Health Care
Doctor
Hospital
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First Aid
Surgeon
Emergency

TREND STUDY

PERSONALIZED MEDICINE OF THE FUTURE

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In cooperation with:

ExpertSight
Partner für Vorausschau

deutsche apotheker- und ärztebank

CONTENTS

Dear Readers:

Your industry, the healthcare business, is facing an extensive transitional phase. Personalized medicine — understood as the overall search for the best personal opportunities for disease prevention and recovery and for improvements in health, will characterize and change your industry permanently in the coming years.

Patients obviously have more data available on their own health status; the data is more comprehensive, of better quality and originate from numerous, different sources. Moreover, patients have many possibilities to analyze and interpret this data for themselves. And digital assistance systems play an important role here as well. The flow of data between patients, their assistance systems, expertise available online, primary care physicians, specialists, medical experts, clinics, pharmacies, wellness centers, and other providers on the healthcare market will define the type of interaction between the players and the industry in a specific case.

And even more: Our conception of illness and health will change. With the growing possibilities for selfchecks and self-optimizing, the boundaries between illness and health will become blurred. And thus, patients will often become healthcare customers instead. The medical industry is in competition with companies again penetrating from the outside into the healthcare market. There will be entry points at the least for telecommunications providers, sensor manufacturers, software companies, sports equipment manufacturers, and the nutritional supplement industry.

The medical industry has a great future — even though it looks different from the past. This study names the significant strategic drivers for the future of your industry. It explains which actors will drive which trends and why. From the roadmaps, plans, and expectations of the trend-setting players it presents a picture of the future of your industry in the coming five to ten years. And based on concrete strategic options, it shows which steps companies in the medical industry must take to meet the challenges of the personalized medicine of the future.

The trends described in this study are to be understood as aids in long-term strategic orientation. But be skeptical of trend studies that forecast that your industry will change completely from one day to the next. That is pure nonsense.
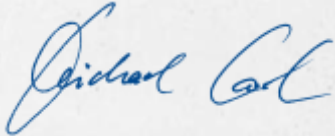
This study is an invitation to shape your own future, an invitation to the industry to develop new approaches to the future based on concise pilot projects. Whether or not you succeed in this will determine if you are counted among the winners or losers of today's trends in the year 2025.

Due to the cooperation of our partner, the Deutsche Apotheker- und Ärztebank, we are able to present this study to you free of charge. Please do not hesitate to contact us or our partner if you would like to use the results of our study to review your strategies. We would love to help.

We expressly wish to thank our cooperation partner for their kind and constructive help. They enabled us scientists to undertake an independent and unbiased analysis of future trends. We wish ourselves and our readers the same open-minded approach to the challenges of the industry, as well as an awareness, as we plan our futures, that we can only influence change by actively shaping it.

Make your company future-proof! We would be delighted if this study helps you to do so. We wish you an inspiring read ...

…and a great future!

Michael Carl
Director of Analysis & Studies
2b AHEAD ThinkTank

29 June 2015

deutsche apotheker-
und ärztebank

Dear Readers:

Every day we are presented with new, exciting sales offers about how we can make our lives easier, nicer, and healthier with some high-tech gadget. With very little expense, using the newest smartphone or computer app. The various possibilities for collecting individual health data today clearly show that the healthcare market is in continual motion. These developments are highly relevant to the Deutsche Apotheker- und Ärtzebank — because we do not only make investments in the healthcare business, but are also making a contribution to the future financial success of German healthcare. We also see that these numerous opportunities are offset by great challenges. That is why we contacted the trend research institute the 2b AHEAD ThinkTank to ask about the essential drivers and the most important factors of the trend toward the "personalized medicine of the future."

Sometimes people who collect their own health data and have it medically evaluated are not even ill. In many cases, they have private motives aimed at a healthy lifestyle, and also there are targeted preventive measures that provide the impetus for people to collect their own comprehensive and very personal data. Practitioners in the healing professions are being confronted with new expectations, because not only are patients arriving who hope for an amelioration of their complaints, but also "health seekers" who plan to use their personal health data to optimize their well-being.
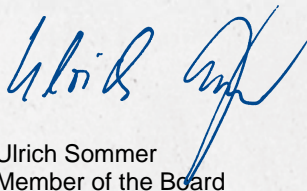
And wherever customer needs and benefits are under discussion, that is where markets will be created. For some time now, new business models have been appearing in the healthcare market under the heading of "personalized medicine of the future." This is a method of compressing individual data into profiles which make the diagnosis and therapy of patients more successful. For example, the highly promising potential applications in oncology give hope of achieving even better medical treatments in the future based on the characteristics of the individual patient.

The collection of digital health data, on the one hand, will generate a gigantic volume of data which cannot be processed without computer support. On the other hand, this information forms the basis for the treatment of the individual patient who is on the hunt for personalized medical care. It is self-evident that the method of processing and evaluating this data will also have an effect on the structures of the healthcare market. However, merely having access to the information is not the same as having knowledge. And thus the interpretation of the data will place the medical professional before new challenges, and even networking among the parties involved will become more extensive.

This trend study compresses the experiences, plans, and forecasts of industry players, illustrates the main points in the development of personalized medicine, and shows what changes we will have to prepare for even today. This would not have been possible without the expert participants, who were willing to invest their time and to share their knowledge with us. For this we wish to express our sincere gratitude.

We look forward to participating in future developments in the healthcare business.

Cordially,

Ulrich Sommer
Member of the Board
Deutsche Apotheker- und Ärztebank

PERSONALIZED MEDICINE OF THE FUTURE

Personalized medicine is the key factor that will characterize the industry in the years to come. The drivers of this trend are the quickly increasing quantity and quality of data, the broad availability of analytical and expert knowledge – no longer limited to healthcare professions – the increasing capability of medical technology, and the penetration of new domestic and international companies into the healthcare sector, and the resultant changes in patient and customer expectations.

The term "personalized medicine" is used rather non-specifically in current literature and scientific discussions. This study is based on an understanding of personalized medicine as an overarching search for the best personal opportunities for the prevention of and recovery from disease and for the optimization of health.

The study is based on qualitative interviews with experts and players in the healthcare sector, both classical representatives of the industry and also new players on the market. For its methodical orientation, the study uses the Delphi method, a popular and well-proven method for scientific future research.

The study describes a vision of the future for personalized medicine whereby the most important aspects are:

1. **Health-related data will take on the leading role.**

2. **Specialists will come to work in inter-professional teams.**

3. **The boundaries between illness and health will become blurred.**

4. **The rate of change will increase.**

Data-driven cooperation between companies will be the new standard. The volume and complexity of medical knowledge will grow. At the same time, patients will indeed have access to more information and analyses, but will not necessarily have more knowledge and understanding, so that a joint interpretation of the data and risks will become the central challenge for the classical healthcare professions. New demands for precision will appear: the probability of onset, severity, progression, duration, and costs of illness. In this respect physicians will work together in flexible treatment teams, which will ultimately be set up for each patient and the patient's individual situation and must to able to function independently of location and company. This places new requirements on the IT competency of physicians and the IT equipment of medical practices. The primary care physician will become, over time, a project manager for the treatment team and will spend a significant amount of time on organization, management, and communication with the different treatment teams. And to do so, the physician will need both a thorough knowledge of project management and also access to the relevant networks. This will have to be reflected in billing structures in the future. This development makes it possible for physicians, even outside of large clinics, to specialize in specific topics and to inject this knowledge into medical histories and therapy processes.

Individualized data collection and its correlation makes it possible to identify very small patient groups which can be approached by specialized providers. This will change the framework conditions for pharmaceutical companies, labs, and technology companies.

Is a person with a certain genetic risk of cancer considered healthy or sick? Where are the boundaries between recovery and physical optimization? Is a health-promoting nutritional supplement a medicine if it originates from an online pharmacy, but just fitness food if it is available in the supermarket? Medical knowledge is growing rapidly and significantly.

The digital knowhow of new market players and the expansion of the healthcare industry are increasing the pace of change in the industry. The lead function of data is significantly augmenting this effect: Handling of data creates a new transparency and internet platforms make diagnostics and therapy comparable. Skilled medical decisions are now facing open competition.

A striving for the best personal opportunities for the prevention of illness and for optimizing health will significantly change the healthcare industry. Companies and providers who prepare today for the underlying logic of personalized medicine will be on a future-proof footing. This offers important advantages — for you or for your competitors.

Healthcare data will take on the leading role	Specialists work in flexible interprofessional teams	The boundaries between illness and health will be blurred	The pace of change will increase

#1: The volume of data and information will increase significantly. People look for providers who will use data from a huge variety of sources in developing therapy and consultation options.

#2 : The quantity of information will become so complex that it cannot be managed without additional support.

#3 : There will be areas in healthcare that will be taken over and handled automatically and independently by digital assistants.

#4 : The composition of teams will be governed by the current needs of the patients and will change on a case-by-case basis.

#5: The objective is to allow people to create their own personal healthcare networks. These networks will become larger than those we know today.

#6: Whoever has access to the patient's data can provide comprehensive advice in her daily life. Competition for this coordinating role will be intense.

#7: New locations will become linked to health: smart homes, smart cars, and smart workplaces.

#8: Patients will become healthcare customers.

#9: New market participants will score points in the digital world thanks to their knowhow.

#10: The enormous cost pressure for the development of drugs will cause an active search for innovative approaches to obtaining approvals: Adaptive approval procedures offer great opportunities here.

#11: 3D printing has the potential to create innovative types of treatment throughout the entire value-added chain in medicine.

TRENDCYCLE ANALYSIS - NOT MEGATRENDS

This is not a study on megatrends. Those who work with megatrends do so on the assumption that there are a limited number of drivers that affect all business areas equally. This is wrong. Trends exist only because industry developments are driven forward or blocked by those individuals who have the resources or authority to do so and to lead others in doing so.

Human behavior – and thus also investment decisions – always follows specific interests, desires and compulsions. These vary by industry and by industry sector. We trend researchers are able to observe this behavior on the part of decision makers; we can try to understand it, we can analyze driving and blocking factors, and we are able to generate forecasts regarding where this behavior on the part of industry players will lead. In the sciences, we call this "qualitative research." The following study is based on this approach. Compared with other industry studies, you will find no lists of percentages in the following pages. Futurists know that the future can neither be measured nor quantified—because it has not happened yet. For the most dead-on forecast possible regarding what will happen in your industry in the years leading up to 2025, no representative survey of customers or so-called experts will help, no matter how large-scale it may be, because no matter how many you might inter-view, they also cannot know what will happen.

The only possible way to come close to a reality that is still in development is to speak with trendsetting companies and industry players who are driving the technologies and trends that we will all meet in the future by the decisions they are making today, because you can talk to these players. Furthermore, you can try to understand their motives and compulsions.

You can find out about their expectations and road maps for the years to come. Where these players intersect, we can see those trends that are being pushed – or blocked – most forcefully. This provides the basis for the most realistic picture of the future of your industry that researchers could possibly offer you. You will find this picture on the following pages.

The trend research institute the "2b AHEAD Think-Tank" specializes in the identification of driving and blocking factors, the analysis of opportunities and risks, and the development and implementation of business models for the future — all individually tailored to the trend cycle of specific companies. This last feature is important because the players who have a decisive influence on the business of their firms vary from company to company. Thus the trend drivers and blocking factors, as well as the opportunities and risks, also differ between companies —even within the same industry.

Those who handle their future responsibly will not run after the one-size-fits-all megatrends of supposed trend gurus, but will base their strategies on the goals and the road maps of the leading attackers and defenders in their markets. This is our mission. We would be thrilled to hear that this study has helped you succeed there, too.

THE DELPHI METHOD AND QUALITATIVE EXPERT INTERVIEWS

The present study is a qualitative, empirical study using the Delphi method. This method is a method for future studies that takes its name from the famed oracle of ancient times. It was developed during the middle of the last century in the US and is used for generating forecasts. Because hardly any expert in these complex times is able to successfully observe several mutually influential fields of expertise at once, Delphi-method studies draw on the assessments of several experts, each with his or her own specialist knowledge. The interviews are conducted using a two-stage process.

During the first phase, the experts are asked individually to give their personal assessments on specific topics during the course of guided expert interviews. During the second phase, in contrast, they are presented with the collective results of the first round. The experts are then asked to hold to their positions from the first phase, or to integrate the results of the first phase in a revised assessment of the subject matter.

The selection of the expert study participants is particularly important for this scientific approach to trend research. For this reason, the so-called "trend cycle" is compiled using a workshop format after an extensive desk research phase covering previously published studies related to the topic. The trend cycle constitutes a list of all of those companies within and outside of the industry whose resources are sufficient to ensure that the strategic decisions they make today will have a significant effect on the future of their industries, either because other players are sure to follow their example, or because they can successfully push their business models because of the influence they have over the market.

One expert was chosen out of each relevant group of industry players who did not merely speak about his own company, but was also able to give an overview of his group. The pool of experts consists of key players from the healthcare industry, technology providers, and attackers from outside the classical industry.

In both interview waves, the experts' investment decisions, business expectations, and statements on industry trends were analyzed and evaluated using guided expert interviews as a foundation. A total of 15 experts were chosen. The experts were individually confronted with various theses and asked to give their estimations regarding future developments. The expert statements subsequently underwent a qualitative analysis and were divided into six trend areas. These trend areas compile the essential statements given by the experts concerning future scenarios for personalized medicine.

To conclude the study, strategic options for healthcare professions and companies in the healthcare industry were derived from the trend areas. These recommendations are based on a synthesis of the exploration of the trend areas, the statements given by the experts and the future scenarios built on those statements, and, finally, the expert knowledge of the 2b AHEAD ThinkTank in innovation management strategies.

HOW WILL LIFE AND WORK ENVIRONMENTS CHANGE BY 2025?

The living environment facing customers in 2025 will be shaped by various factors. The average life expectancy in Germany, for example, will exceed 85 years and tend towards 90. In many families, celebrating the 100th birthday of a grandparent will have become a normal occurrence. Even among other families, the question will arise: What will people want to do between the ages of 60 and 85? Vacation? Work? Most are sure to experience a sort of new beginning as they enter the third active segment of their lives between 50 and 60. The phrase "new beginning" is meant literally here: a new job, a new home, a new life partner ... active living will continue at that point. Therefore physicians will have to place a greater emphasis on preventive measures which promote lasting good health.

The arrival of retirement age with its reduced mobility and activity will be pushed even farther back. People will half want this in order to spend those 30 years in a meaningful way, and they will half be forced to it in order to avoid the very real threat of old-age poverty. The world economy will be increasingly dominated by Chinese players — not only in the mass-production industry, but also in the areas of commercial innovation and conceptual design. Asia will gradually grow out of its role as the region of discount labor, and will begin looking for its own cheap staffing opportunities in Africa: first in Northern and Southern Africa, and years later also in Central Africa.

In Germany as well as internationally, people are streaming from provincial areas into major cities. Rental costs are rising in the booming metropolises while rural areas are slowly being abandoned. Germany, in the meantime, has experienced a long-predicted transformation: We now live in an era of full employment where every halfway qualified person has a job. Not only that: Headhunters are beginning to show up at the door, because there are approximately 3-4 million unoccupied positions in German companies. The companies themselves see this as a catastrophe.

Not so the employees: They have the upper hand in the employment game for the first time in decades, and thus can freely choose the jobs they want. This trend is pushing salaries upward, but is also cause for the fact that roughly 40% of the working population are changing projects – and companies – every 2-3 years as so-called "project workers."The short supply of personnel will also compel the healthcare industry to develop and communicate its attractiveness as an employer in new ways.

Against this background, some of the fundamental values of our society are being redefined: Security in life remains important, but is becoming linked to new factors in the face of constantly available new jobs. Trust will remain important, but in the coming times of greatest possible transparency will not simply be handed over to major brands, but will have to constantly be tested. Continuing contact and active care for the patient by her physician will form the basis for a solid relationship of trust. Proximity will still be important, but it will be measured not just in distance, but also primarily by affection and interaction.

People will experience their personal health as the greatest luxury of the future. Thanks to all varieties of body enhancement, health will increasingly become a purchasable consumer good: Medical nutrition will eliminate most illness in society; brain food promises us the optimization of our brain functions as needed. And — the emerging production of human organs as replacement parts will lead to further increases in life expectancy in the luxury segment.

The greatest change, however, between now and 2020 finds its cause in the rapidly expanding phenomenon of digitalization.

In the future, it will permeate every aspect of human life with information and communications technologies. Ten years from now at the latest, over 95 percent of the adult population of Germany, Europe and the United States will regularly use the Internet. One striking trend in this regard is the fact that, even from 2015 onwards, more people will be using the Internet via mobile terminals than through stationary systems. In the next few years, the number of smartphone owners will rise sharply until it will no longer be possible to sell mobile phones that cannot access the internet.

Business strategies, however, have for some time now ceased to focus on smart phones and PCs. The successors to iPad & Co. will go by the names iTable, iWallpaper, iMirror, iCar, iWindowpane, iDresser, i-ICE-Seat, and so on. All objects that can successfully be digitized will gradually be converted into Internet devices. In this regard, futurists speak of the "Internet of Things." This entity will not only encompass the family home, but also the entire city and the entire world. The time will come where every object will have an IP address. The new volumes of data supplied by the Internet of Things will also open up vast opportunities for medical practitioners in the areas of prevention, diagnostics, and therapy.

Information flow and the synchronization of stationary and mobile devices will become wireless, and device control, through the use of sensor and gesture control systems, will increasingly adapt itself to (human) interpersonal communication. Medical practitioners and pharmacists in the future will need to find ways to integrate these new forms of interaction into their customer dialogue. The futurist of a large mobile communications company has said: "Today, when I go into a hotel room, I have a screen on the wall, a telephone, and Internet access. In four to five years, I won't receive a room key anymore, but rather a code that will be loaded onto my phone. The moment I open the door, the room will recognize my device, access the Internet, and present me with all of the possibilities the world of telecommunications has to offer." Already in use today: biometric procedures. Vein scanners are using the unique vein structure of the hand to produce a secure and copy-proof key.

Simultaneously, flat-rate telecommunications packages will guarantee the rapid expansion of this trend. Its key industry drivers will be the telecommunications companies, for whom mere data-transfer services will be a minor concern in the future. Data transfer itself will be sold as cheaply as possible, so that business models centered on apps and mobile commerce can truly boom. Healthcare professionals must prepare for the time when both they and their customers will have permanent access to the internet from virtually everywhere. Thus every touch point will become a point of sale. This trend is both a great opportunity and a great risk.

THE TECHNOLOGY KNOWS THE CUSTOMER

The emerging Internet devices (on mirrors, tables, cars, walls, windows, etc.) will, however, not become computers as we know them. This is because new user-friendly concepts for product operation and new human/machine interfaces will develop. The iPhone and iPad introduced touch control. The next step, gesture control, which does not even require contact with the device, was introduced mainly by Microsoft. At the moment, Apple and Google developers generally prefer speech control systems. Both gesture- and speech control systems will exist in 2020. After 2020, these control methods will be replaced by thought control systems (brainwave recognition), which today still sounds futuristic. This last type, in the meantime, has already definitively outgrown the science-fiction stage, and will find its first commercial applications in the next few years—in medical assistance systems as well.

Emotion recognition will find its way into our devices even before the advent of thought-recognition systems. In this control method, devices recognize the emotions of their owners and can react appropriately. A car, for example, would correspondingly exhibit a different driving style when its owner is stressed and tired than when she is rested and relaxed at the wheel. Experts estimate that emotion-recognition systems will enter the luxury market in 2015 and will expand rapidly into the mass market from there. This development will owe its speed and momentum to Moore's Law – just as valid today as in the past – which dictates that the processing power of electronic chips doubles every 18 months at the same price. Also influential in this regard will be the large price drop for sensor technology, thanks to which sensors of all kinds will be mass produced in gigantic quantities. The technological hurdles for an automated and individualized customer sales pitch will largely disappear.

Medical practitioners and pharmacists will have to prepare themselves for the time when electronic devices will not only recognize individual customers, but also their current state of emotions, sensitivities, and bodily functions. Consumers will grow accustomed to communicating with their devices in a "human way": through language, facial expressions, gestures, and later even thoughts. They will also get used to the fact that technology will be capable of assessing their present situation and reacting to it successfully — within fractions of a second. Electronic devices will thus become "more human" than their human counterparts, because they will know much more about their counterparts than the average stranger would! This presents a great risk for human experts and sales representatives, but also a great opportunity for those who know how to use the technology competently.

SYSTEMS ARE BETTER THAN SALESPEOPLE … THEY REMEMBER YOU

Indeed, the additional benefits of connected devices in the future will not come about by means of data as we understand it today: those statistical heaps of data that lie in databanks today. Our present conception of data will change.

The intelligent compilation and evaluation of information on users' dynamic data will become part of our future understanding of data. Object recognition, image recognition, and observation-capable interfaces will guarantee that in the future, everyday objects will observe the behavior of their users, combine this real-world data with stationary information stored via the Cloud, and produce unique and situation-appropriate prognoses regarding the current needs of the user using automated algorithms or business intelligence systems — always accurate down to the second. It remains to be seen to what extent these devices will require an intelligence of their own or will function as part of a "smart grid" through which they are controlled situationally, yet in a centralized manner. The question of "data" in 2020 will have little to do with the definitions we are accustomed to today. It will mainly be a question of the recognition of the user's needs ... and the prediction of her desires before they have reached her lips.

Physicians and pharmacists will have to prepare for the time when devices and systems have a more detailed recollection of the patient. A connected device in the year 2025 will not only recognize the patient, but will know within fractions of a second what her complaints are, what medications were most recently prescribed, what therapeutic activities were last performed, etc. With these assets, the electronic assistance systems in the year 2025 will often be able to provide patients with individualized answers better adapted to the specific situation than can human physicians or pharmacists. Physicians must find a proficient way to use these devices and systems as assistants and yet still offer a "human added value."

SMARTPHONES AS INTELLIGENT ASSISTENTS … THE COMING TRAFFIC-LIGHT SOCIETY

In spite of the rapid expansion of smart-phone use and the resulting opportunity for consumers to use all new apps available, one basic truth of technology- and media use cannot be ignored: Only a small percentage of us are highly active users who proactively seek out, try, and use new applications. The vast majority of the world's population remain couch-potato consumers.

This leads to problems when today's apps require active intervention and input by the user. The result is this: Even when the vast majority of users own devices that have apps on them, this in no way means that these apps are being used.

Therefore, systems that operate without active user control will represent an important market for the future. They will "monitor" their owners during their everyday routines, analyze the data, prepare requirements profiles and then permanently filter their owners' environment based on these profiles. They will get their "intelligence" from an automated exchange of data with other nearby devices. In this way they will place recommendations (unprompted) into the field of view of the user when she is presented with an everyday situation which requires a decision. Technology developers do not describe these assistants as a program, but rather as a conglomeration of numerous individual programs. Much of the needed data will be obtained from the user's routine movement patterns, and these patterns take into account her recent locations, internet history, and the like.

WE WILL SOON HAVE INTELLIGENT TECHNO-LOGICAL ASSISTANTS THAT OWE THEIR INTELLIGENCE TO DATA GATHERED FROM THE CUSTOMER´S EVERYDAY LIFE.

At the same time, we will experience a paradigm shift in the realm of data protection. Naturally, all of the predictions mentioned so far will only take place if people release their personal and user data for this kind of analysis and prognostics. This is highly probable. For, even today, we experience the same patterns and strategies when we move in the computerized world of the internet. Even there, the security of our data is undergoing a major paradigm shift. The assumption that private citizens do not want to release their data is 80s thinking. Today's population lives in another world. It does not want to keep its data secret! We want to release our data! Data protection will become more important in the future, but also different. The data protection of the future means that the consumer can view, change, and delete the data saved about her with a single click. There will be a system in place that ensures this. Companies that have the trust of their customers as "trust centers" will have the best chances strategically. No company really wants to annoy its customers with mass advertising that scares 90% of recipients away and is only useful for the remaining 10%. However, in order to filter out this 10%, companies will have to evaluate consumer data. And for that, they need the trust of their customers. Customers will understand this, because life is much more comfortable when one only receives the right kind of ads.

Healthcare professionals will have to adjust their strategies for the "traffic light society" that we will be living in by 2025 .Their customers will have grown used to having an electronic assistant on their smart phones for every area of life that gives suitable advice, product evaluations, and tips for every possible situation. Customers, however, will not want to receive all this virtual information as rows of digits or mountains of text. They want to be told: Is this the right product for me, or not? In most cases, your customer in the year 2020 will trust her smartphone more than human salespeople. This is a good thing, because the smart phone will give her better answers! The competent vendor of the future will have to make sure that his product will stand very high on the customer's list — and very "green" in her traffic light …

NEW PLAYERS GROW MORE POWERFUL

There is another technology trend that will probably have a greater impact in the future than any other: In years to come a breakthrough is expected in mobile payments. This means: The smartphone will become a means of payment! Step by step it will replace cash, but will also replace debit cards and credit cards. Different technologies for mobile payments provided by different providers will operate side-by-side. This strategic power will rest with any company that owns the technology interface through which the payment flows. Currently, three main technologies can be seen in development: First, there are the so-called smart cards, the successor to credit cards, which are swiped through an attachment on the smart phone and pay using an app. This technology leaves the power over customer data with the credit card companies. Second, telecommunications providers are working on a payment system of their own that charges payments to the user's phone bill. The power over customer data in this case lies with the telecommunications companies. Third are the NPC chips mentioned earlier, which are already being built into the first smart phones. These could potentially give the power over customer data into the hands of the smart phone manufacturers.

Merchants in the healthcare industry must understand that intermediaries will take over a significant share of customer management. They will act as brokers, as "knowledgeable third parties" who give tips about the lowest-cost providers and the most trustworthy therapy methods.

The challenge for medical providers themselves will be to become intermediaries — that is, to invest in their own intelligent assistance systems.

LOSS OF SIGNIFICANCE FOR SALESPEOPLE ... THE DEVALUATION OF THE EXPERTOCRACY

Let's not beat around the bush: These digitalization trends hold not only great opportunities, but also major risks for today's companies. When we look back from 2025, there will not only be big winners in the digital world, but also large numbers of losers as well. For what can sales staff do when customers know better via bar-code scanners and Amazon if a particular product is right for them, how other customers have rated it, and if they can get it cheaper around the corner? Today's expert, tomorrow's cashier! And this will not only affect salespeople. What can teachers do when their students know more than the department of education requires by reading eBooks? Today's expert, tomorrow's reciter! What can craftsmen do when homeowners no longer seek advice on heating their houses, but simply hire craftsmen to install heating system X — which the internet says is the best? Today's expert, tomorrow's handyman! What can tour guides do when there is always someone in the group who has more to say about the history of local landmarks – thanks to his smart phone – than the guide could ever memorize? Today's expert, tomorrow's chaperon! What will real estate agents do when their clients receive an offer for their dream apartment automatically in their glasses when they cross the street? Today's expert, tomorrow's doorman!

In the next few years, we will experience a devaluation – a loss of significance – of the expertocracy that will radically change large segments of our economy and open the way for new markets. Because: Those experts who characterize our world today will have to ask themselves the hard question: Can my expertise be offered more quickly and more custom-tailored by software in the future? Salespeople who do their work simply in terms of gathering, compiling and passing on data … will lose. Their share in the market will go to electronic assistants.

But this is no reason to stick our heads in the sand. On the contrary: Those who actively use this trend in their work will be among the winners in tomorrow's business. The biggest winners will be the more competent healthcare professionals who know how to use the capabilities of digital devices for themselves as electronic assistants and, at the same time, are able to offer their patients and customers services that digital devices cannot.
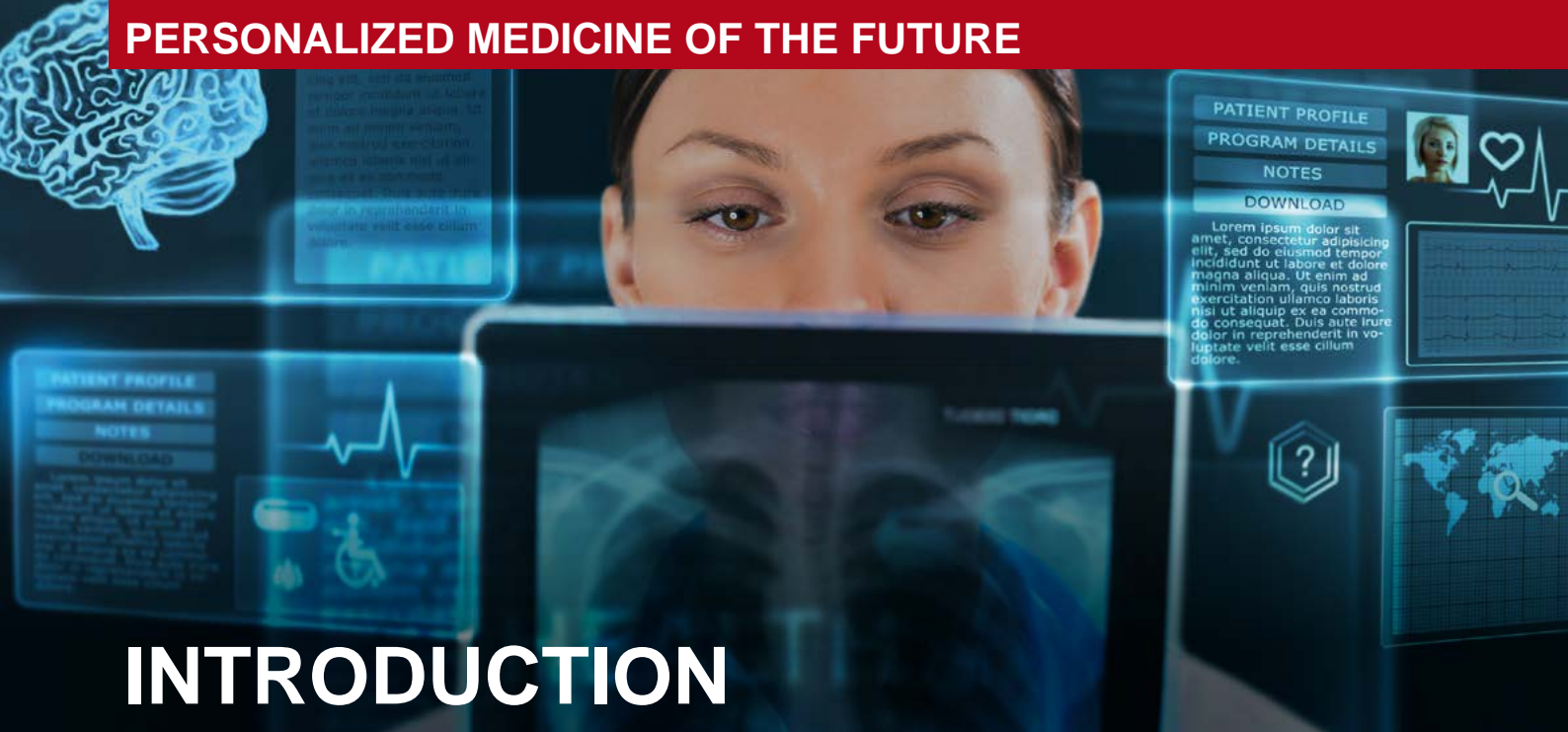
INTRODUCTION

The idea of medical care specifically tailored to the individual is not new. However, in the future our idea of personalization, and thus of personalized medicine, will change. Personalized medicine is more than just a branch of medicine. It is a paradigm shift for the medicine of the future.

ACCEPT THE CHALLENGES

A healthcare system in which personalized medicine plays a major role will produce many changes. It will be characterized by a new relationship between patient and physician or pharmacist. The flood of data will have to be channeled and utilized. And, not least, new products will be created and new markets opened up. This represents new challenges for patients, for employees in all career groups in healthcare, in pharmacy, biotechnology, and diagnostics companies, for the manufacturers of medical equipment, for health insurance companies, and not least for public policy. To make this vision of a personalized healthcare system a reality, certain prerequisites must be satisfied. These relate primarily to questions of the financing of medical services. For even if medical procedures are approved for use on humans and thus in principle become available on the healthcare market, most patients will only be able to benefit if the treatment costs are covered by their health insurance. But this also affects the regulation of research, government approval, and manufacture of products. Personalized medicine additionally confronts our society squarely with ethical questions: How should medical services be distributed? Who is to assume what level of financial responsibility? What responsibilities are to be assumed by the individual, by the insurance companies, by the corporations? These questions must be clarified in order to sharpen our view of the future. Numerous developments are indeed possible and

even seem to be plausible, but are they also desirable? This discussion will have an important effect on the structure of personalized medicine and will provide the opportunity to exploit innovations for society as a whole.

CREATE THE GENERAL CONDITIONS

One finding of this study is clear: The question of whether or not personalized medicine will arrive has been decided. It will come, because there is both a demand and a supply. The question of how it will arrive will be decided by the various stakeholders. Depending on what framework conditions are created for research, development, distribution, marketing, and the sale of products and services in personalized medicine, the emerging segment may result in a fragmentation of the healthcare system. In that case, personalized medicine will only benefit financially well-situated patients who can purchase services outside of the insurance system and outside of Germany. Proceeding from the idea of an inclusive public healthcare system, the question arises of how to ensure that as many people as possible can profit from the innovations arising from personalized medicine. The domestic companies involved in the healthcare market must find a way to profit as quickly and comprehensively as possible from a market that is growing constantly around the world. This will lead to new role concepts and a new distribution of tasks within the healthcare industry. The classical roles will change in favor of an increase in new professions, new companies, and a new form of cooperation within and among institutions. The structures of the healthcare system must adapt to the continuing transition. Only in this manner can health services be provided to patients on a consistent and high level of quality.

TAILORED FIT — NOT "ONE-SIZE-FITS-ALL"

The successful decoding of the human genome by the Human Genome Project in the year 2000 was a milestone in the history of personalized medicine. With this success, humanity gained its first insight into the genetic foundation of every person. This scientific advance made it possible to cast a greater light upon the origin and progress of many diseases. Today we can better understand the interplay of environment and genes and use this for advances in medicine. Thus the prescription of therapies has changed permanently. Whereas previously treatment was based generally on symptoms and the overall pattern of disease, the therapy of the future will be tailored to the individual. Instead of "one-size-fits-all," a customized solution will be specified for each individual. Physicians will have tools in hand to make highly reliable predictions about the effectiveness and compatibility of various therapies.

"We will be better able to define the bounds of sensible and valuable treatment. We will be able to make better guidelines for treatment. This is the great value of personalized medicine".

Prof. Frank Ulrich Montgomery, M.D., President, German Federal Board of Physicians

Instead of trial and error, the dosage and duration of therapy can be adapted according to the individual's requirements. More accurate diagnostics will aid in reducing the spectrum of treatment, defining the treatment corridors, and thus in achieving an improvement of the therapy. Changes can be recognized earlier on. And thus personalized medicine offers the opportunity for faster intervention and, if necessary, modification of a non-effective therapy or of an excessive dosage. This will mean a real increase in effectiveness with reduced costs.

PERSONALIZED MEDICINE TODAY

Today there exists a confusion of terminology of major proportions: personalized medicine, individualized medicine, predictive medicine, precision medicine, tailor-made medicine, individual medicine, stratified medicine. There are numerous concepts which are being used virtually interchangeably. All concepts express the intent to develop a tailor-made, individualized, and thus personalized approach for each patient.

In the year 2015, there were about 40 medications approved explicitly for personalized therapies in Germany. Fundamentally the matter is based on the following three issues: Will the patient likely respond to the medication? Is the medication probably compatible with the patient? And what dosage of medication should be administered to the patient? Therefore a genetic test is necessary before the employment of a given medication. This test will determine whether the medicine is effective for this particular patient or will cause certain side effects. About ten additional medications are currently in the approval phase.

Individualized Medicine
Predictive Medicine
Individual Medicine
Personalized Medicine
Tailor-Made Medicine
Stratified Medicine
Precision Medicine

However, these numbers are just the beginning. The Association of Pharmaceutical Research Companies estimates that about one-third of all new research projects in the drug industry contain at least one component for individualization. The majority of individualized medications today are being used against cancers, but medications based on personalized medicine are also on the market to combat arthritis, migraines, HIV, depression, and a number of autoimmune diseases. And the applications of personalized therapies will continue to grow in the future.

STATUS OF MEDICINE TODAY: TEST FOR EFFECTIVENESS

Personalized medicines are already available in Germany today which require a genetic test of effectiveness before treatment begins. Some examples are:

- **Tamoxifen for the treatment of breast cancer:** test for hormone-receptor-positive breast cancer cells. If the test is positive, the medication will be used.

- **Lomitapid for elevated cholesterol or fat levels:** A test for genetic evidence of homozygote family hypercholesterolemia. If the test is positive, the medicine will be used. This affects about 5000 patients in Europe.

- **Gefitinib for lung cancer:** A test for genetic evidence of activating mutations of EGFR(epidermal growth factor receptor)-tyrosine kinase. This substance is only effective against lung cancer when the mutation is present. This applies to about 10% to 15% of patients.

- **Bosutinib for chronic myeloid leukemia:** A test for genetic evidence of the Philadelphia chromosome. This substance is only effective when the mutation is present. This applies to about 30% of leukemia patients.

Source: Verband der forschenden Pharmaunternehmen, vfa.de/personalisiert

"PERSONALIZATION" WILL BE REDEFINED

Tomorrow the focus will no longer be limited to the genetic and molecular adaptation of therapies. The basic data used for the individualized adaptation of therapies is already growing at an accelerated pace. The decisive drivers of change are found in the field of digitalization. The use of data collected from smartphone apps, sensors in smart homes, and wearables opens up new possibilities for specifically adapting health services to the requirements of each patient. Because in spite of all the impressive advances in the field of genetics: A person is more than a collection of genes, and personalized medicine is more than a mere tailoring of pharmaceuticals and their dosages to the patient's chromosomes. Often the involvement of genetics in the disease pattern is a minor factor. A person's lifestyle, working conditions, and social and mental factors make a significant

contribution to the onset of disease and will consequently will be involved in the personalized medicine of the future. Especially the inclusion of different sources of data and parameters in personalized medicine will open up greater opportunities for improved disease prevention and therapy.

HOW INDIVIDUAL IS PERSONALIZED MEDICINE?

The idea of personalized medicine can be briefly summarized as *"patients are not all alike."* Personalized medicine intends to give each patient the best personal opportunity to avoid and to recover from illnesses and to improve health. The basic idea is that individuality offers more successful treatments than generic solutions.

The vision of producing each medication and each product for each person on an individualized basis at all times will remain a utopian idea for reasons of feasibility and costs. The objective is to produce products adapted to reasonably sized subgroups and to create greater latitude for individual differences among patients in particular areas. It is not merely a matter of developing a better medication. Rather it is important to promote a healthcare system which is patient-oriented, focused on prevention, and is comprehensive, yet also personal. Is this always necessary from a purely medical viewpoint? Is it not always correct to advise patients to be active for at least half an hour every day? No doubt. But in the future patients will increasingly expect that products, services, and recommendations will be tailored individually to them. They will specify the design of their athletic shoes. They will mix their breakfast cereal individually to their own tastes and optimize it for nutrition. Automobile manufacturers, tourism providers, the textile industry, banks, insurers, cross-industry — providers will exploit the potentials of digitalization and will attain what is today an unheard-of level of individualization. This is the new standard which will also characterize the healthcare industry. Because here too — as shown in the study — there are providers who will offer personalized medicine from today's healthcare industry and beyond. Thus they will bring about another transition: No longer will the patient be defined as someone with whom something is wrong. The classical patient will become a new healthcare customer, acting independently and competently to achieve improved health with personalized medicine. Patients will demand this.

PERSONALIZATION AT ALL STAGES OF CARE

Personalized medicine is data-centered medicine. The data available about a given patient is extensive even today and will continue to grow exponentially. While yesterday lab values and X-ray images were the basis for medical decisions, even today this is based on many individual parameters. In the future an overall picture will emerge from an unpredictable volume of individual parameters which will determine diagnosis, therapy, and medication. Every lab value, every X-ray image, every gene analysis, every consultation note, and all data from the everyday life of the patient will be parts of the puzzle which jointly, piece by piece, produce a growing quantity of data about the individual. The data from new examinations will complete the picture for the individual person even more. Personalized medicine is a generic term for a future form of healthcare which takes account of these individual factors at all stages of health services. This ranges from screening for risk factors and preventive measures to the diagnosis of disease, the evaluation of the prognosis, the selection of suitable therapy options, all the way to therapy monitoring and follow-up care. This requirement will make personalized medicine a future topic of discussion and will transform the healthcare business.

LET THE VISION CREATE THE REALITY

In coming years this vision of a personalized healthcare system will increasingly become a reality in everyday care. This will change existing structures and procedures. Personalized medicine will mean that patient data will take on the leading role in the overall chain of treatment. The existing volume of data and the speed required in decision making will lead to an ever more differentiated specialization of professions. Surrounding the patient, specialists will work together in a team and apply their expert skills at the required points. Entire health networks will emerge for the individual person, with nodal points formed from both the traditional agents in the healthcare industry and also newly arriving providers. The individual's personal health network will be a dynamic network which is adapted to current health requirements.

The decision-making tempo will increase, and likewise also the tempo of the development of new products or other health solutions. Communication and internal processes, however, will also be accelerated. Personalized medicine offers the opportunity to find new locations for health and for the placement of health-related subjects where formerly they were rarely encountered. These will be, above all, the customer's own home or vehicle, shopping centers, restaurants, and the workplace. Opportunities for new products and new markets will show up here.

FROM ONE GENOME TO ONE MILLION GENOMES

In 1990 an international team of researchers tackled a unique challenge. The goal was the complete sequencing of a human genome. The work included research on more than 25,000 gene; more than three billion gene segments had to be examined. Initially the project was scheduled to run for 15 years. Due to faster computing power and improved possibilities for processing the data obtained, however, the project was completed five years early. In June 2000, Bill Clinton and Tony Blair announced in a joint press statement the successful decoding of the human genome. This was one of the greatest scientific accomplishments of our time and was also a milestone for individualized medicine. Since then, scientists in the USA have gone a million steps farther, and in coming years intend to decode one million genomes and make them available as a database. With the information obtained, biological processes can be further explored and the interaction of health, illness, and personal genetic makeup can be understood.

Companies from other industries have recognized this and are now developing health-related products for the first time. Thus it is up to pharmacies, medical practices, hospitals, and pharmaceutical and diagnostics companies to find and exploit these new opportunities.

TREND AREA 1: INDIVIDUALIZED HEALTHCARE SOLUTIONS FOR PATIENTS

As the volume of data grows, increasingly complex risk profiles can be defined for the individual patient. Consequently, patients will expect personalized medicine to provide a more accurate prognosis about their condition. Physicians will have to translate the scientific prognoses into the everyday life of the patient. This provides the opportunity to develop a genuine partnership on equal footing and to increasingly transform workers in the healthcare industry into consultants for patients. However, this will also change the relationships between workers in health care. Teamwork and interprofessional cooperation revolving around the patient will be required.

PERSONALIZED MEDICINE

For many patients the concept "personalized medicine" is generally ill-defined because there is a gap between the scientific definition of personalized medicine and the patient's point of view. By "personalized medicine," patients generally understand medicine personally adapted to the patient. This desire is as old as medicine itself. Patients want their doctor and pharmacist not merely to interpret their purely physical symptoms, but rather to take into account the overall circumstances of their illness, including their family and social situation, personal professional stresses, and other factors of life. Patients want not only fast healing and the elimination of the cause of illness: Especially the chronically ill desire a companion during the progression of the disease who make it possible for them to come to grips with their illness and to successfully deal with it. Even for the physician or pharmacist, however the current narrow interpretation of personalized

medicine limited to genetics and molecular biology is insufficient. Rather it is a matter of a shared relationship, of getting to know one another, of trust in the abilities of the physician, and of making decisions together. The personal objectives of the patient are determined and chartered. These objectives are specific to the individual. One patient wants a cure at any cost and will seek multiple diagnoses and therapies with numerous side effects. Another patient has other priorities and prefers a life with minimum contact to hospitals or complicated therapies, and is willing to accept that this will mean a shorter lifespan.

NEW DEMANDS FOR PRECISION

In the future we will prepare complex risk profiles from the available data and use them to make predictions about the patient's future. The predictions will be more comprehensive and accurate than is the case today. Physicians will be able to predict whether a medication or therapy will be effective and the severity of any side effects. Even the probability that an illness will occur will become predictable and thus calculable. In addition, in the future we will not only begin to collect data once we have complaints, but there will be a continuous data stream about us — about every person. Thus we can be located on our own 'health map' at any time, just as our physical location can be determined constantly by our cell phone thanks to a GPS connection.

In addition, the internet and patient platforms play an important role for the experts we interviewed. This is because data about the patients will be supplemented by comparison data and information about symptoms, illnesses, and therapies found on the internet and on patient platforms. By comparing this data, the individual patient and the patient's physician or pharmacist can compare an individual's health with that of other people who have a similar health profile. This will change patients' expectations; they will demand significantly greater precision. Patients will expect physicians to provide exacting statements regarding the severity and duration of their illnesses and the probability of recovery. They will be accustomed to operating with percentage values and will actively request them. Thus the challenge for individual patients is to transfer mathematic values to their understanding of their own lives and to be able to draw conclusions from them. A 10% risk of contracting lung cancer in one's lifetime is something quite different from a 10% chance of recovery in the coming five years if one has already been diagnosed with lung cancer. Patients have more information than ever before, but this does not automatically bring more knowledge or understanding. It will be impossible for the patient alone to organize and evaluate this information. Thus a patient will need experts to provide advice and consultation, who provide support and take up the patient's cause. However, this role will not automatically be assigned to the primary care physician in the future; quite different players in the health industry will compete for this essential function — and thus for the most promising entry points for successful business models.

INTERPRETATION OF DATA BECOMES THE CORE CHALLENGE

In spite of all the possibilities for making predictions, the practice of medicine still remains a life science which cannot be reduced to mere numbers. The influence of the will to live, a positive attitude, or other soft factors will still be difficult to calculate in the future.

"People today arrive for a consultation with their physician or pharmacist with an entirely different level of knowledge. We no longer make decisions for patients, rather we help them make their own decisions."

Friedemann Schmidt, President, German Federal Association of Pharmacists

In addition, patients today are not yet accustomed to handling complex risk assessments. Even the handling of complex charts and diagrams and the interpretation of images is by no means an easy task for many people. The explanation and interpretation of data and the communication of risks will become increasingly important. For primary care physicians, specialists, and dentists, this means that they will involve their patients more with statistical models and will have to explain them in layman's terms. This is because an understanding of risk data is a central factor in personalized medicine: It is the foundation for preventative actions and therapy decisions. Especially in borderline medical situations, it is difficult to find a common approach with the patient to begin a high-risk therapy or to approach the final phase of life. The health goals of every patient must be developed in a joint discussion and are then used as an orientation framework for following steps. For pharmacies this means that in their consulting role they are included in the patient's risk profile and can offer pharmacological advice on this basis. The derived recommendations are tailored to the individual patient and likewise result from a statistical analysis of patient data. However, these recommendations have to be presented to the patient in an understandable manner.

For physicians, this means that in some cases an uncomfortable consulting situation may arise. And, for some patients, a knowledge about their risk of illness may lead to a fatalistic attitude toward prevention. They will get the impression that their health is entirely predetermined; this can be expressed in a certain kind of nonchalance. If a patient has a lower risk than the overall population, then the impression might arise that prevention would not be necessary. In addition, false information has to be recognized and sorted out. Patients might possibly have wrong conceptions about physiological processes in the body which will have to be corrected. Other patients will request treatments which are unnecessary or inappropriate from a strictly medical point of view, or which are inappropriate for the specific patient. A demand may be expressed here for health products and medical services which is influenced by advertising and discussions with other people, and from sources not based on science. Current heated discussions about inoculations acts in this respect as a small harbinger of the multifaceted confluence of information and interests in medicine of the future. Physicians will learn that their patients will go beyond the advice given to them and will not accept a physician's specialist opinion as the basis for decision making.

In addition to rational motivations, other factors will appear here, such as prior experience, hopes, psychological repression, or personal beliefs or conceptions. These situations must be mitigated during consultation. And, of course, not every disagreement can be removed to the complete satisfaction of both parties. This balancing act will increasingly become a measure of the value of any health consultation.

CONSULTATION FOR THE PATIENT

This process provides an opportunity for all stakeholders in the healthcare industry to become established — again? — as partners to their clients. In the past, many physicians and pharmacists complained about having too little time for the individual, that their functions were fully interchangeable and that they could not perform their actual health commission. Personalized medicine will also change the task spectrum of all employees in the healthcare industry toward more consulting. Due to the availability of copious data on the patient, a holistic consultation will become possible. Data will always be available that indicates the patient's present condition and any current problems. This data is, so to speak, an extension of the physician and an aid in setting priorities and adapting the content of treatment. The patient needs assistance, not only in case of illness, but rather also throughout her entire life journey. As coaches and life consultants, employees in the healthcare industry can again perform their original role as supporting agents, consultants, and sources of knowledge.

The competition for this will be fierce, and patients will be free to seek out their own coaches. In addition to personal consultants, virtual coaches will also compete for patients. Even today there are already providers in the healthcare industry offering their members coaching sessions for stress reduction, on handling diabetes, or who even serve as nutritional consultants. They can be called up online using a tablet or smartphone. Insurance companies are active in this field. Athletics firms like Nike or Adidas provide fitness coaching, whereas other companies offer virtual athletic courses. This development is already quite extensive, primarily in the field of education. Universities and individual persons using Massive Open Online Courses (MOOCS) are offering specialized subject units for students. MOOCS are instructional units offered online for a large number of persons simultaneously. Using the internet, the problem of location is solved and the individual learner has a larger selection of opportunities. This principle will also enter the healthcare field in the future as patients in all areas of life become more accustomed to using internet services. In the future, personalization will mean not only personal contact, but even more: services tailored to personal needs.

All these virtual coaches have in common that they know the location of the individual person due to compiled data, are familiar with his or her health status, and can tailor their offers to each person's individual situation. Due to their multimedia structure, such virtual offers have the added advantage for the patient that they are both entertaining and fun.

In addition, personal consultants will offer their support in the areas of nutrition, sports, and life management. They will be positioned as expert-substitutes who can guide and assist a patient in attaining health goals. They are both the classical specialists in the fields of care-giving, health, fitness, sports, and also laity who have acquired an enormous amount of knowledge due to their own personal experience, or who at least can convincingly impart such knowledge. The representatives of classical medicine will have to relinquish their prerogative of interpretation. Even though the expert/scientific quality will not be at the same level among all consultants, it is still possible to score through personal attention, game elements, and motivational support and regular feedback. And, for many people, health advisors outside of the healing professions are actually an attractive alternative. Since they are available outside of the official system, they are consulted especially regarding health questions which are more associated with an element of shame. For physicians or pharmacists, it will be a matter of creating an offer which is attractive to the patient in these circumstances. "One-size-fits-all" is no longer enough; coaches are in demand who can pass along their knowledge according to a particular situation and take into account an individual's inhibitions and motivations. Anyone who fails to do so in the future will lose patients to the competition.

SPECIALISTS IN THE TEAM

Teamwork is needed to attain the goal of comprehensive patient consulting. The composition of the team will have to fit each individual patient and will have to change over the course of the patient's life. The involvement of different specialists will be governed by what expertise is important for the current phase of the health process, that is, to optimizing current health circumstances. The therapeutic team of the future is not limited exclusively to the medical profession. Individual, personalized patient management could also be provided by an interprofessional team. A team of this kind could make use of different experts and points of view. The opportunity here is to have an actual holistic treatment in which pharmaceutical, nutritional-physiological, social, ethical, mental, or even caregiving aspects are taken into account, in addition to the purely medical aspects.

The expertise needed for the treatment need not necessarily be located on site. Rather it will be possible for the patient to reside in Hamburg, to have a physician in Berlin, an orthopedist in Munich, and if needed to bring in a specialist from Chicago. This allows experts in the health system to expand beyond their customer base; they can offer their services globally.

This possibility will not replace a visit to the office, but will supplement and expand the treatment chain at individual locations. At the same time, medical work will become more flexible — patients will no longer be limited to the hours between 7:00 a.m. and 8 p.m., for example. This brings up opportunities for new worktime models. Health professionals will be able to enjoy an expert's career, such as is already often the case today in many other industries using online communication. Expert careers differ in many respects from classical careers within a company. Experts have specialized knowledge, so that they are sought out for advice. Expert functions include complex specialization and require specialized training and professional experience in the particular field. Of course, experts can be employed within a company, but often their everyday tasks will be structured such that large portions of their work are performed independently and in a decentralized manner.

HOLDING THE REINS: HEALTH COORDINATION

The goal here will be to create a personal health network around the individual patient where every nodal point forms a building block in the care scheme. In the future this kind of network will become larger than today. Not only the individual physician, primary pharmacy, and nearest hospital will be involved. The network will be expanded by additional medical specialists, labs, and companies in the nutrition industry, the pharmaceutical industry, the sports and fitness sector, in financial services, and in the therapy, medical equipment, and IT sectors. Even other patients and independent information

media will have a secure position in an individual's health network. The proper functioning of this kind of personal health network will be ensured by means of a central entity that coordinates all health-related matters. All data from diagnostics and therapy converge here; the individual components of the team will be coordinated toward the goal. Traditionally this function was the sole purview of the primary care physicians. They will still be the central contact point for many people in their personalized health plans of the future. But the controlling function can also be taken over by the play most best suited for a particular cluster of symptoms and for the patient's current phase of life. In the case of a cancer patient, this will be the oncology unit; for a woman who wants children, it will be the gynecologist; and for an elderly person interested primarily in assisted living, this could even be a caregiver. Initially this controlling function will appear primarily for complex clinical pictures and then increasingly will be reflected in the daily routine of healthcare.

Of course, not all nodal points of a person's health network will be operating at all times. The activation of individual nodal points for a limited time can be triggered by the health circumstances of an individual person and controlled specifically by that person with the support of the healthcare coordinator. Even the coordinator will not always have to be the same person. Due to the ease of data transfer, a change in the primary contact person will also be simpler in the future. Oversight will be assured and information will be retained and further supplemented. However, in the future even other occupational groups and new actors will take over this function. The coordinating function in the personalized medicine of the future will no longer automatically be linked to the primary care physician, and even more: It will not necessarily be linked to medically trained experts. There will be a competition concerning who will assume this role. Because: Whoever owns the controlling function will have an important role in deciding who is accepted into the network and who will perform what function in the provision of medical care.

THE INTERCONNECTION BETWEEN PLAYERS

Previously many players in healthcare have operated independently of one another, even though medical practices, hospitals, pharmacies, and other service providers are linked together at the procedural level. A loose connection is created due to referrals, prescriptions, and shared examination reports. Examinations are often even duplicated because the next provider in the chain has not seen the previous findings — raw data and its interpretation — and begins the diagnosis anew. Diagnostics reports are not linked to discussions about assumptions or observations. Today we are already seeing indications that this will change dramatically in the coming years. Some telemedicine networks are already in operation which take X-ray images or computer tomographs generated in one clinic and have them evaluated by specialists in another clinic. There are also expert teams that jointly discuss the treatment and in which different disciplines have an equal right to contribute to the solution. Due to the complex treatment regime in the field, oncology is a forerunner here. In the future this will also appear in other disciplines. Obtaining a second opinion before surgical intervention has long been the standard today, but in the future there will be greater interaction among medical professionals and an expansion of the parties involved. The physician will be in communication with the pharmacist, the pharmacist with the lab, the dentist with the physician. They will all communicate with the patient, who thus moves into the center of the personal healthcare network. In parallel to this, the attitude of many physicians will change: Teamwork will be a matter of course, especially for the coming generation of physicians. The image of the lone demigod in white belongs to the past. Communication and joint decision making will be in the foreground. These working structures are already familiar to physiciansfrom school, university studies, and their private living environments. And they will bring these structures with them into their practices and clinics.
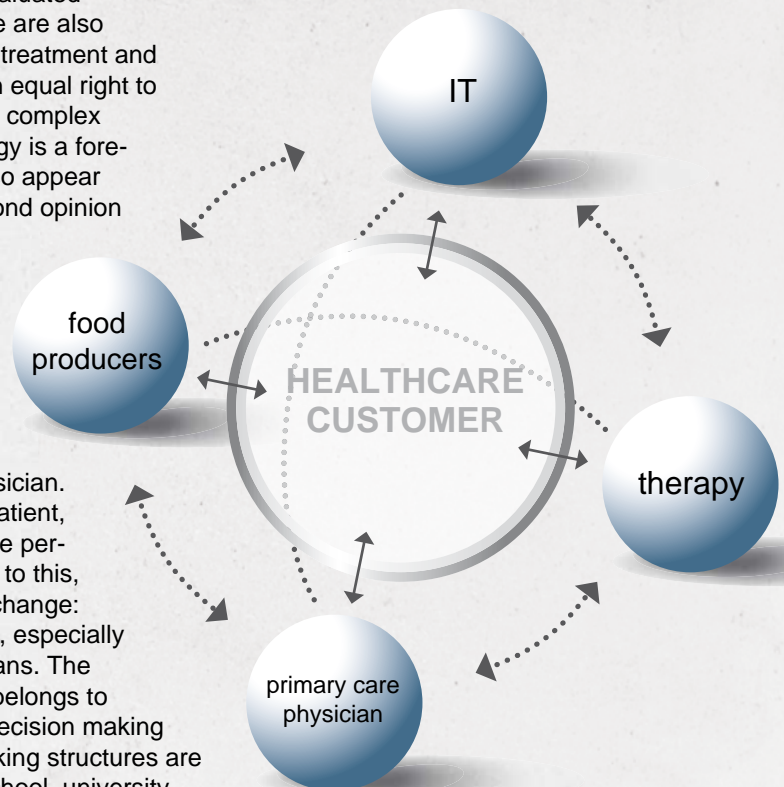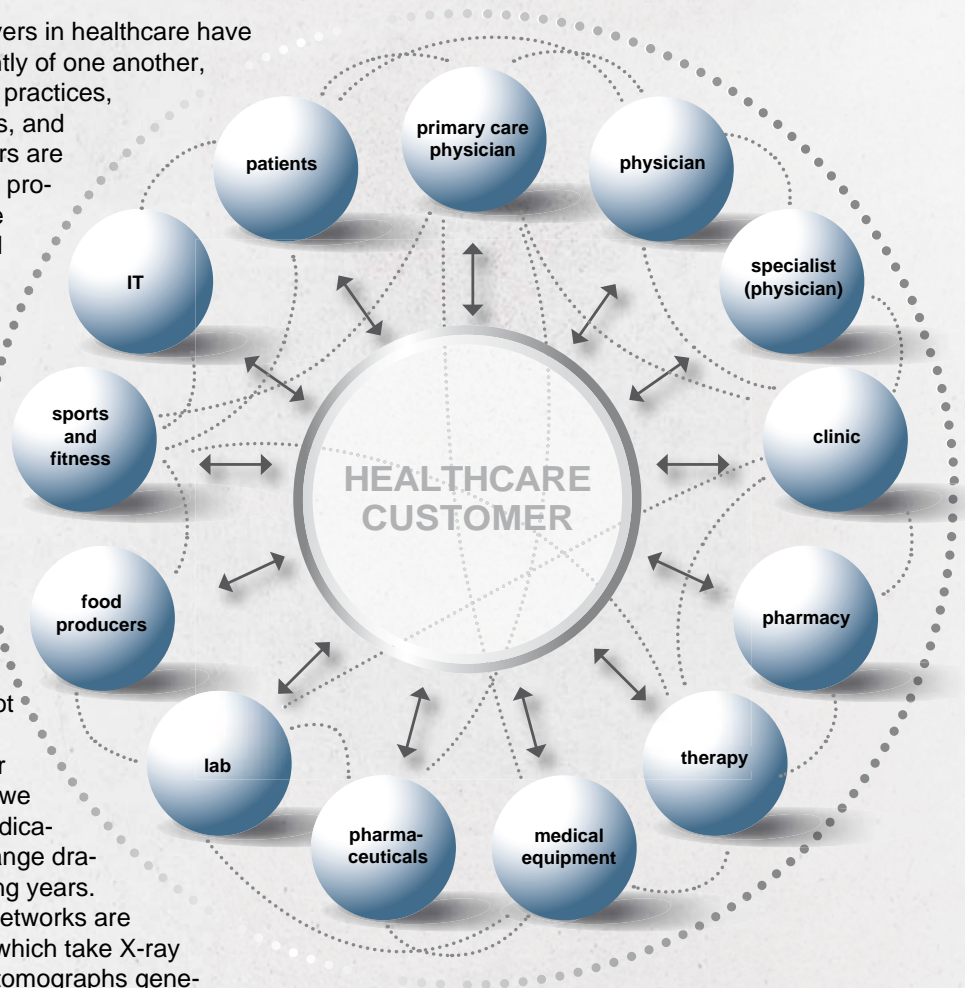
TREND AREA 2: DIGITAL PROCESSES

In the matter of personalized medicine, data will have a controlling function from beginning to end in medical processes. For the physician, the pharmacist, and above all for the patient, maintaining an overview is essential. It will be a key challenge to establish links between these sources of data and to make optimum use of the data potentials. Physicians and pharmacists will have to get used to the idea that both they and their patients will have internet access everywhere and at all times. Clinics will rethink their procedures, and drug and diagnostics companies will expand their range of products. This opens up an opportunity for the intelligent electronic assistants of the future which support, and sometimes even specify, decision making in the realm of health consultation. Apps and IT-based algorithms will help to compare patient profiles and to identify the best diagnosis or therapy options.

TREATMENT PROCEDURES BECOME MORE COMPLEX

Medical treatment procedures used to be guided by the comparatively simple principle of cause and effect. Therapy decisions were based on lab values, often supported by imaging methods such as X-rays. Physicians then interjected their knowledge and experience into the next step of diagnosis or treatment. These principles of cause and effect will become far more complex due to the data available in the future. The genetic profile, the probability of developing a disease, the patient's history and that of the patient's whole family, and the patient's lifestyle — all these factors will play a part.

WHOEVER HAS THE DATA HAS ACCESS TO THE PATIENT

The increasing volume of data about the individual patient represents an immense opportunity for primary care physicians, specialists, dentists, and pharmacists. And equally also for providers of medical equipment and products, and for companies in the pharmaceutical and diagnostics industries, all because this data creates greatly improved circumstances for the individual tailoring of diagnosis, therapy, and healthcare products. Diagnostics and therapy will be coordinated with information about the patient's lifestyle. Today data regarding, for example, physical activity, prescribed medications, eating behavior, or routines of dental hygiene is often collected using a questionnaire. In the future, it will be a matter of evaluating the data collected by the patient's smartphone and the smart objects at her home and using them for the consultation, because all this data is already available. The smartphone already knows how active a patient is on a daily basis. The app can estimate quite well how many calories a patient consumes each day. The first connected dinner plate that will document and analyze meals will arrive on the market. The toothbrush with Bluetooth functionality will know how often and for how long a patient brushes her teeth. A pillbox with internet connection can tell whether medication was taken at the proper time. The challenge will be to collect this data reliably at high quality and then to process it. Even today it is possible to connect a smartphone to high-precision measuring instruments. In 15 years, the collection of data using smartphones and wearables will be commonplace.

WHOEVER HAS THE DATA CAN STEER THE PATIENT

In the future it will be possible not only to obtain data from smartphones, but rather also to send the patient virtually direct recommendations based on this data back over the same device. It will be possible to monitor and analyze the person's daily routine based on current data. The existing data about an individual will allow him to largely steer his everyday habits toward a healthier lifestyle. Many preventative recommendations fail today because they ignore the individual's daily routines or the recommendations given cannot be easily followed. We will soon have intelligent assistants that obtain their intelligence from daily, routine data and can adapt the recommendations individually. The objective is to use these innovations to maintain personal health. For primary care physicians, trained physicians, and dentists, this represents an opportunity to guide patients in their everyday routines, in real situations, to face real everyday challenges. This even represents an opportunity for pharmacies. Patients do not always have to come to the pharmacy to benefit from a healthcare proposal. Pharmacies can extend a helping hand into the patient's life and guide them in their everyday routine. The use of different sources of information and guidance on the internet will enhance the consultation that follows. There will be a real fight over the data here. It is even expected that both state-run and private commercial institutions and companies will compete for access to the customer.

SALES BECOME PERSONAL

As internet usage becomes universal and ubiquitous, marketing in the healthcare industry will tend increasingly toward the creation of digital brands. Targeted customer groups will be approached along different channels, such as Facebook, Instagram, or YouTube. The challenge is to find the right channel and the right approach for each target group. Also, the approach will be personalized for each patient. The goal is to have relevant information ready for the customer and to bring the customer into contact with the product in relevant situations. Without relevance to the customer, there will be no sale. This trend will occur more slowly in parts of the healthcare industry than in many other industries. This is because the digital channel today has a rather lesser significance due to the relatively advanced age of customers needing certain products or services. But this will also change in the future. Firstly, the usage behavior of older people will change, and secondly, new customer groups can be exploited.

Thus both healthcare providers and also individual products will become digital brands in the coming five to ten years. Don't just rely on your current market position! The demands of sales and marketing will change, and thus the old rules of the game will no longer apply. Companies from different industries will have far greater competencies and experience in the preparation of online product landscapes. Diagnostics and pharmaceutical companies in the future will have to make enormous efforts to keep pace here.

DATA TAKES THE LEAD ROLE

These developments will cause changes in procedures in hospitals, medical practices, and pharmacies. The entire treatment chain of the future will be data-centered. There will no longer be a defined zero-point for beginning the collection of data. A patient's data will be continually supplemented and updated. New data will enrich the already existing data and will determine the steps in treatment and the specialists consulted for the treatment. Additional therapy will be specified based on daily evaluations.

This data will by no means reside with only one provider or only in systems like electronic health cards. Rather the collection of meaningful data will proceed along new, innovative routes and decentralized methods. This will result in data silos: Health data is not inherently portable and randomly combinable since the providers will consciously create these island solutions so as to obtain a competitive advantage. In this way they can improve customer loyalty to their own medical services.

Efforts to standardize the data are time-consuming and expensive. But computational power will continue to fall precipitously in price while the capabilities of data-analysis systems increase. This justifies the expectation that computers will be able to produce and interpret ordered relationships from a mass of data taken from different sources. Today's lump-sum billing will not be able to reflect this. A patient's data will guide her pathway from prevention through diagnosis, therapy, and follow-up care, just as a navigation device guides a vehicle through traffic. It detects potential traffic jams, guides the user along the best route, and has all the right information about service stations in the area. In the same way, the data will determine the patient's route along the healthcare system. The pathway will be opened to the goal of each patient, depending on the initial circumstances, condition of health, and the risks present. And the goal can change during the course of the trip — the system of medical experts is flexible and can adapt the treatment plan to cutting-edge data.

The system keeps possible alternative therapies at hand, and can even forecast the duration and costs with sufficient accuracy. For example, the patient and everyone else involved in the treatment can see the present status and what steps are still planned. This provides the necessary transparency for all parties. It is also an important factor in motivating the patient to continue the treatment as planned, since the consequences of any deviation from the plan can be explained to the patient at any time. Patients can directly confirm the effectiveness and reliability of the treatment and receive feedback in this way.

NEW BUSINESS OPPORTUNITIES FOR HEALTHCARE COMPANIES

The volume of information will become so extensive that it will no longer be manageable without additional support. To respond to the requirements in a personalized manner and to satisfy the needs of the individual, all participants in a personalized health network will need to be familiar with the specific case. This will require intensive and accurate work — and assuming a continuing increase in the volume of data — would even necessarily overtax the healthcare system if the various parties do not receive active support. This role will be taken over by the emerging new technologies of data merging, analysis, and interpretation. They reduce complexity and allow the users to function with greater precision and independence in different personal healthcare networks.

"Information will become so complex that we will not be able to integrate it in the available time. One person simply will not be able to do so. We need technical support in order to process everything."

Prof. Frank Ulrich Montgomery, M.D., President, German Federal Board of Physicians

Technical systems will group, display, and relate items of information to each other for physicians and pharmacists. Then, building on these results, medical expert systems will point out relationships between the data and make certain that the practitioner's attention is directed toward what is essential. Digital innovations will make it possible to make better decisions faster within everyday routines. Vendors of smartphone systems such as Apple, Google, Samsung, and Microsoft are already offering industry solutions for handling vital data and for the implementation of studies. Apple is the leader; their "HealthKit" system is already being used in pilot projects by the majority of leading hospitals in the USA. Initial trials with cognitive expert systems are very promising.

At IBM Watson, the bridge has already been built from human speech to medical decision-making. The system has generated innumerable published studies and the content has been processed semantically such that it can even make effective recommendations for therapy based on patient data. The greatest success in the pilot projects has been achieved chiefly in orthopedics and in cancer therapy. The electronic system can deploy its particular strengths in an excellent manner here, since both the multiplicity and timeliness of the studies is decisive, and also the needed computational power for individualization is high.

Politics in the USA, which represents the leading market, has paved the way for a transformation in the financing of health services. In the future, greater emphasis will be placed on the positive outcome of a medical service than on the mere procedure. The lead function of medical data can have quite a cost-reducing effect for service providers. For hospitals, the continuing treatment of patients and their follow-up care at home will become less cost-intensive as long as medical personnel can ensure that the hospital is informed at all times about the patient's condition. For example, if the collection of vital signs occurs via mobile terminals, there will be a cost savings for providers since a smaller amount of outpatient and inpatient medical services need be kept on call.

In the future this will mean that even in other areas, expert systems will independently support the search for a suitable therapy. They are capable of comparing data from tens of thousands of people with those of the patient, then recognize patterns and prepare a medical roadmap base on the mass of information. This data will be provided to the physician in the form of a graphic display which can be evaluated just like an X-ray image or a computer tomography image today.

Technology will also assist people in regard to the indexing of information. In the future patient reports will no longer be a chronological sequencing of findings, diagnoses, or lab values. Technology will make it possible to group the available information logically with respect to one particular problem and to visualize it as needed. The information will exist with different levels of detail. There will be both overview information with a reduced volume of data and also highly detailed portrayals. The user will be able to go more in-depth as required. This ensures that no information needed for a medical decision will be lost. Medical expert systems will provide security in the form of intelligent guidance in the hectic routine of medical practices, pharmacies, and hospitals.

Just as the guests' requests are saved in a hotel's CRM system today, in the field of healthcare there will also be systems that guide the individual employee.

Even today there are protocols in place in emergency medicine and in the operating room that are a permanent component of everyday practice. Index-card systems will be replaced by digital assistants in all areas of medical services. Medical guidelines will be adapted by apps according to the particular situation. Intelligent systems can link protocols with each other and respond to inputs and to information already stored. For the patient, this does not primarily represent a kind of restriction or external determination, but rather an improved level of assurance for the patient. In this manner a high quality of medical services can be assured.

This development offers opportunities for diagnostics and pharmaceuticals companies to expand their product ranges. In the future medications or medical apparatus will not be purchased alone, but rather in combination with services for the clinical user and also for the end consumer — the patient. Consultation, quality assurance, the coordination of procedures, and training are all areas where companies outside of the industry will offer services in the future. Therefore it is important not to let these areas slip out of your grasp, but rather to specifically input your own know-how.

CLINICS WORK COMPATIBLY

Especially with regard to inpatient clinical treatment, it is important to interlink the individual specialist departments and to profit from their available expertise. The greatest obstacles in doing so are, firstly, the difficulty in merging data on the patient, and secondly in overcoming the existing hierarchies and professional boundaries.

"In comparison to many other industries, healthcare is still in its infancy in regard to data exchange and usage."

Dr. Matthias Essenpreis, Chief Technology Officer, Roche Diagnostics

The electronic health card project and the vigorous disputation the question access for individual professional groups, of data storage and protection, show that this problem in healthcare is a highly complex one. A quick resolution cannot be expected because the matter deals with both highly confidential, yet simultaneously also necessary data to allow proper medical treatment.

With our high standards in data security, Germany is playing a leading role here. Many other European, and primarily also non-European, countries are comparatively even farther ahead in the linking and disclosure of data.

But even the best data linkage is of no use when the professions within the hospital or within hierarchical levels do not use the data collectively. Here, too, oncology is impressively showing the increased added value for the patient stemming from an interprofessional tumor board which discusses individual cases and treatments. The strict top-down approach still frequently encountered in many areas means that some potential solutions will not be addressed or discussed. This frustrates not only the individual employee, but also jeopardizes the implementation of the highest-quality treatment for all patients. Thus data exchange is a question not only of access to data for the individual, but rather of the provision of information to a number of team members.

A NEW GENERATION CHANGES THE USE OF TECHNOLOGY

Any university student today who will soon be entering the professional workforce is familiar with technologies. The coming generation is working with tablets and smartphones instead of pen and paper. Apps will commonly be used for communication, navigation, and for shopping and leisure.

"Physicians in training today will not want to use any paper in their future practices. They want modern communications methods. They want to be able to analyze patient data on a touch screen and get a report at the press of a button which will reinforce their therapy decisions and simultaneously also include cost accounting."

Dr. Matthias Essenpreis, Chief Technology Officer, Roche Diagnostics

The generational change will also bring about a change in the use of new technology. Things that are viewed as sensible in everyday life will also be demanded in the workplace. In the area of data visualization, the coming generation of physicians will expect solutions that they can use both for diagnosis and also for consultation with their patients.

MELDING OF SOLUTIONS

In the future it will be possible to support the entire treatment chain with digital technologies. Often today it is the individual solutions that fail since they only reflect a small part of the overall process. There are already smartphone apps that can store daily blood pressure values, sensors in bathroom scales that automatically record body weight, and methods to send this data to the family doctor. But in the future all these measured values will be interrelated. The physician will automatically be alerted if any alarming values are reported and the first instructions for subsequent conduct will be provided to the patient immediately. Any required office visit will be coordinated with the treatment team based on available lab values and, of course, under consideration of its urgency. Therapy options can be discussed and planned with a cardiologist and therapy compliance will be monitored by a pharmacist in real time by sensors on the medication dispensers. Pharmaceutical companies and the manufacturers of diagnostic products can play a leading role here. It will be important to infuse your own strengths into the healthcare network and create a transparent product for the patient. For example, individual steps can be combined so as to merge the components into one overall process.

CONTROLLED, AUTOMATIC, OR AUTONOMOUS?

In the healthcare industry of the future, there will be areas that will be taken over in a controlled manner, automatically, and autonomously by digital assistants. This trend can already be observed in other industries. Complex processes will become more and more automated. By no means will this merely be a matter of manufacturing the necessary components or setting up production lines in industry. The automated control of aircraft and the operation of self-driving cars show the potential waiting to be exploited in information technology. These developments will be accelerated primarily by the expanded possibilities for data evaluation. Information technology today is capable of creating ever more precise and reliable algorithms for the control of processes and even of entire systems. We should not be deluded: Digital expert systems are superior to people when it comes to sorting gigantic amounts of data. They are never tired, or emotional, and they never forget. Physicians must get used to the idea of grappling with the gathered data and with the resulting recommendations. There will be cases in which a physician will not entirely agree with the digital system. In other situations the physician will come to a different conclusion. The question remains: Who then decides? Or more precisely: Who can make better decisions?

Whom does the patient trust more? And: What criteria will be used as the basis for making this decision? An additional factor is the quality feature of response time. Regardless of the specialty, customers and partners expect a rapid response, an optimum total time, and fast reaction to any arising problems. This applies equally today in medicine. Processes will have to be further automated simply to keep pace here. In this way a parallel processing of tasks can be achieved so that more can be done in a shorter time. The classical representatives of healthcare professions will also have to deal with these changes in framework conditions and – from the viewpoint of the patient – standards.

Fully autonomous systems in which the human is replaced entirely by a computer and the system takes over diagnosis and therapy entirely on its own cannot be expected in the near future. This is partly due to the current state of technology. And in addition: Some necessary preconditions for the use of such systems in healthcare have simply not been clarified to date. This relates primarily to the question of liability in case of system error. Many experts report their fear that IT-based systems will be a kind of impenetrable black box that cannot be checked. Or even that incorrect linkages cannot then be detected. In addition, for some of the experts it is also quite imaginable that the underlying algorithms will not primarily be directed toward the patient's well-being, but rather that it might be possible for interest groups to influence priorities here. A third factor is also blocking autonomous systems in medicine. Their use affects primarily the physician's own self-perception. The question of the role of the physician's intuition in the treatment process and how the interplay between man and machine can be intelligently structured are important building blocks for the successful implementation of digital assistants.

TECHNICAL SUPPORT FOR THE PATIENT

What applies to physicians and pharmacists applies equally well to the patients. The patient in the year 2025 will, in many cases, have more confidence in her smartphone than in an unknown physician or pharmacist. Because the smartphone already advises her in all of her daily situations. People will confirm this experience in everyday life, in the most varied circumstances of life and work. A connected device will not only know the patient, but even within fractions of a second will know what the patient's complaints are, what medications were last taken,

or what therapeutic treatment was last discussed with the patient. With these capabilities, electronic assistance systems will be able to give the patient much better, more individualized answers appropriate to the situation than can a human health consultant.

DATA SECURITY BECOMES DATA SOVEREIGNITY

Of course, all these forecasts will only prove to be valid when people release their personal data and data regarding their activities for this kind of everyday analysis and forecasting. Specifically in the realm of health data, the assumption is justified that people would certainly be reluctant to do so. One relevant concern here might be that the data could be used by health insurers to exclude people from certain rate structures. Or that employers will analyze the data to check the performance capabilities of potential employees. The concern on the part of many providers in the healthcare industry is that health data will be hacked and sold to companies. And of course, our understanding of data security will undergo a paradigm shift. The fundamental assumption that people will not want to divulge their data originates in thinking from the 1980s. But the populace today is living in a more open, transparent world. They do not want to keep all their personal data secret, but rather will release data when it can be meaningfully used: Data confidentiality versus data benefit. Privacy by design will become the basis for the development of new software modules or even apps. Data security will still be important, but different. Data security in the future will mean that the patient retains authority over her data and will decide how it is to be used. With one click, patients can review information stored about them, then change or delete it. Patients will have the power to determine who among their health networks, their physicians, their care landscapes, and their surroundings has access to their data. This will exceed the capabilities of many people. However, it will not fundamentally impede the trend. Because just as tax advisors, experts, and other professionals help to make complex circumstances understood, this circumstance will also help to create new service offers.

Medical data networks will become clearly delineated: What data will be visible for every provider, what will be partially anonymous, and what will be entirely private? Players in the healthcare industry of the future will not be interlinked directly, but rather will be connected through their access to the data sets. These data networks will grow.

They are complex, and in the future will be highly important for methods and processes. And they will not stop at national borders. This factor alone underscores the mode of operation of existing data security mechanisms.

This transition is fundamental. All players in the healthcare industry must face the question of whether they intend to participate in this trend. And they must also face the alternative: Anyone who does not have access to these data networks will struggle with clearly less-favorable circumstances for becoming a part of tomorrow's personal health networks. These players will cheat themselves of an opportunity to operate in a medically meaningful manner, an opportunity for feasible business concepts. They will lose patients and healthcare customers.

USING DATA QUALITY TO CREATE SECURITY

Many patients today have the feeling that exams are being duplicated. Even data that has once been collected on a user's smartphone will be viewed with a certain skepticism in medical practices and hospitals. If in doubt, it simply just better to check the values again...

"Today it is simply unjustifiable for a patient with different symptoms to go to different doctors and each one performs the same check from top to bottom."

Dr. Peter Engel, President, German Federal Dental Board

This reticence is understandable, because if data forms the basis for a medication, therapy, or prognosis, then every doctor will want to ensure that the database itself is correct. Trust is good — but control is better. Data that is collected in a hospital or medical practice is measured with equipment certified for medical use and regularly inspected. In addition, these devices are operated by trained personnel. The environment is controlled and the results are reproducible and verifiable. But all this does not apply to self-collected data in the patient's own personal environment. So who is responsible? The patient? The manufacturer of devices or apps? Or ultimately the physician or pharmacist? Until the question of liability for the accuracy and reliability of data has been answered, it will also be difficult to use the data already available in a professional context.

But there should be no doubt: The quality of values measured by wearables and smartphones has improved enormously in recent years thanks to optical sensors, more precise algorithms, and improved battery capacity. Camera resolution has also increased enormously and will continue to be expanded.

INTEGRATION OF DATA STREAMS AS PREREQUISITE FOR HEALTHY LIVING

The picture of the future at this point is crystal clear: The possibilities for comprehensive data collection and evaluation will increase significantly. Technical innovations will allow the collection of medical data of verifiable quality outside of medical practices and hospitals. The new players on the healthcare market are already using this data today.

The demand from the customer side will increase. The possibilities for data linkage will be used more extensively in the patient's personal healthcare network. Those companies and practitioners in the healthcare industry who succeed in incorporating this data into their routine processes, who properly estimate the quality of data and can standardize it to the necessary extent, and who tie in with the developing personalized healthcare networks will obtain a decisive advantage over the competition. Whether from the corporate or from the practitioner's perspective: Whoever falls behind in this regard will be cut off from the possibility of being actively involved in the personal healthcare networks of their customers.

TREND AREA 3: PERSONALIZED MEDICINE CHANGES THE VALUE-ADDED CHAIN

Personalized medicine will fundamentally change value-added chains and today's standard modes of operation. The increasing volumes of data and the expansion of digital processes will change research and development, the manufacture of medical products, marketing, and distribution. The focus will be aimed at shorter development times, smaller target groups, and lower-cost clinical test series. This will mean changes for medical practices, hospitals, pharmacies, and in fact all companies in the healthcare business. Former competitors will become occasional partners — and all parties involved will have to get used to a faster pace.

RESEARCH BECOMES PARTICIPATORY

Due to the digital processing and global networking of collected data about the individual patient, the opportunity will arise to compare a number of features among different groups of patients. Patient platforms in particular will use and support this development. On these platforms, patients can share and compare their diagnoses, symptoms, and therapies with one another. The afflicted will find counsel there from others affected by the same maladies. The conclusions derived from such data is very powerful due to the large number of patients. Patient platforms offer a genuine advantage for people who want to improve their health and well-being. The route they will take? Sharing and comparing data. For the afflicted, this represents a hope for better, more successful therapies. For the severely ill, these platforms offer the hope that by providing their own data, they may at least help others.

Whereas formerly biological and molecular research has been the starting point for innovation, the picture of the future will be more diverse due to open innovation. In particular the possibility of involving and including the patients makes it possible to approach the innovation process from the perspective of the user. Thus the responsibilities in the product value-added chain will also change. Employees who are in direct contact with the patient will no longer be responsible solely for the assurance of quality service and distribution to end consumers in the future. Rather, they will become a starting point for new products which will necessarily involve biological research. Patient platforms in the future will not only be another distribution channel, but rather also a starting point for new products. Specifically in the case of rare diseases, knowledge will be generated on patient platforms that can be highly relevant to classical research. These platforms can provide scientists with data from the patients' everyday routines. Research projects in hospitals can be expanded with this treasure trove of data. In this way the artificiality of the laboratory situation can be overcome in the healthcare research of the future, in particular wherever the subjective observations and views of patients are supplemented by data collected from their smartphones or from sensors in their domestic surroundings. The research approach opened up in this way goes clearly beyond former practice: use of the data for greater society and the generation of an ever-greater volume of data, both throughout Germany and around the world. And, bit by bit, an extensive knowledge base will be constructed so as to develop, test, discard, and then advance the hypotheses of health science. Partnerships between public and private institutions are one way to benefit from these potentials.

Due to global interconnection, a volume of cases can be obtained that would be difficult to find in domestic programs. In addition, these platforms will provide an opportunity to recruit subjects for studies and to make contact with afflicted persons who heretofore had no point of contact with classical medical or pharmaceutical research. In the past, persons who were presently ill could hardly hope to benefit from new developments. Until the knowledge gained from research led to the development of new medications or products, or to changes in therapy regimens, years would pass if not decades. This too, will begin to change due to personalized medicine. There is a chance that patients and researchers will cooperate anew and that the result will be a real win-win situation.

LEAVE THE BLOCKBUSTER BEHIND

To bring a new medication onto the market today represents a significant investment in research, development, and approvals. In the years following initial approval, this investment must be recovered under the granted patent protection. A rule of thumb states that a medication must have an annual sales potential of $500 million to cover the costs for research, developmen, and marketing. The current business model in the pharmaceutical industry aims to develop medications for large groups of patients — these medications are known in the industry as "blockbusters." The blockbuster model makes financial sense in terms of recovering such immense investment expenses. But, at the same time, this means that promising medications that fail late in the approval process represent an enormous financial burden for the individual company. And equally so if it turns out during pharmaceutical testing that the initially assumed target group is much smaller than forecast.

In the future, business models will be required that link the products to a service solution and thus create a genuine added value for the customer. Global competition will no longer permit merely the offer of a good product. Given the large number of competitors, a product offered in isolation is often largely interchangeable with other alternatives. However, if it is offered in a package linked to a relevant service, then a company can increase customer loyalty for the long run. This trend is already evident in many industries, but it will not spare the healthcare industry; the demand from customers and patients results from the growing importance of consulting and the coordination of product offerings. And this means new opportunities for companies. Pharmaceutical companies in the future will develop more service solutions for their customers.

And medications will be offered as a package deal, including shipping, health information, and supplemental products in one package. When an individual company is not able to achieve this product bundling, then cooperation with other companies – even with competitors – will offer a viable opportunity.

APPROVAL OF MEDICATIONS BECOMES ADAPTIVE

The enormous cost pressure for the development of medications has currently triggered an active search for innovative ways through the approval phase. In addition to the optimization of current internal methods and processes, an approach aimed at developing adaptive approval methods has opened up enormous opportunities. This approach conveys the logic and demand structure of personalized medicine into the development phase of medications: A flexible response to the results of intermediate phases is possible during the approval phase. The regimens will become less rigid, and the subjects will be divided into smaller groups. The experts interviewed indeed point out here that a smaller group of patients does not necessarily mean a savings in expenses. And likewise it does not mean that the price for medications would have to be higher for a smaller group. In turn, it follows that a smaller sales market is only financially feasible if costs for research and development phases can be reduced. And this is where the experts involved in this study see a significant effect of personalized medicine. In the future, medical developments will trend away from blockbusters toward smaller sales markets.

"In the method of adaptive design, patients are collected into so-called 'baskets' according to particular molecular markers. Then a check is run to determine whether there are any indications of successful treatment in these groups. Then this branch of the study is enlarged, and the other, seemingly unsuccessful ones are dropped. This is how the study can adapt itself to these developments while it is being conducted."

Prof. Christof von Kalle, Ph.D.
Director of the Translational Oncology Department at NCT and DKFZ

These groups begin with different regimens and are evaluated at regular intervals. Depending on the success of the groups, these will continue in the study — or not.

Thanks to personalized medicine, the criteria for the inclusion and exclusion of participating subjects can be better defined so that a targeted search is possible. Studies can also be conducted independently of a particular site and managed from a virtual study center. Adaptive study designs can reduce costs for approvals because it will be possible to obtain the required evidence with smaller groups of patients. And this provides an opportunity in particular for smaller and medium-sized companies. Due to falling costs for the approval process, niche products will also become financially interesting. Costs will become more manageable and thus new markets can be exploited.

However, the experts do see the potential danger here that medical standards may be undermined during the continual adaptation to findings obtained in small patient groups. The experts point out that such shortcuts in research and approvals might come at a cost to the patients. A new definition of quality criteria for approvals is needed here, which leaves more room for an innovative research regimen, but at the same time assures the protection of patients and ensures safety in use of the medications. If these quality criteria are not discussed and worked out jointly by society, public-policy makers and companies, then in the future research will continue to concentrate primarily on large groups of patients with large anticipated profits. This would have an adverse impact primarily on patients with rare diseases for whom the development of a test or therapy is not financially feasible.

CHANGING IMPORTANCE OF DIAGNOSTIC PRODUCTS

Personalized medicine will cause a change in the relationship between therapeutics and diagnostics. Formerly therapeutics were the lead product. In the future there will be more companion diagnostic tools in which a diagnostic test will be offered in tandem with a given medication. The test is packaged with the medication and its purpose is to predict the effectiveness of a therapy. The majority of companion diagnostics today is focused in the area of oncology, but the field will expand together with the overall market. The more specifically a therapeutic product is aimed at small and highly individualized patient groups, the more heavily diagnostics will become companion diagnostics without which the therapy itself would not be marketable. If a diagnostic test is absolutely necessary for a medication, then the question is one of where, and what are, the individual components of the value-added chain within the company. This factor will have an effect on the price structure of therapies and diagnostic products.

Usually in the past diagnostic products were compensated for according to the actual costs incurred. This model no longer fits with diagnostic procedures which specify the use of an entire therapy regimen. In the future, prices will be reflected according to their central role in the healing process. Cooperation between the classical manufacturers of therapeutics and diagnostics companies will thus be worthwhile, since formerly separate business models will blend into an integrated business model.

COMPETITORS BECOME PARTNERS

Of course, this cooperation between former competitors will face certain challenges. Not only will these companies develop entirely different products, but even their present customers, customer sales approach, and financing rationales are entirely different. The direct customers for traditional pharmaceutical companies have primarily been physicians in private practice and in hospitals. Direct customers for the manufacturers of diagnostic products today are mostly independent labs or labs associated with clinics. For the successful sale of their products, pharmaceutical companies primarily emphasize their unambiguous clinical benefit, whereas for diagnostic products, usually technical aspects form the main argument for a sale. This will also change access to the market. Whereas previously a company's marketing strategy, its speed on the market, and the sales prowess of its sales staff were the key factors in determining how many patients could be reached with a medication, in the future this role will be filled by a test. For the pharmaceutical industry, the sales price is particularly important; for the diagnostics industry it is the volume of sales. In addition, questions of workload capacity and ease of use are important for the diagnostics industry. For the pharmaceutical industry, in contrast, the focus lies in cost coverage and possibilities for clinical use. In the future, these product packages will be more significantly tailored to one another. Thus companies will exploit the opportunity to use and to benefit from the strengths of both industries through joint research, development, production, and distribution. This means that both financial assets and also know-how will have to be exchanged. Thus the entire care chain can be mapped through this kind of cooperation.

FINANCING OPTIONS FOR HOSPITALS

Personalized medicine has long been standard procedure in oncology. There are many other areas, however, where the services of personalized medicine are still in the trial stage. This is because the financing of services and of digital healthcare products is often yet unresolved and is by no means uniformly regulated. This creates a difficult environment for the continuing development of innovative approaches. Nevertheless, if a hospital desires to include these services among those offered, then financing will have to be provided either from government subsidies, by partial financing from the hospital's own funds, or by financing from insurance companies based on a separate claim made by the individual patient. All three methods, however, involve additional funding and, above all else, the equal personal involvement of physicians and patients. To file a petition for coverage by health insurance services outside of the standard coverage, expert assessments will have to be written and the patient will have to contact the insurance provider directly to obtain the services in question.

The consequence is that these services can only be obtained by patients who are willing to go through this process. For hospitals, this means that they can potentially expand their services, but this is involved with the risk of suffering financial loss. Yet despite this dilemma, hospitals are the strongest players and are in a position to be the pioneering innovators for personalized medicine. Because with their large number of patients, only they can demonstrate the clinical benefits of a new product or of a changed treatment chain. In the future as well, this will be the prerequisite for transitioning from the innovation stage to the standard treatment phase. And this means that hospitals will have to be involved in the development of medical solutions and in pilot projects, and will thereby also bear a portion of the financial risk. Due to their proximity to universities and research centers, they provide an optimum focus for trying out new developments. This is an opportunity to differentiate oneself from the competition and to enhance one's own service profile. In the future this will become increasingly a criterion by which patients select their service provider. Personalized medicine and digital support is desired in the public policy agenda, which opens up opportunities for financing as well. Funding is already available for the implementation and commercialization of innovations. This represents an opportunity for hospitals to begin actively fundraising in the same way that universities and companies have long been doing. Of course, this presumes that even clinical employees will have the latitude to cooperate in scientific endeavors.

And in turn, this presumes that the objective is not dependent solely on some individual career considerations, but rather that each hospital will prepare an agenda for its own future profile and bring it to fruition. Anyone who wants to be viewed as a pioneer here will have to act as a coordinator for relevant projects, and cannot operate exclusively as a clinical cooperation partner and clinical test site. Here too, the coordination of health-promoting network activities will gain considerable relevance.

PERSONALIZATION AT THE PUSH OF A BUTTON WITH 3D PRINTING

Processes are changing rapidly — not only in the field of research and development. The production of healthcare and medical products is also changing. And 3D printing is primarily responsible. This technology is by no means new. But the rapid advances in processed materials, in the possible combinations of materials, in the speed of the printers, and even in the purchase prices for the printers themselves are in fact new.

3D PRINTING

3D printing is a creative manufacturing method in which three-dimensional shapes are produced from various substances. The production itself, known as the print, takes place on the basis of a three-dimensional model, and the starting materials are applied in layers. The development has since progressed to the point where, besides paper, concrete, metals, resins, ceramics, plastics and many other materials, now even biological material can be used. As far back as 1983, the American Chuck Hull developed the first precursor, and three years later had the method patented. The construction of complex shapes in one procedural step is possible without loss of material or the prior preparation of molds.

3D printing in industry is not just an idea for the future; rather it has many uses, from the production of prototypes and patterns, to that of unique items or products in small batches. Its uses extend from the printing of marketing gadgets to the 3D printing of entire houses. Pioneers in the use of this technology are the automobile industry and the aerospace industry. Originally the technology was tested and used in the medical field. Since then, other industries have long ago surpassed medicine here — especially due to the prerequisites for use, which are disproportionately more difficult in the health business.

In other industries the use of this technology occurs in three comparatively simple steps. First, based on the design concept, a model is prepared from a CAD file, which is then printed and thus leads to the end result. The value-added chain in the medical industry is incredibly more complicated. For medical uses, CAD-based files must be prepared from the available patient data. Then biocompatible materials are needed for the print which meet the most demanding specifications. And, after the actual print, the products must be approved for use in the patient. In the past, all these steps were associated with enormous costs and were thus not feasible for medical technology. The industry is catching up, however. Expiring patents for printing methods have allowed costs to fall further. In addition to falling prices, the increasing possibilities for data generation and processing are making themselves known in leaps in innovation. To exploit the full potentials of 3D printing, methods must be found in the future for standardizing the approval process and cost absorption for personalized products produced by 3D printers. In addition, a reliable set of studies is needed that will confirm the anticipated benefits and thus make this innovation available for daily treatment.

"In 3D printing there are new methods and new materials, and the costs are sinking. Data quality and computing technology are also improving. This makes the technology very promising."

Dr. Marcel Pfützner, Founder and CEO,
MMM Medizinische Modellbau Manufaktur GmbH

PRINTABLE HUMAN ORGANS

In medicine, the future hopes placed in this technology are gigantic. This is because 3D printing has the potential to create innovative kinds of medical services along the entire value-added chain. 3D printing allows the low-cost production of small and even tiny product runs, and thus satisfies an important prerequisite for individualization in medical engineering. Thus, in the future, the technology will supplement conventional production methods and even replace them in many areas. In the area of prevention, it will provide splints and supporting elements for athletes. In the area of diagnostics, it will assist in the planning of more complex operations by the surgical team and for keeping patients informed. In the area of therapy, it will mean the possible reprinting of body cells, bones, and even entire organ structures, the preparation of implants for the individual patient, and the printing of medications. And in the area of follow-up care, the most frequently encountered aspect today: the preparation of limb prostheses and dental structures.

3D printing will not replace mass production. This method makes sense precisely where personalized health products are needed which cannot be reflected by a standardized production line. Rather, the method will be used for products that have to be perfectly adapted to a specific patient and which therefore cannot be produced in large quantities, and are produced only once in an extreme case, but whose production process nevertheless must be standardized and is thus financially feasible. The vision of the future is to produce numerous products at the press of a button and not thereby to manufacture mass products, but rather also to obtain entirely individualized products.

3D PRINTERS IN HOSPITALS, MEDICAL PRACTICES, AND PHARMACIES

Even though in visions of the future it is often stated that every hospital, every medical practice, and every pharmacy will soon have its own 3D printer, the future of the next few years looks rather different. 3D printing for practical medical purposes will be handled by specialized service centers and engineering centers at university clinics, because this is where the know-how and financial means are available for investing in the equipment and in the entire process chain. The individual practice or pharmacy will not generally be able to do this. However, it is possible that printers will be used at a subsidiary site where the end product is printed. A step in this direction will be to accept the specialized centers as cooperative partners. This method also offers the individual medical practice new potentials for patient-oriented and individualized treatment with products such as body splints or dental prostheses. In this respect, even pharmacies could become possible printing sites.

New career possibilities will open up for individual physicians or pharmacists. Whoever gains competency in this growing field can use this expert knowledge as an expert consultant, both in companies and hospitals or even for end users in medical practices and pharmacies. Hospitals will be able to distinguish themselves in a new field and become strong partners for the practices and pharmacies in the region. Through flagship projects, pioneers in this field can create entire network effects and thus establish treatment networks. They have the best circumstances for making a prominent tie-in to their customer's personal healthcare networks and to bring forth a powerful financial – and also healing – effect.

3D PRINTING FOR THE PATIENT

A patient suffers a simple fracture of the lower arm after falling from his bicycle. After diagnosis by an orthopedist, the patient's X-ray photographs are sent to a 3D center. This center is located at the nearest university clinic about 50 kilometers away. The data is analyzed there and a complicated model of an artificial splint is prepared. After about two hours, the model is finished and the splint can be printed out directly at the medical practice. The splint is then applied to the patient at the practice and inspected. Thus the patient is saved the travel time, treatment time is greatly reduced, and the patient receives a perfectly suitable, personalized therapy.
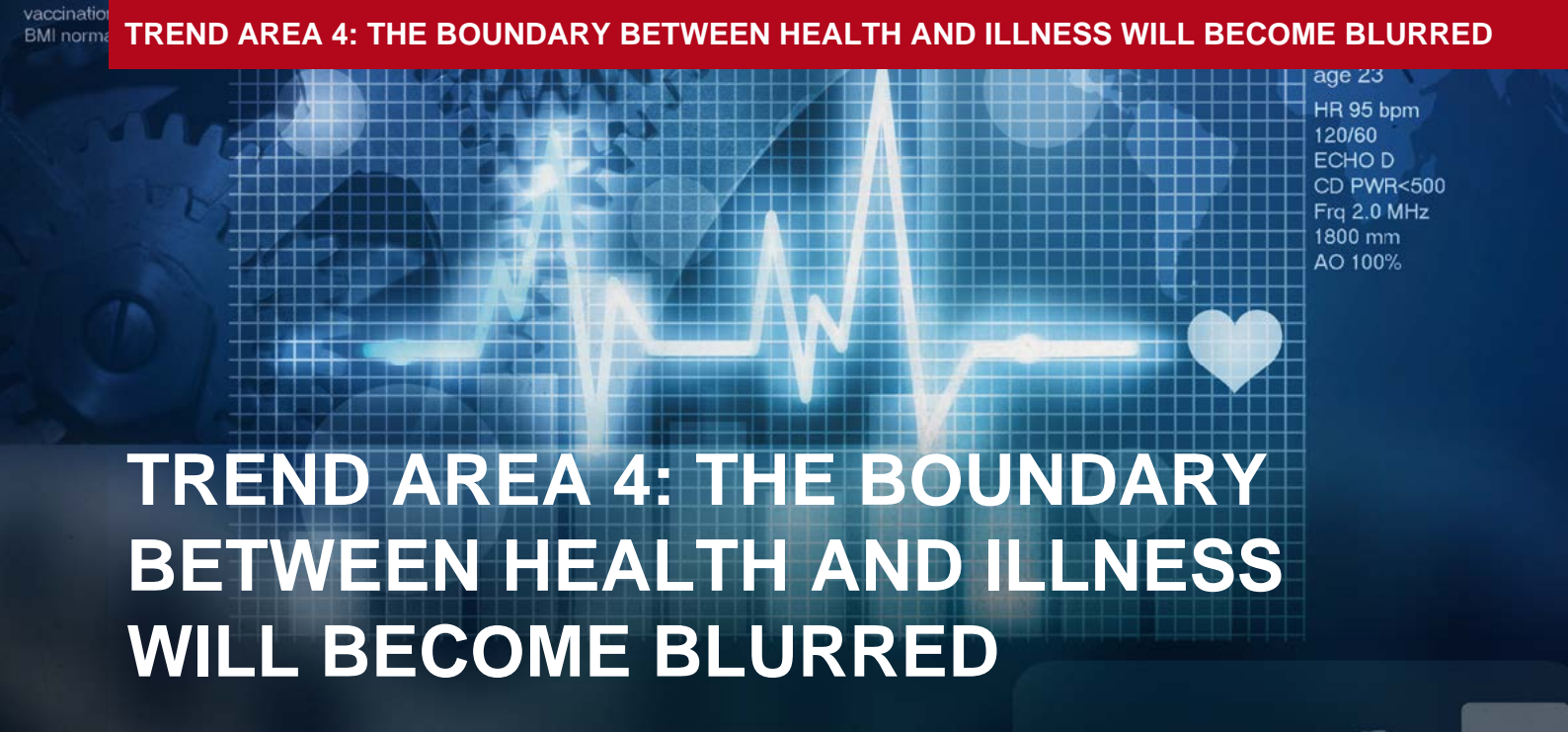
COMPANY PROCEDURES GO DIGITAL

To keep pace with the increasing rate of change, all companies and market players will have to get used to an increasing amount of digital communication. Efficient communication ensures the exchange of data and of expert opinions and is the lifeline in the healthcare system of the future. Every team member in the patient's treatment chain needs a proper perspective on the data that is important for treatment. This will eliminate duplicate examinations, and thus the treatment can build upon information already available. These factors will decide how efficiently a patient can be treated. In the future, proximity to the patient and to business partners will no longer be measured in meters. Proximity will be created through the exchange of data about the patient and the proffered solutions based on this data. Communication will be permanently available — anywhere, anytime. Companies in the health business must understand that the digital channel to the customer will constantly become more important. It will have to be set up by the company before the competition can do so. Where formerly the digital channel had primarily accompanied products as a support, tomorrow it will be the central location for marketing and sales. The key imperative is to place the product visibly on the market and to handle the unique factors of the digital sale. This means that the employees responsible for this task will play a new role in product development, because they develop the product right from the beginning and thus play a vital role in shaping its marketing and sale.

"The easy part of digital is the digital solutions. The difficult part of digital is matching your company's internal business processes."

Frits Reneman, Vice President Digital Experience, Adidas

Efficient communication along multiple channels will also be expected by the customer or patient. This is because the new generation of customers will expect simplicity, speed, and convenience. Initial contact will then shift from the personal to the digital realm. Customer communications will occur increasingly online, by email, or by telephone. This represents a challenge for medical practices, pharmacies, hospitals, and companies. More contact points must become available by telephone, video phone, smartphone, website, or e-mail. Mobile devices such as mobile phones and tablets will thus become the most important strategic location for consultation with patients. Also, any organization that conducts digital communication with the customer will have to do so within its own structures. To that end, specialists will be required to set up and expand these structures, and who can also include that portion of company staff that is today still averse to technology and digital communication. Good communication will not simply take care of itself. In particular, the management of communications channels represents a challenge and requires competencies in the areas of employee guidance, project management, and digital communication. Participants must be brought together, target objectives discussed, and individual steps coordinated jointly. Proper management is indispensable here if the overall team will solve conflicts productively, minimize friction, and ultimately be successful. The apportioning and assignment of work packets within the immediate staff and beyond that to one's own network, the continuing control of capacities and talent, and the combining and communication of work results will become new core components of leadership — in medical practices, pharmacies, and companies in the healthcare industry. To the extent that the company size allows no separate structure for management and control in this sense, this will become a direct leadership task for the physician, pharmacist, and company management. Regular discussions, melding as a team, the clarification of roles, and the verification of defined objectives takes time. This is not reflected in our current healthcare system. Indeed, the provision of financial resources for coordination activities and proper appreciation of their importance is a fundamental prerequisite for reaching the full potential of personalized medicine.

TREND AREA 4: THE BOUNDARY BETWEEN HEALTH AND ILLNESS WILL BECOME BLURRED

Personalized medicine will create new locations associated with healthcare. Due to existing risk profiles and the data available about our present condition in real time, it will be possible for people to be informed about their own health status anywhere and at any time. And conversely: It will be possible to steer the individual's attention to healthcare subjects. This will open up new market opportunities which have long been of interest — and not just for the healthcare industry. In particular IT companies, telecommunications providers, and the nutritional supplement and fitness industries will achieve a greater and greater presence. To stay competitive in the future, digital channels must be exploited and communication with patients and customers restructured.

THE BOUNDARY BETWEEN HEALTH AND ILLNESS WILL BECOME BLURRED

That people are never either 100% healthy or 100% ill is not a new idea. We are always in a continuum between these two extremes. There are numerous clinical studies on quality of life with illness which include aspects such as the patient's own health perception, vitality, or even ability to structure her daily routine. The Karnofski index uses a percentage scale here, where 100% represents complete health with no complaints, and 0% means death. In personalized medicine, precisely this continuum will be clearly evident and comprehensible for the individual patient. Due to the available risk profiles and the extensive data basis it will be possible not only to detect the presence of already existing illnesses. In the future, the individual patient will also be aware of many of her personal risks. This brings up the question of who is then actually healthy, and where the boundary is located between illness and health.

With personalized medicine, the boundaries between health and illness will become blurred. This will change the perception of those locations in everyday life that are associated with health or illness. Previously the classical locations associated with illness were the physician's office, the hospital, or the pharmacy. Due to the decoding of potential diseases in the future, these locations will again become places of health. Not only sick people, but also healthy people will be found there, who come for medical and health consultations. The World Health Organization defines health as a condition of physical, emotional, mental, and social well-being which goes far beyond the absence of illness or complaints. This definition can become a fundamental understanding for personalized medicine: for patients, physicians, pharmacists, and even companies in the healthcare industry.

PATIENTS BECOME HEALTH CUSTOMERS

In the healthcare market, people are both patients and customers. This development is not new. Due to private supplemental insurance, over-the-counter medications, and the new IGeL-services, this is already the case today. But what is novel is that many healthcare customers in the future will no longer be awestruck by the professionals in the industry, but rather that today's *patients* will increasingly take on the expectations more typical of *customers*. The new opportunities to find and exchange information in a relevant, personal network, whenever and wherever desired, will have an enormous effect on what patients expect, and increasingly require, from their physicians and from all other professions in the healthcare system.

Patients will be informed; they will verify medical information and actively look for the therapy options that work best for them. And they will no longer rely exclusively on the professionals they deal with at a given time, but rather on the assessments of other users, on independent sources, and on new providers in the healthcare market. This is how people learn in all digitalized areas of life. They purchase products that other buyers have awarded five stars on the internet. They book hotels that other guests have praised on booking websites for having a good price-value ratio. And likewise they will look for a physician, a therapy, or a hospital in the same way. Patients assume they will be able to compare offers, obtain discounts, and experience a certain level of customer service. Any physician, pharmacist, hospital, or medical practice that is not able to meet these expectations in the future will lose patients as customers. Whereas patients were generally dependent on the physician's abilities, they will become increasingly emancipated and self-aware customers. Where patients had to rely on the physician's collection, evaluation, and interpretation of data, in the personalized medicine of the future the patients themselves will be in control of the largest and most important volume of data on their health status, and will have different possibilities to assess and interpret it. And whereas patients previously have often focused on illness and symptoms, the focus of customers in the future will be on their overall health status. Patients will become healthcare customers. To emphasize this change, this study hereinafter will refer solely to the concept of healthcare customers and will not use the term "patient."

HEALTH INDEX FOR KNOWING AND MANAGING PERSONAL RISKS

But how will the healthcare customers of the future create personalized healthcare networks, specific to themselves, that provide support for optimizing their own health and well-being? Of course: with the assistance of a healthcare coordinator — the primary care physician or other players in the healthcare business who convincingly perform this function.

However, to view this coordination function strictly as an option, and to place the service providers and not the customer in the center, would be to misunderstand the change in roles which will be brought about by the personalized medicine of the future. The healthcare customers themselves will then be in a position to create a differentiated picture of their risks, outlook, and treatment options. This picture will be individualized and oriented toward a specific treatment. We suggest going a step farther here and, in the future, using a health index that includes both the actually existing risks, an awareness of the risks, and a personal response to these risks. The risk for an illness here can be reflected not only as a percentage value of the genetic risk of disease. The question here is chiefly of the magnitude of any potential shortening of life span, the potential hazard of loss of independence, and the risk of having restricted social and emotional autonomy. These three dimensions cannot be viewed separately from each other, but together form a picture of the current – and of the potential future – picture of a person's health. In addition we must include the factor of knowledge, because precisely knowledge about risks and strategies for minimizing them forms the basis for an adequate, individualized preventive care structure. With regard to the aspect of "knowledge," we must remember that many illnesses are still in the initial stages of being researched. The knowledge available in medical practice is thus quite variable depending on the particular illness. And this applies not only to very rare diseases, but rather also to dementia, for example, or to Parkinson's, whereby numerous disease factors have not been unambiguously clarified. Mastering a risk situation will have an important effect in deciding which therapy or prevention approaches are most appropriate. This mastery is composed of competency and of the actual actions related to mastery. The one describes the available resources and various potentials for approaching one's own health topics. The other describes the actual implementation — the steps which are actually carried out.

INDEX OF PERSONALIZED MEDICINE

	RISK of shortened lifespan	RISK of reduced independence	RISK of social-emotional loss	KNOW-LEDGE	COMPE-TENCE	ACTION
Highly pronounced			X		O	O
Moderately pronounced	X					
Weakly pronounced		✓		X		

These six dimensions, risk of shortened life-span, loss of independence, social-emotional loss, knowledge, mastery, competence, and action can lead, in combination, to a visualizing of personal health status and health perspectives.

This health index is tool for the healthcare customers themselves. They can use it as a basis for assessing their present health status in a multi-dimensional view and then for working out their own personal, individually relevant future health scenarios. This index is by no means rigid, but changes as new information is added due to increases in knowledge, changing life circumstances, and many other personal factors. The index is a reflection of one's own personal perspective and appears differently for every person, even if, for example, the risk of a particular disease for two persons is an apparently exactly equal at 43%. Consequently, the health index can be an aid in medical consulting, in the clarification of health status, and in risk management. It can be used across industries for the development of appropriate solutions to the individual healthcare customer, and opens up opportunities for interplay between different professions. Also, the index forms the basis for the structure of a personal healthcare network. Here again, the primary role of healthcare customers of the future will be clear: It is the healthcare customers themselves, with support of the healthcare coordinators, who will set up their own personal healthcare networks.

NEW LOCATIONS FOR HEALTH

In the future our health landscape will also change. New locations for health will be added: shopping centers, workplaces, automobiles, and restaurants. This is not a new challenge in the field of health sciences, but personalized medicine means that it will also become part of an individual's usual awareness. Because in the future healthcare offerings will appear based on the data available. Appropriate offers can be made in real time, based on this data, by everyone who can access and evaluate the data. This increases the pressure on traditionally operating health professionals and companies in the healthcare business.

The shopping center in the future will know not only what is needed at home. With the smartphone as point of contact, it will also know the needs of the shopper as well. For example, an appropriate offering for nutritional products, clothing, or health products can be made to the healthcare customer while he is shopping. Initially that may be viewed as paternalism. Can I not even decide anymore what I would like to buy? Absolutely!

The capability of the everyday digital assistant in our pants pocket or purse will increase markedly in the coming years. The smartphone will become a digital assistant that will increasingly know the users and his needs and little by little will be able to predict these needs correctly. The decision will still rest with the human users, but they will be better prepared to make the decision under consideration of all available data. For example, digital assistants can specifically tailor a person's nutritional intake according to his or her particular health goals.

While shopping, customers can be offered a blood-sugar test, for example, and a dietary plan tailored to their needs. The data thereby collected can even be compared with customer data gathered at home. This can be both a personal consulting site, and also an automatic test station operated by a commercial partner of the shopping center. Shopping centers will open up market opportunities for pharmacies, laboratories, diagnostics companies, and the pharmaceutical industry. Because in addition to nutrition, many similar starting points will appear in the areas of athletics, lifestyle and wellness. This role can be handled both by players in the healthcare business and also by those outside of the classical industry. However, the healthcare industry obviously does have strategic advantages: It has existing partnerships, the right products, and enjoys the confidence of its customers. Therefore the important matter here is to use these advantages and to grasp the newly emerging market opportunities. The core challenge will be for companies to integrate themselves into the value-added chains of other companies in other industries, and thus to provide attractive offers both to the end consumer and also to the middleman.

At the workplace, employees can be offered products for rehabilitation or even those that prevent particular illnesses. Active health maintenance will become more important, especially in industries where highly paid experts occupy key posts within a company. Maintaining the health of these employees will be a central aspect in the future in terms of keeping a company competitive for the long run. In many respects, employee health management is a budgeting strain whereby the success of health investments is difficult to measure. Every day we spend a lot of time at the workplace. This is a central location for keeping one's health in view. A discussion will arise concerning what data and risk profiles will be directly visible for the employer, so as to keep them from being used to identify and terminate low-performing employees.

A clever combination of protected data about the individual and a simultaneous anonymization with respect to the employer is one possibility for creating attractive offers at the workplace which will be readily accepted. Then there is the opportunity that companies will become genuine health locations for their employees and this will be positive for both sides. However, since this is by no means assured; there is opportunity for service providers to assume this risk for a company and to point the way to success on a fee basis. This will require an accurate exploration of the origins of health risks and tailor-made health products, as well as comprehensive consultation. Specialized service providers can reduce the risk since they will manage numerous companies and can analyze a far greater database than a single company could. The competition in this area will be stiff —specifically at the intersection of prevention and therapy it is important for the diagnostics and pharmaceutical industry to occupy this territory with their products before other companies do.

The automobile of the future will be not only a means of transportation, but also a location for health. Many people use their cars daily, sometimes even several hours each day, for professional reasons. Modern cars already have numerous sensors and measuring points integrated into their many assistance systems. These features have been used to protect the driver and are used also for autonomous driving. This already existing technical equipment can be used – with a little modification – to document the health of passengers and to measure any changes. Conclusions can be drawn about stress levels, the need for rest, emotional strain, and so on from factors such as eye movements, voice pitch, and heart rate. Vehicle manufacturers are trying to create additional sources of income since vehicles have become everyday consumable items which differ from each other only in subtle ways. Just as automobile dealerships earn more today from maintenance than from car sales, in the future as well, providers of healthcare products will generate continuing earnings for automobile companies during the useful life of the vehicles.

Even restaurants today are already aware of food allergies, and will use digital advertising to make appropriate suggestions as soon as the guest is seated at the table. Or, alternatively, the patron's smartphone will scan the menu and compare the individual menu items with the nutritional goals of, say, an athlete, and can help in selection of suitable food. We expect that when a guest makes a reservation, the guest's preferences, needs, and experiences will be digitally analyzed so as to offer certain menu selections and individualized courses: first the guest, then the menu.

THE USER'S HOME PROVIDES HEALTH DATA

This trend will take place within a person's own home. His everyday routine will be monitored by sensors and other smart-home devices to collect increasing amounts of data on his health status. Many values can be measured, recorded, and checked for discrepancies merely in passing. Eye scans will recognize illnesses; the smart wristwatch will provide vital data, as also will wearables. Even lab values can be collected and evaluated automatically. The bedroom, refrigerator, and bathroom will become locations were health products will be in demand.

Much of this is technologically possible even today. In the coming five to ten years, this usage will increase, and in 15 years will be standard in most new structures. This is where the demand will appear in the future. Anyone whose values go out of range will immediately receive an offer from a fitness studio for a personalized training program, either at the studio or even at home. If a person's blood sugar level increases, then contact can be made with a doctor immediately. Medical support at home will be a benefit both for already ill patients and also for healthy people. This aspect will be reinforced by the trend toward self-monitoring and optimization. In the future it will be even more commonplace than today to collect one's personal data on a daily basis. There will be numerous motivations for this. Some people will strive for enhanced performance by adapting their daily activities to their biorhythm. Others will want to control their weight and nutrition for weight loss. Others will just be curious and want to know more about themselves from the data available to them. Even the additional benefits will not be based on data as we understand it today: Those static piles of data sitting in a database. Our present conception of data will change. The user's activity data will also be recorded and evaluated. Object recognition, image recognition, and monitored interfaces in the future will ensure that everyday objects will monitor the user's behavior, then combine this real-world data with static information stored in the Cloud, and use statistical models and business intelligence systems to prepare individualized and situational forecasts about the momentary needs of the user accurate to the second.

KNOW YOUR OWN GENOME

Knowing your own genome will be quite common-place in the future. This will be possible due to the steadily falling costs and the ever increasing number of relationships between individual genes and the origin of illness which are currently being researched. But despite all the euphoria about the decoding of our genes, one thing is still certain: At this time only a limited number of conclusions can be drawn. Numerous interactions still have not been examined.

"I think in the future genome sequencing should be free for everybody."

Dr. Jun Wang, Chief Executive Officer, BGI

But where will your own genome be studied in the future? Firstly, the experts expect an expansion of public test centers where a customer's genome can be examined. These will be located, for example, in specialized centers or hospitals. Many countries will even offer gene sequencing programs for their entire populations and create the necessary centralized infrastructure. And secondly, there will be increasing numbers of providers that will analyze the genome from physical material sent by healthcare customers from home to the lab. Even today companies offer DNA analysis for their customers. In Germany there are strict legal limits for private vendors of gene sequencing. National borders, however, are not an obstacle to selling on the German market. The result is that this business area will be exploited by foreign companies and German customers will opt for this service. We should not expect that in ten years all healthcare customers in Germany will know their own genome. But we do expect that the number will increase markedly and costs will continue to fall until it becomes a free service for everyone. In the future, labs will offer this service to private clients, as well as to healthcare customers from hospitals and medical practices. Indeed, often a mere decoding is nearly worthless to the individual healthcare customer, because she needs a translation of the results into practical, relevant information. And in addition, the legal restrictions on opportunities for gene analysis by private customers in Germany are perceived as patronizing by many healthcare customers. And the well-intentioned advice of a physician that gene sequencing has no effect on one's health status at the moment is likewise perceived by many as a forced external limitation. The discussion about advantages, possible hazards, ethical aspects, and limits here will be undermined by supply and demand.

PROVIDERS OF GENE TESTS FOR CUSTOMERS TODAY

Health risks
*The company **easyDNA** offers private parties an analysis of DNA for 25 health risks. The health risks are, for example, multiple sclerosis, migraines, obesity, Alzheimer's, breast cancer, or intestinal cancer. The analysis is available starting at 230 euros.*
www.easyDNA.net

Genetic suitability of partners
*The company **GeneParter** offers dating services a genetic profiling service. Based on the genetic profile of the customer, the company will provide an assessment of the genetic compatibility of two persons.*
www.genepartner.com

Analysis of origins
*The company **iGENEA** offers an analysis of origin of genetic information. This allows assignment of membership in an ancient people group such as the Celts, Basques, or Germanic tribes and their geographic origins. Depending on the particular service ordered, costs run between 199 euros and 1099 euros.*
www.igenea.com

The "warrior gene" variant
*The company **Gentest** offers a test for the MAOA-L genetic variant. People who carry this variant in their DNA display more impulsive and aggressive behavior and a greater willingness to take risks. Thus this gene variant is also known as the "warrior gene."*
www.gentest-deutschland.de

Gender of unborn child
*The company **easyDNA** offers to determine the gender of an unborn child for expectant parents.*
www.easyDNA.net

Thus the remaining challenge is to bring the data collected into some kind of useful relationship. This translation service will be included with the product offer. Competition surrounding this service is already quite high. There will be personal consultants, apps, and websites that all offer the service. And so one can imagine that pharmacies will cooperate with labs to meet a need here for their healthcare customers. This can even be a starting point for labs and pharmacies to adapt their products to the individual needs of their clients and healthcare customers.

NEW MARKETS, NEW ATTACKERS

Today we already see two different markets for healthcare products operating with their own demand and financing logic, and usually handled by different actors. Firstly, the market for chronically ill people. This target group has a great need in general for complex products which are regulated by their health insurance and consequently are financed for the individual healthcare customer. In addition, there is a growing market for products to improve or maintain health over the long term. These products are usually offered on what is known as the secondary healthcare market. They are frequently not financed by health insurance but paid out-of-pocket by the customer. The new locations of healthcare signify new market opportunities; they offer starting points for new products or services, chiefly to companies outside of the classical healthcare market. Previously medical practices, pharmacies, care facilities, hospitals, or the producers of medical products belonged to the healthcare industry. But this definition will change dramatically. Even today there are numerous examples showing that this transition is already underway. As a service for motor-vehicle drivers, ADAC insurance has already set up a transport service for handicapped and sick persons. The communications giant Deutsche Telekom has a separate health division. The computer and smartphone manufacturer Apple is selling its own applications for measuring body values and lab values. Among e-commerce companies founded in recent years, e-Health has been a dominant player since 2014. German venture capitalists note a large increase in business ideas in this area, and consequently an increased number of requests for financing, especially in the area of lifestyle.

"At the moment there is an interchange going on among expertise providers. Physicians are working for classical IT or hardware producers and are being employed on product development. And vice-versa."

Sandra Hoyer, Director of Consumer Health & Pharma, Deutsche Telekom Healthcare Solutions GmbH

In personalized medicine the aspect of prevention through a determination of risk factors will play a new and greater role. For many people, health is a high-priority item which is expressed by a healthy diet, increased physical activity in everyday life, and the avoidance of too much chocolate or smoking. This means: In the future products from the primary and secondary

healthcare markets will blend together. The boundaries will be blurred as also the perception of illness and health will change. This also shows up in the targeted enticement of employees from companies in formerly non-related industries. It is high time to position your company in the area of prevention by rolling out your own products or services before the competition does so.

COMPETITIVE ADVANTAGES, DIGITAL KNOW-HOW, AND COMMUNICATION

New market participants can score primarily with their expertise in the digital world and its associated communication channels. These companies have an advantage over many companies in the healthcare industry because personalizing healthcare products assumes that data is available on the healthcare customer which can be used as the basis for individualized offers. The smartphone in the future will be an important constituent of personalized product offers. The smartphone and its apps allow direct access to the healthcare customers. Whoever pops up on the display will be acknowledged, but all providers will be competing for a few minutes of daily presence. These trends will be heavily promoted by all stages of the digital revolution, by developments in social media, and by the growing importance of the mobile web. Of course, even before Facebook & Co. there were social networks between people. And obviously information was available even before the World Wide Web. But the digital network surrounding an individual can be more relevant than the people physically surrounding him. And through the healthcare network, the customer does not just find information, but the information finds the customers. And not just at home, but through their smartphones and mobile data packets, even on the way to work, in school, in a traffic jam on the freeway, during exercise, and on vacation. Because competition is no more just the local competition, but all of the world's competitors are just a mouse-click away.

This will lead to discussions about today's regulatory policies. The prohibition of competition among physicians and pharmacists or even the legal restrictions on the expansion of branch pharmacies are only two examples that show how legal protection for the healthcare customer can disadvantage the individual physician or pharmacist. Because in the future the healthcare professional will be in direct competition with companies outside the industry or with entities outside of Germany who are not subject to these restrictions.

Even today the uncertainty about the continuance of regulatory hurdles acts as a constraint on investments and additionally brings this difficult situation into sharp focus, for example, for pharmacies.

"A good tip for junior employees is to improve their skills in the area of big data and to become involved in actual projects. This will definitely increase the possibility for advancing to the board of directors in ten years."

Prof. Dr. Michael Feindt,
Founder und Chief Scientific Advisor, Blue Yonder GmbH

All institutions and companies in the healthcare industry are currently facing a powerful challenge in regards to communication: How will healthcare customers and companies interact in the future?

New communications channels, points of contact, and types of data will appear due to digital transition and intelligent sensors; countless others will follow. Management of these channels and points of contact will be decisive for your success in the future. And this is precisely where the new attackers already have an advantage. In particular medical practices and pharmacies are accustomed to having the traditional patient come to them. But in the future this will be less often the case. The roles in personalized medicine will be different. The transition is comprehensive and will both expand and change the entire industry. Healing practitioners and companies in the healthcare industry will have to change themselves, their working methods, and their business models. Their prospects for playing a meaningful and financially rewarding role in the personalized medicine of the future are outstanding for all those who grasp that personalized medicine is an opportunity to place the individual at the center of medical thought and action again.

HOW TO BECOME FUTURE-PROOF

Personalized medicine will lead to fundamental changes in the healthcare sector. The picture of the future described in this study was developed on the basis of expert interviews and compiled according to the Delphi method. The people whom you serve in the healthcare industry will naturally expect the range of services of personalized medicine to appear within a few years. Anything they cannot get from you ... can probably be had from one of your competitors! Therefore this study is an invitation to medical professionals and companies to open their eyes to the opportunities in the healthcare business of tomorrow, to think about their own positioning in a timely manner, and to make active preparations for that future.

Personalized medicine of the future makes it possible to place people and their healthcare needs into the center of medical thought and action in a new way. Remaining healthy will be just as important as finding remedies and cures. This will mean changes in job profiles and modes of operation; ethical and financial factors will have to be reviewed and taken into account. The investment is worthwhile, for the sake of health — and for your financial survival.

In this respect we can keep things short and give one strategic recommendation: Track the health data of your patients and think about your healthcare company – your practice, your pharmacy, your lab, your clinic, your therapeutic merchandise, your services, your products – from the point of view of patients and healthcare customers, their data and needs.

Of course we can go into greater detail, because whether this trend occurs, be it step-by-step or in one sudden leap, the process will convert your company into a new one.

The implementation of personalized medicine goes much farther than the mere development of individual highly specialized medications. The healthcare industry of the future is broader and more diversified; in addition to classical medical procedures, new customer needs will appear. The greatly expanded data volume will allow new forms of consulting and thus new consulting providers. Companies from various industries will recognize healthcare as a profitable business and will get involved there — whether the industry likes it or not.

One comment in advance: You will be tempted to counter some of the following strategic recommendations immediately with reference to prevailing regulatory conditions. Of course, medical and pharmaceutical activity are based on these requirements. But please also note how each of these allegedly protective regulations simultaneously acts as an obstacle to innovation, how they retard vigor, investments, and the courage to innovate. This effect is clear. But whether regulatory obstacles will endure is by no means decided. Today's regulations need not be the regulations of tomorrow; even billing catalogues are not in place for eternity. Do not limit your thinking.

With a view toward the world of the future in 2025 at the latest, we therefore always recommend not to remain oriented toward the regulatory governance of today, neither in a protective nor in an inhibiting sense. This applies all the more since innovation cycles will become much shorter, even in your industry: The rate of change is increasing rapidly.

We recommend the following steps as the results from the present study.

These strategic recommendations are of particular interest to healthcare professionals

These strategic recommendations are of particular interest to companies in the healthcare business

These strategic recommendations are of particular interest to clinics

BECOME YOUR CUSTOMERS' HEALTHCARE COORDINATOR

1. *Call your patients "healthcare customers" and treat them as such. You are dealing with people who will be competent and informed, who want to improve their health and take part in the process, not merely suffering people who lack something, not deficient objects of medical treatment.*

To avoid misunderstanding here: Anyone suffering should be able to get help and should find in his physician or pharmacist a qualified contact person. This is about perception of people. When you put the customer in the central focus, then you will not see sick people coming through the door, but people who are 83% healthy.

2. *Every healthcare customer has an individual healthcare network. Become a coach and support the customer in building and maintaining her healthcare network. This is the central function created by personalized medicine: The coordination and management of the healthcare network of the individual healthcare customer and thus the improvement of her health. And what's more: Of her well-being. Take on this role for the entire healthcare network of your customers, or only for specific areas.*

- Your role as the first, comprehensive contact person will no longer be simply self-evident. Become the coach who helps your customers improve their health, and rediscover your position as a person of trust.

- Do not rely on the healthcare customer of tomorrow being referred to you almost automatically by the primary care physician. The customer herself will make health decisions in the future.
- A customer who does not know your products and services, who has no confidence in you, and sees no prospective benefits in contacting you will not choose you as a provider. If it was ever thought to be enough: In the future it will not be enough for practicing physicians to assume that the customer is aware of the benefits of their products and services. Enter into direct dialogue with your healthcare customers.
- You can also position yourself as a healthcare coordinator in the form of a competence center. The better your digital processes, the more likely you can be a coach — even independently of your location. To provide the needed assistance on site, you can always invite subsidiary healing professionals into your network.

3. *Actively approach your healthcare customers. Call them. Meet with them regularly. Place them on center stage; use all the available data. Follow the customer's perspective and keep the entire field of personalized medicine in view.*

- If you have not done so already, break away from the constricted view of traditional medical training that leaves out anything it views as not grounded in science, based on medicine, and anchored and reflected in the healthcare system.
- Also, take seriously the same things that your healthcare customers take seriously as belonging to the optimization of their health — especially there where you would advise a different course or recommend other decisions.

- Get into the position to make direct contact with the healthcare customer and to structure all communication. The manufacturer of innovative knee prostheses in the foreseeable future will not actually be the surgeon. The companies penetrating into the healthcare market from outside, beginning with nutritional supplements and the producers of sports articles, will change the industry with their direct customer sales approach.

- Remember the alternative: Anyone not an active part of the personalized healthcare network of an individual healthcare customer will ultimately have to assume the thankless role of "prescription dispenser, pill salesperson, X-ray image printer"— entirely without regard to their own competency.

THE NEW MINIMUM REQUIREMENT: BE CONNECTABLE — IN EXPERTISE AND COMMUNICATION

4. *Set up vertical networks and configure the communication within your network. Include in your networks all functions that are relevant from the view of the healthcare customer.*

- Add to your horizontal networks – today's physician networks, conferences, etc. – by adding vertical networks. Intensify your present cooperation with primary care and specialist physicians and with hospitals, and integrate additional companies and new players from the healthcare industry. Orient this step toward the vertical healthcare networks of your customers.
- Assure your healthcare customers that you can offer them a network that is valuable from their point of view.
- Prepare for communication within the network — before your healthcare customers confront you with their biometric data for a custom hip, with a suggested therapy, or with personally optimal nutritional plans from sources unfamiliar to you.
- Make use of the opportunity to transition, for example, from being purely a therapeutics vendor to becoming an integrated provider for diagnostic tools, biomarkers, therapeutics, and related services.

- Synchronize your development activities. As a part of "companion diagnostics," cooperation between the classical manufacturers of therapeutic devices and diagnostics companies will become more important, and formerly independent business models will merge.

- With personalized medicine, hospitals have an opportunity to sharpen their profiles. As sites for databased medicine, they will be in a position to analyze, and to benefit from, extensive volumes of data. In this way they can transition from diagnostic and treatment facilities into competence centers that actively conduct research and development.

5. *Become a specialist and make targeted use of the specialties of other players in the healthcare industry.*

- Actively approach the members of your network and get to know their specializations.
- Communicate within your network regarding what specialized abilities and skills are already available that you could offer to other coordinators on a case-by-case basis.
- Conceptualize today's cooperative partners, but also even competitors, as strategic allies here: Use your network to expand your own competency and actively communicate this.

- Become established as a 3D-printing center, for example, and offer additional technically complicated procedures for healthcare products, prostheses, surgical planning, and the like. Make comprehensive digital processes available for healthcare professions: The on-site physician measures and transmits the raw data to you, then you calculate models from the raw data and print and deliver them.

6. *Sharpen your public profile before your healthcare customers do it for you.*

- Share your knowledge not merely in technical articles, but also report on interesting research results in the broader media. Provide the information in a readable manner and place the information into a technical, social, and ethical context for your readers or hearers.
- Your professional self will no longer appear only in the consulting rooms of the future, but even in digital space. Anyone who does not exploit this space will have to rely passively on the favorable evaluations of third parties.

- A customer who does not know about your services and products cannot decide to select you as a provider. Use the expanded possibilities of digital communication through personalized advertising in apps, even including entries in forums, to attract the attention of healthcare customers.

INVEST IN IT EQUIPMENT AND IT COMPETENCY

7. *Invest in information technology that enables digital communication with your healthcare customers and other parties involved in the particular healthcare network.*

- Maintain an electronic customer file in your healthcare network. Do not wait for the introduction of the electronic healthcare card. The digital networking of health-related customer data will become a much more comprehensive and faster reality across all channels.

- Orient your electronic customer files in line with the corresponding interfaces as an open system, because the customer files maintained in your system will only ever be able to represent a limited portion of customer data.

- Implement a system of digital customer communication, electronic scheduling, and digital customer information.

- Allow healthcare customers to access your electronic product management system.

8. *Invest in IT that puts you in a position to network with your customers' healthcare data.*

- Make use of all the available data, because diagnostics of the future will not be based solely on disease symptoms, but rather also on the data from the healthcare customer's personal lifestyle. Your customers collect the data so that it will be used!

- Network your systems with all available sensors in their homes and work environments: from smart-phone to networked automobile to smart home. Your most important partners here are the providers of apps and operating systems, from tech giants to health startups. Risk factors can be detected at an early date and preventive measures derived on an individualized basis, and in real time, based on data from the customer's daily routine.

- At the same time, take leave of the idea that it is *your* data. This is your customer's data and it must remain so. You can help them – and this is your particular role – to understand this data.

9. *Invest in IT that provides the results of analyses and allows their direct implementation.*

- Invest in IT that supports you in the interpretation of health data. Even in the initial stages, it must provide you with factually well-founded interpretations.

- Exploit the opportunities of the graphical, statistical, and textual processing of health-related data on your healthcare customers. The combined, detailed interpretation of all available data is one of the core tasks of the healthcare coordinator. Whoever convincingly displays competency here has taken an important step closer to obtaining the trust of the healthcare customer — and this is the foundation of any future-proof business model.

- Establish your company as a service provider for established physicians for visualization of healthcare data. This will provide doctors with the additional element of content-related motivation to partner with you.

EXPAND YOUR PRESENCE INTO NEW HEALTH LOCATIONS

10. *Maintain a presence in your health customers' living and working environments.*

- Get on the smartphone displays, tablets, video displays, and all online connected devices of your healthcare customers. For example, consider developing medical apps that enhance your presence in online portals and your own digital information products.
- Build strategic alliances with other companies in an expanded healthcare network for your customers and in this way grow large enough to develop joint digital health assistants. Your presence will be greater in a cooperative network.
- Improve your visibility in your healthcare customer's everyday world, and create new sites for health-care sales: Offer travel medicine in outdoor sports shops or dietary medicine in health food stores and in plus-size shops; offer daily fitness updates on the monitors of your customers' navigation devices.

- Develop showcases and exhibit your technical prowess in road shows. You can acquire customers through having an active presence at all kinds of events.
- Also consider patient platforms, which will become a starting point for pharmaceutical and healthcare companies in the future for the development of new products.

ADAPT YOUR COMPANY PROCEDURES TO THE DEMANDS OF PERSONALIZED MEDICINE

11. *Communicate on an equal footing.*

- Expand your customer dialogue structures. Use every method currently available today: face-to-face, post, online, mobile, telephone, email, chat, and social media.
- Network these communications routes so that the current state of communication with the individual healthcare customer can be documented at any time and is transparent for all participants.
- Network these communications routes so that your brand look is recognizable throughout.
- This kind of networking also makes it possible to exploit any new communications routes in the future or to drop any that are seldom used.

- Include customers, patient organizations, and patient platforms in your product development. The better you know your customers, the better you can develop personalized products, and the earlier and more extensively can they be incorporated into your processes.

12. *Convert your company procedures to real-time development and create the necessary structures.*

- Break apart the schematic sequence of product development → marketing → sales → service. The drivers for new products and their improvement can appear at any of these steps in the process. Get your company into a position to conduct customer dialogue at any of these steps, listen to the customer, and initiate the appropriate changes.
- The product development of tomorrow will not stop just as soon as a product moves into marketing and sales; it is more a continuum of communication with your customers. You will need a production process that produces standard modules up to a certain stage, and then these modules are individualized in real time and can even be adapted according to changes in the user's circumstances.
- Evaluate your products and services on a continual basis. Change and improve them daily. This is not a matter of more appropriate sales strategies; real-time development only makes sense if it results in better products.

13. *Internalize the logic of adaptive development- and approval processes.*

- Your methods, processes, and solutions are always merely temporary. Be the first to scrutinize your own products.

- Concentrate on flexible products that make this possible. Right from the beginning, think about the changeability of your products and services. This will enhance your pace of innovation, minimize the risk of loss, and increase the probability of success.

14. *Fulfill your leadership task of structuring content.*

- This will be your central management task of tomorrow: Apportioning and distributing the work, managing the progress of work in the network, and combining and communicating the results — no longer just with respect to your assistants in the practice and pharmacy, but beyond this to your network of medical specialists and companies in the healthcare industry.

- Anyone on your team who is working on the customer interface must have modern project management know-how so as to structure both the work internally and also with respect to network partners.

- This will require an effort and expense. Actively seek to invest here.

15. *Make your work transparent, make information available, and share data.*

- Whoever shares data and information increases the volume of data and promotes better professional opinions and assessments for healthcare customers.

- Enhance the confidence of your healthcare customers in yourself and the network that you offer. This will reinforce positive customer reviews.

- The routine sales channels to medical practices and clinics will be of little value to the medical product manufacturer if the healthcare customer only trusts certain alternatives and specifically demands them. Divert sales gratification and use this latitude for customer communication.

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adaptivity

Product feature which describes products or services that are both individualized and situational, and adapt to the respective needs of the user even after being purchased.

big data

Denotes enormous heaps of data which are too large to be evaluated by human effort alone. This data results mainly from an evaluation of Internet usage, but also from other devices such as cameras, microphones, etc. In order to process this data mass, new technologies and analysis systems are necessary.

blockbuster

Blockbuster refers to medications with global sales in excess of one billion dollars annually. These medications are marketed globally and are consumed by a large number of patients. The most successful blockbuster to date is a medication to lower blood cholesterol. In 2005 it achieved 13 billion dollars in global sales.

body enhancement

Refers to the improvement of the capabilities of the human body.

brainwave recognition

Technology for the recognition and interpretation of human emotions, thoughts, and intents.

Cloud

An IT model in which data is not saved on dedicated hardware, but rather is saved on the internet so that it is available at any time from any location having an internet connection.

companion diagnostics

This terms denotes a test which is offered in tandem with a medication. The test "accompanies" the medication and its purpose is to predict the effectiveness of a therapy. If its suitability is demonstrated, then the medication can be prescribed. If the prerequisites are not satisfied, then the medication is not prescribed. The first tandem was the HER-2-test for the medication Herceptin, which is used for breast cancer patients. Herceptin is only prescribed if the HER-2-test shows that the patient will respond to Herceptin.

contact point / customer interface

Potential situations or locations where customers can be approached directly and personally (consulting discussion, store, website visit), and intermediary persons who can bring the company and the customer into contact.

Delphi method

This is a method for future research named after the oracle of antiquity. It was developed in the middle of the last century in the USA and is used to generate forecasts. Since in today's complex times hardly any one expert is able to survey several mutually influential fields of expertise at once, in a Delphi study several experts with specialized knowledge are interviewed to obtain their assessments. The interviews proceeds over a two-step process. In the first round the experts and interviewed individually and requested to provide their assessment on certain future topics. Then, in the second round, they receive the aggregated results from the first round and are free to maintain or alter their original position accordingly.

digital assistance systems

Digital/electronic software (e.g., smartphone apps) for customer service and consulting which provides recommendations based on the analysis of data. Financial services providers and third-party vendors can offer customers individualized risk analyses and products. Today's comparison portals are the precursors to these systems.

health competency

Health competency means the individual ability of the patient to make everyday decisions which have a positive effect on health.

individualized therapies

These are therapies tailored to a specific patient. They can be prostheses or implants, or therapies prepared using the patient's own cells. These are unique therapies and thus are used only on one individual patient or have an effect only for one single patient. This is the highest form of individualization.

primary and secondary health markets

The health market is composed of numerous companies, institutions, and products and services on offer. The primary health market comprises the "classical" provision of health services. These products and services are usually handled by health insurance companies or even by the government. The secondary health market comprises products and services from the realm of fitness and wellness, health tourism, athletics, nutrition, and living. These products are usually available for purchase on the open market and are paid for by the consumer.

smart grid

Intelligent power network that controls the interaction between power generators, power storage, consumers, and the power grid.

test for side-effects

Medications for personalized use are already available in Germany; they require a genetic test for possible side effects before their prescription. One example is the ingredient Simvastatin for changes in fat metabolism: testing for the presence of the c.521T>C-mutation in the gene SLCo1B1. At elevated dosages of this medication, the mutation increases the risk of diseases of the muscles, even including the dissolution of muscle cells. If the test is positive, then the dosage is not increased.

the right medication for the right patient at the right time

The objective of a prescribed medication therapy. Medications today must be effective for the majority of the populace and cause few or no side effects. This impedes the development of new medications and the approval of active ingredients, because the approach "one size fits all" necessarily means that people will respond differently to a medication due to a number of different factors. Personalized medicine should make it possible to find an effective therapy for the individual patient.

trend cycle

A compilation of all those companies inside and outside of the industry which have sufficient resources such that their strategic decisions today have an important influence on the future of the industry.

wearables

Wearables are wearable computers that are attached to the user's body when in use. This includes wrist watches and also everyday clothing.

The 2b AHEAD ThinkTank is one of Europe's most modern institutes for trend analysis and future studies, and employs both scientists and policy advisers. For its customers, the 2b AHEAD ThinkTank analyzes – using scientific trend studies – both the opportunities and risks associated with trend developments in their businesses. The 2b AHEAD ThinkTank not only analyzes within the target industry, but across industry boundaries, incorporating all stakeholders that shape the future of the respective business model. With its analysis, the 2b AHEAD ThinkTank helps its customers to understand who or what drives their relevant trend environment and for what reasons.

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ExpertSight provides support to players in the healthcare sector in the future-oriented structuring of their business areas. We help our customers recognize the most important drivers of change in the healthcare business and to become future-proof companies. ExpertSight prepares trend analyses, conducts Delphi studies, and develops future scenarios in healthcare. Through our future workshops, we also demonstrate our technical and methodological expertise. Our partnership with experts in the areas of direct patient care and caregiving research, and with political decision-makers, provides a direct benefit to our customers. Our methodologies are proven in practice and based on sound science.

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The German Pharmacists and Physicians Bank (apoBank), with over 382,000 customers and more than 105,000 members, is the largest cooperative primary bank in Germany, and is number one among financial services providers in the healthcare business. Our clients are healthcare professionals, their membership organizations and professional associations, healthcare institutions, and companies in the health market. The apoBank operates according to the principle "By healing professionals, for healing professionals," that is, we specialize in serving players in the healthcare market and are supported by them as owners. Thus the apoBank's business model is unique in Germany.

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