosystems could become ubiquitous for a variety of both medical conditions and wellness goals. They offer many advantages, including keeping patients closely involved in monitoring their own care, sending early warning signals about impending illness, providing clear recommendations on optimal treatment plans, and giving access to platforms for fitness competitions, support networks and knowledge exchange.

Embracing the opportunities presented by digital health ecosystems will ensure that insurers are positioned intelligently to respond to future competitors. At its heart, insurance has always been a data-intensive industry with a unique ability to generate sustainable risk pricing based on actuarial methods and accumulation of risk data. However, with health moving to a highly networked, real-time and dynamically priced environment, insurers will be challenged to manage the overwhelming flows of data. They will need to apply behavioural science, and supplement traditional customer research methods to identify context-specific drivers of customers’ insurance-related behaviour.

There are, however, downsides to such innovation. There has been an explosion of apps around wellness and health that have only a tangential relationship to the science they claim validates their service. Moreover, in many countries the price of many devices and data plans, as well as cost and availability of bandwidth makes these – and any services designed for them – inaccessible for many home users, and there are problems with integrating operating systems. More complex digital tools may be unable to deal with real-world complexity and be poorly integrated. Regulatory requirements, particularly in the areas of privacy and competition will need to be addressed.

Successful digital health ecosystems will be user centred and highly integrated, taking into account user needs and priorities. Customers will increasingly demand the same experience online from their insurers as they have interacting with other industries. Insurers will need to redefine their product offerings so that risk cover becomes part of a larger package. Within this context, insurers face a fundamental decision: should they position themselves at the customer interface and actively design platforms, or should they focus on being product providers?