The Pac Man Principle in the Healthcare Market

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Abstract

Google, Amazon and Apple have a billion-strong market targeted: the healthcare market. Fitness Apps, assistance systems, wearables, and activity tracker, which measure the number of steps or running activities, are booming. The main impetus for the proliferation of new digital services is not from doctors, hospitals, health insurance companies, or politics, but by consumers and patients.

Additionally, devices that not only help us with our fitness but can monitor and manage disease and its treatment like ingestibles and even implantables are right around the corner.

Ageing society, rising health consciousness, more personal responsibility - these are the key drivers behind the rapid spread of small, digital helpers. And not to forget: the devices are ease of use and in many cases apps are offered for free.

Like the Pac Man game in the 1980s, the apps and digital helpers walk through the healthcare market by eating outdated, time wasting less customer-oriented processes – and there is food plentiful for years to come.

In the first step, the paper examines - based on analyzing general and health-specific trend - the challenges in the healthcare market. In the second step, it shows various examples how digital transformation changes the healthcare market, especially at the interaction between consumer and the different actors in the healthcare system. In the third step, key learnings are explored and suggestions are made regarding healthcare providers.

Keywords: Digital Transformation, Pharma, Healthcare, e-Health, Healthcare Service

1.0 Trends and Resulting Challenges in Healthcare Market

Unlike other industries, the healthcare market is characterized by a variety of stakeholders. They all are facing general and specific healthcare trends but the challenges are different (Figure 1). In the following sections, the big challenges in healthcare are explained.

1.1 Addressing the Needs of a Growing, Connected, Aging World Population

Providing a sustainable healthcare is getting more and more challenging due to population growth, ageing society, and urbanization: The world population is projected to increase by more than one billion people within the next 15 years, reaching 8.5 billion in 2030, and to increase further to 9.7 billion in 2050 and 11.2 billion by 2100 (United Nations, 2015). Especially countries in the Western world have to deal with a population which is ageing more and more. In a few years, for the first time in history, people aged 60 years and older will outnumber children younger than 5 years. The UN expects by 2100 almost one billion people aged 80 or over (United Nations, 2015). In Japan, now more diapers are sold for adults as for children. But this is not just that there are more elderly people but also due to a more active leisure behavior which raises the need for incontinence diaper (Baltzer, 2016). More challenging ageing society has led to an increase in lifestyle related diseases such as diabetes, cancers, and heart disease. This has a strong impact on rising health costs reaching a level which make the current system almost unsustainable. Urbanization leads on one side to a more efficient healthcare supply in the cities, but on the other side, more and more supplier of healthcare in the country are leaving as well which cuts offs the access to medical service for the remaining population.

In many countries, digitization initiatives have been launched in the healthcare market in recent decades; often the full potential is not recognized or utilized. For example, an electronic health card was introduced in Germany. Mainly privacy concerns on the part of insurers and the doctors are alleged, so the card can only be used for identification. Two of the main targets - better healthcare and cost reduction - were not achieved (Baltzer, 2015).

The healthcare market in Europe is a trillion euro industry (OECD, 2015) in which more than 90% of the expenditures are being spent on treatment rather than prevention (Vyganix, 2016). More and more people are health-conscious and begin to take care of their own health. They are already comfortable using apps to track their fitness level and take more control of their personal health. One of the main drivers for change in any given market is the level of customer dissatisfaction with the existing situation or service (Muldowney, 2015). Long wait times at the doctor, having to arrange for a personal consultation weeks and months ahead, travel time, monthly health insurance fees are cost and time expensive. Instant or ad hoc availability of a doctor when needed is rarely possible in the current structure of our health system.

Smartphones and Internet access at any time - regardless of where people are - lead to a connected world and will shake up the healthcare market dramatically. People are busy these days and time is a precious good. As a result, consumers are constantly connecting via smartphones. Communication with a doctor however still isn´t easy. The more channels and touchpoints of communication between a patient and a doctor there are, the easier it is for patients to use their preferred method to keep in touch. Apps, services and the omnichannel capability of the smartphone are bridging the gap by allowing for contact by phone, email, text, chat, and even social media from a single system - the patient´s smartphone. Another

convenience factor is that apps allow data to be documented for later review. The ability to automate appointment reminders is also a convenience for both the health provider and the patient.

Figure 1: Trends and stakeholders in the healthcare market
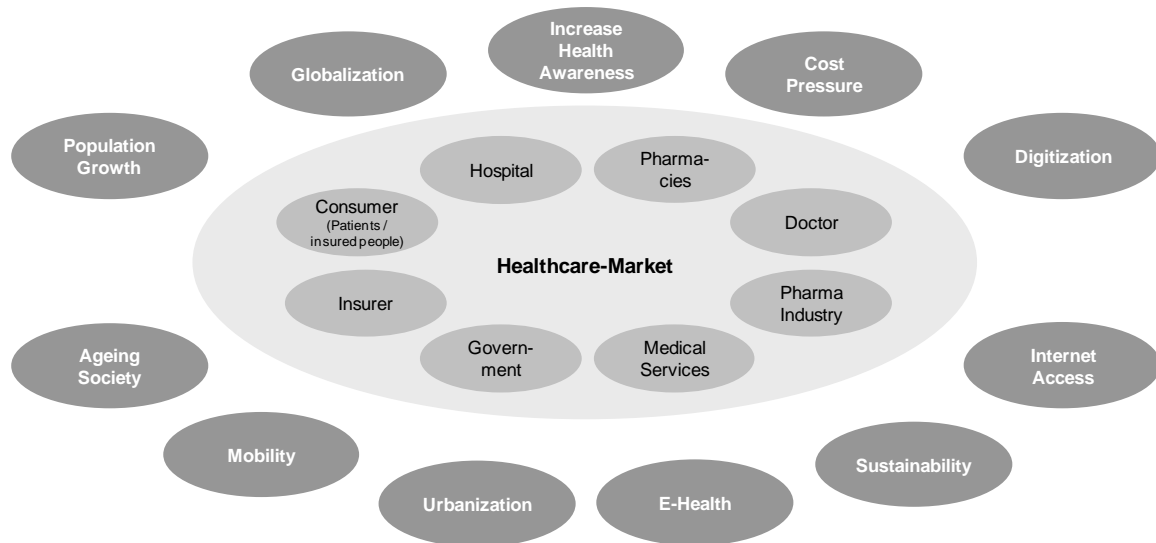
However, communication with the doctors is not the only thing getting more convenient. Pharma companies with strong brands but traditionally limited contact with the patient as a user of their product, now in the era of perpetual Internet access via smartphones and the increased health awareness, see this situation as completely changed. It is a big chance for pharma companies to get in touch with the patient through providing medical information or service apps related to the specific illness.

1.2 Patients: The Main Driver for Smart Services in the Healthcare Market

The main characteristics of this connected healthcare market – an e-Health market - is its potential to be a catalyst of change and its ability to shift the power from healthcare providers, health insurance companies, clinics, and doctors to the patients. e-Health will democratize information understanding and access to health information and service. e-Health will extend the traditional healthcare model with patient-driven services that extend and/or replace existing services and empower patients. Furthermore, e-Health smart services will provide for an increased level of information. The flow of information between all healthcare stakeholders e.g. patients, doctors, health insurance companies, care providers – is currently been interrupted due to incompatible and disparate systems, non-existing interfaces between systems, a mixture of analog and digital processes and protectionism behavior. Smart services will support the partnering and collaboration between patients, healthcare professionals, care providers, and insurance companies by speeding up and facilitating the information flow process. An increasing amount of patient data will be generated by the patient himself/herself on his/her smartphone; thus putting the patient in the driver seat for his/her own data. A paradigm shift, which along with new services and apps accessible through the smartphone, will end up in a new role allocation between patients and doctors and clinics and care providers.

1.3 Apple and Google Will Fire Up the e-Health Market

This dynamic development is being accelerated by the e-Health-market entry of companies such as Apple or Google. DeepMind, a Google owned company located in London, is developing a software in partnership with specific British hospitals to alert staff to patients at risk of deterioration and death through kidney failure. DeepMind, famous for its innovative use of artificial intelligence, is being provided with data of up to 1.6 million patients from three hospitals in Great Britain (Hodson, 2016). Google´s strength in data analysis gives them a strong competitive position in the healthcare market - better diagnosis and improved understanding of disease at population level.

Apple's CareKit is an open-source software development framework for medical-care apps. Apple´s CareKit is designed to help app developers build software focused on medical care (Apple Inc., 2016). Based on this framework new software can be expected for the iPhone and Apple Watch that enables patients to monitor ongoing medical conditions, track medicine intake, and exercise and share the data with their doctors.

2.0 e-Health - The Disruptive Power of Apps and New Services

The following examples show the disruptive power of apps and new services for the traditional healthcare market demonstrating an unprecedented dynamic. The examples are only a small selection of the ever-growing range of e-healthcare solutions but demonstrate the general principles of how disruptive technologies will change the healthcare market.

2.1 Blood Diagnostic Test

Accel Diagnostics (http://www.acceldx.com) offers pScreen™, an easy to use, convenient blood diagnostic test - a lab test at the patients' fingertips. The system itself is small as a credit card and allows anyone to perform a medical diagnostics test anytime, anywhere. The test requires only a tiny amount of sample. According to Accel Diagnostics, two drops are more than enough. The app stores and shares test results with the patient's doctor. No visits are necessary, and time to result is dramatically reduced. Apart from cost savings, pScreen™ shows the general benefits of smart digital e-Health services residing on the patient´s smartphone: reduced waiting times, anytime-anywhere execution of the test, patient's control over data, and access to professional advice from the connected doctor.
Even ingestible like nano-sensors, which can travel the bloodstream, record blood data, and send messages to a smartphone, are under development (Aspler, 2014).

2.2 Monitoring the Heart's Health

Kardia from AliveCor (https://www.alivecor.com/) allows patients to quickly access, track, and analyze their heart's health. The system is following the same principles as the abovementioned pScreen™ app. Tests can be performed by the patient himself/herself; results will be shared with the doctor. This provides for a proactive and professional care for the patient´s heart. Data can be captured anytime anywhere at the patients convenience and the doctor will be able to diagnose and develop individual treatment plans. Kardia Mobile from AliveCor is smaller than a credit card and connects to most smartphones. In less than a minute, the system records a medical-grade EKG, which then can be relayed to the doctor for analysis and diagnosis.

2.3 Monitoring the Medication Plan

Care4Today (https://www.care4today.com/) is built on the power of mobile technology to help patients manage their medication. The medication reminder function contains the patient-entered dosing information. With a need to regularly take their medicaments, older people will benefit from an improved adherence to medication. Family members, nurses, or doctors can be connected to support the prescription rules. Connecting all relevant health partners for a patient will generate additional benefits not possible to achieve in our today's analog world. Medications errors and intolerance based upon several prescriptions from various doctors for one patient could be discovered early and health risks could be eliminated.

Proteus Digital Health provides an even more advanced technology to monitor the medication plan starting with a sensor-enabled "smart" pill (http://www.proteus.com/how-it-works/). After reaching the stomach, the sensor sends a signal to a patch placed on the body. The patch itself is a sensor and records the medication-taking and other data like steps, activity, rest, and heart rate. The patch passes on the data via smartphone to a special discover app and discover portal which allows the medical team to monitor the patient's health.

2.4 Transparency on Health Record

Medical records are traditionally paper work and remain at the doctor, not at the patient. If a patient is visiting another doctor, often the same analyses are performed as the results of former test are not accessible. Patients2go, a product of Germany-based Xonion, replaces the paper files and makes them available digitally on a tablet or smart phone. The patient becomes the owner of his/her data. The electronic health record keeps all medical records and critical data such as blood pressure, heart rate, and medication plan. This transparency leads to faster treatments and reduces costs. On the other hand, interactions of drugs which may lead to intolerances are recognized easily.

The efficient use of existing data is estimated – based on a field trial in Germany - to reduce the overall expenditure on healthcare by up to 20 %. Another result looks at life expectancy: it could be extended by one and a half years (Baltzer, 2015).

2.5 The Role of Sensors: The Doctor in Your Smartphone

Smartphones already serve as the central hub for communication for day-to-day tasks: checking reservations or bookings, making appointments, updating a status, and gathering information. Data exchange with doctors, upload of pictures, chat, instant messaging, videochat, and reminders will become a cakewalk, no changing of devices or communication channels and no worries about where information is stored. And sensors such as EKG-, blood pressure-, skin temperature devices can be connected to a smartphone, and data can be captured, stored and transmitted, thus further expanding the health capabilities of a smartphone. The connection and integration of sensors in the smartphone generates a powerful combination which is able to replace a lot of routine tasks of a doctor. Two examples will show how the smartphone evolves into a „pocket doctor".

2.5.1 Managing Ear Infections

Oto (https://www.cellscope.com/oto) is a smart device that attaches to an iPhone and lets parents take a video of the inside of a child's ear. The app enables them to share the video with a doctor for an immediate answer. Thinking this development further in the future, an app might give advice to the patient based on big data analysis. No doctor would even be involved in the process. Patients will become independent from a doctor for routine tasks, monitoring specific health parameters. Doctors will have more time spending on severe issues rather than checking measurements or routine tasks.

2.5.2 Measuring Body Temperature

Kinsa Health (https://kinsahealth.com/) is a start-up company based in New York. It has received FDA 510(k) clearance for a smartphone connected thermometer. The thermometer can be used like a regular thermometer to measure the temperature under the tongue, in the rectum, or under the arm. The device connects to a smartphone through the headphone jack and benefits from the processing capabilities of the phone for recording or displaying the temperature.

2.6 Multipurpose Health Tracker

Digital diagnostics is coming to the patient at his/her home. In addition to the abovementioned examples, the services will range from eye, ear, and throat exam to cardiac exam. These services are using devices/sensors connected to the smartphone. Future services will even do „intelligent" analysis and interpretations based on big data algorithms. Another advantage of such connected sensors over the classical approach of measuring data is the possibility of continuous measurement rather than one time measurement at the doctor´s office or a clinic. Kito (https://azoi.com/) is one example of such a multipurpose health tracker. Doctor and clinics not only would be relieved from time consuming measurement procedures but would also gain a way better and complete picture from their patients. Continuous measurement furthermore can serve as an early warning system.

2.7 Telehealth: The Virtual House Call

Telehealth services consist of a variety of technologies to deliver virtual and remote medical, health services. Telehealth is significantly enhancing and improving the service for disabled persons and elderly people with no access to bus or trains to get to the doctor's office. Patients living in rural areas today would be able to communicate with their doctor at least via video chat. Such services by no means would completely replace a personal appointment. However aftercare or follow-up consultation, disease monitoring, and other tasks could be enhanced. They also help to reduce costs and avoid unnecessary appointments. First pilot projects by two major German healths insurance companies show excellent adoption rates and high satisfaction ratings.

2.8 The Healthcare Future Is Interconnected

A major difference between today´s world of healthcare and future e-Health services is the way patient data is exchanged between the various healthcare partners and the interconnection of those partners with the patient at the center.

Future data exchange in a digital healthcare market will allow for
- patient to patient (community)
- patient to doctor
- patient to pharmaceutical company
- patient to clinic
- patient to health insurance company.

2.9: Connecting Patient to Patient and Patient to Pharma Company

Consumers will benefit from this in many ways; new opportunities are offered to manage their health conditions and communicate with like minded people. The community PatientsLikeMe, a social network based community bringing together people with interests in health and care to support each other, shares learning and even provides a platform for tracking health data. The App "MS und ich" is an example for the connection between patient and a pharmaceutical company (http.www.msundich.de/). But due to regulations issue there is no real data exchange possible.

3.0 Key findings and learnings

The adoption of IT in healthcare systems has, in general, followed the same pattern as other industries: Firstly, IT was used to automate highly standardized tasks; secondly, IT connected different processes inside a company or between companies; and thirdly, what is called disruptive technology tries to understand first what customers really wanted (Biesdorf, Niedermann, 2014).

So it is not surprising, that the examples in Sect. 2 show that the customer needs are the starting point. The rising expectations of patients using new technologies and their own devices to manage diseases are met. The examples show that digitization in healthcare is not a substitution of traditional healthcare but a complement which makes life easier and more over safes money. Like the Pac Man game in the 1980s, the apps and digital helpers walk through the healthcare market by eating outdated, time wasting less customer-oriented processes – and there is plentiful "food" for years to come.

The patient is in the driver seat. e-Health will extend the traditional healthcare model with patient-driven services that extend and/or replace existing services and empower patients. It is a myth that people don't want to use digital services for healthcare or that only young people would use it, as a patient survey showed in 2014 (Biesdorf & Niedermann, 2014). Another finding from the same survey points out, that patients don't want highly innovative service offerings but "more efficiency, better access to information, integration with other channels, and the availability of a real service if the digital service doesn't give them what they need."

The transformation from traditional healthcare to e-health is more than just digitizing certain processes. It's a revolution which can be characterized by a general change from a traditional doctor centered to a more and more patient centered healthcare market:

1. Power shift to patients
2. Health self-services through apps and sensors

3. Connected data and flow of information
4. Improved and faster diagnosis based on big data and continuous measurement of relevant health parameters
5. Implementation of effective early warning system
6. Establishment of effective patient communities
7. Rise of Telehealth services
8. Cost Savings.

Healthcare providers have to accept this change and even better should understand the underlying customer/patient needs. As pointed out before, mainly patients expect more efficiency, better information, channel integration, and the availability of a real service. Healthcare providers should meet these core requirements.

4.0   Conclusion

While this chapter looks at the future of wearable devices and their impact on e-Health and puts the customer/patient first, the discussions would not be complete without listing some of the main challenges that have to be overcome before this idea of better and faster healthcares services can be embraced by society.

Some issues that concern researchers and practitioners relate to hacking of medical devices. While some go a step further and fear future bioterrorism attacks when advances in nanorobots in our bloodstream mature, the bottom line is that cybersecurity issues have to be addressed.

Another factor that still causes intense discussions in an already interconnected world is the issue of privacy. What would protect a patient from governments or companies from misusing their health-related data? This question has often led to slowing down of new technology adoption.

Doctors also find the idea of self-diagnosis alarming. Manufacturer and seller of the devices have to ensure that these devices do not turn patients into doctors.

There are two social issues that also raise their head in discussions:

- Will this create a separation in society? Will some get and stay healthier faster than others because they can afford these technologies?
- What would be the impact on our society as technology leads to enhanced monitoring, early detection, and, therefore, extension in life span of humans?

Some of these issues are beyond the scope of discussion, but with the advancement this paper highlights, these discussions will soon be part of the adaption process for such devices. The authors hope that these discussions keep the benefits to the patient and the already fatigued healthcare system in the forefront as it needs a much-needed revitalization.

5.0   References

Apple Inc. (2016). Apple Advances Health Apps with CareKit. Available http://www.apple.com/in/pr/library/2016/03/21Apple-Advances-Health-Apps-with-CareKit.htm (accessed May 16, 2016).

Aspler, S. (2014): How ingestible sensors and smart pills will revolutionize healthcare. Available https://www.marsdd.com/news-and-insights/ingestibles-smart-pills-revolutionize-healthcare/ (accessed May 15, 2016).

Baltzer, S. (2015). Das Potential von Patientendaten wird unterschätzt. Available http://www.faz.net/aktuell/gesellschaft/gesundheit/gesundheitsdaten-bieten-fuer-krankenkassen-ein-enormes-potential-13862478.html?printPagedArticle=true#pageIndex_2 (accessed April 15, 2016).

Baltzer, S. (2016). Erstmals mehr Windeln für Erwachsene als für Kinder. Available http://www.faz.net/aktuell/wirtschaft/unternehmen/zellstoff-hersteller-sca-verkauft-mehr-windeln-fuer-erwachsene-14071263.html (accessed February 15, 2016).

Biesdorf, S., Niedermann, F., (2014). Healthcare's digital future. Available http://www.mckinsey.com/industries/healthcare-systems-and-services/our-insights/healthcares-digital-future (accessed May 15, 2016)

Hodson, H. (2016). Revealed: Google AI has access to huge haul of NHS patient data. Available https://www.newscientist.com/article/2086454-revealed-google-ai-has-access-to-huge-haul-of-nhs-patient-data (accessed May 1, 2016).

Muldowney, S. (2015). The five key drivers of disruption. Available http://intheblack.com/articles/2015/05/01/ the-five-key-drivers-of-disruption (accessed May 15, 2016).

OECD (2015). OECD Health Statistics 2015. Available http://www.oecd.org/els/ health-systems/health-statistics.htm (accessed May 15, 2016).

United Nations, Department of Economic and Social Affairs, Population Division (2015). World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. ESA/P/WP.241. Available http://esa.un.org/unpd/wpp/Publications/Files/Key_Findings_WPP_2015.pdf (accessed May 1, 2016).

Vyganix, (2016). Prevention over treatment. Available http://www.vigyanix.com/blog/prevention-treatment-7-healthcare-startups-leading-revolution-infographic (accessed May 15, 2016).