Stiftung für Technologiefolgen-Abschätzung
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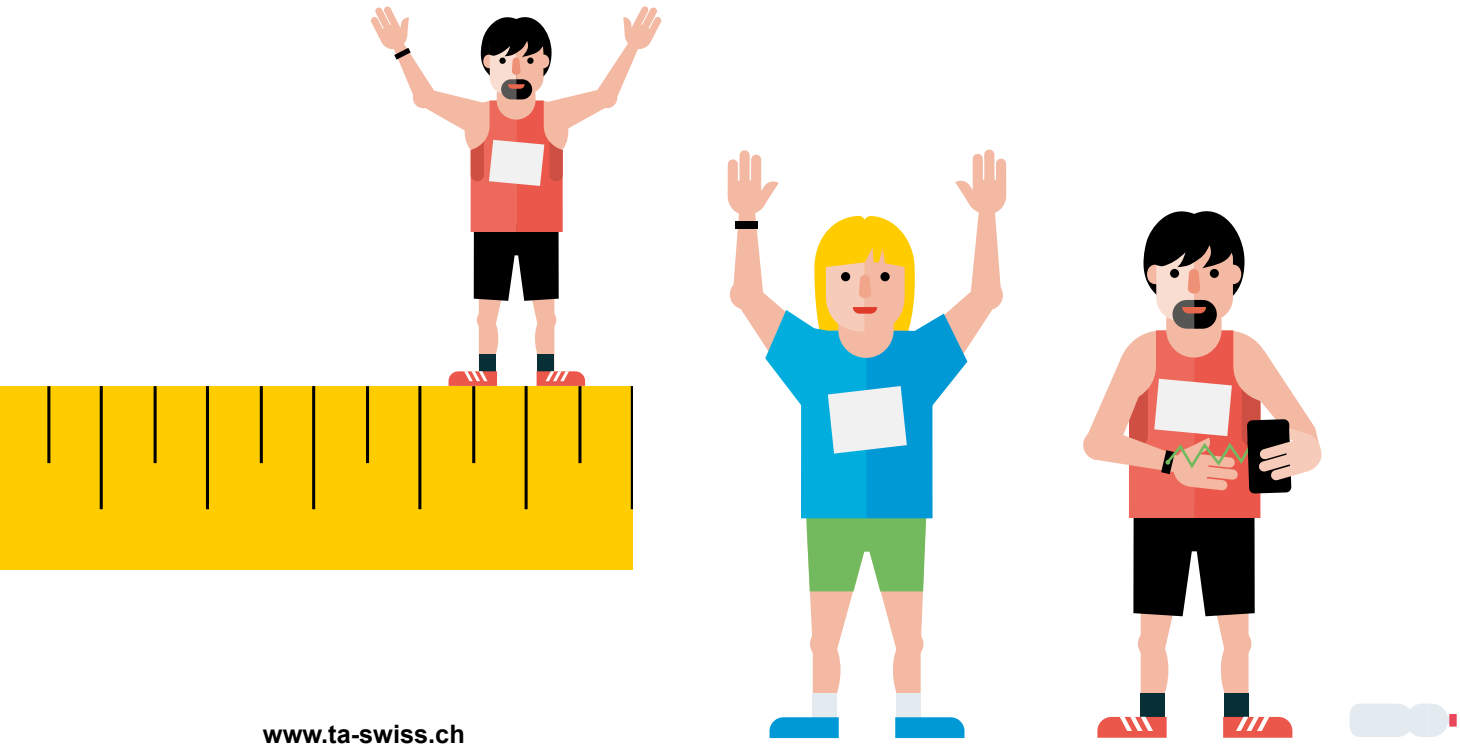
Foundation for Technology Assessment

The measure of all things: potentials and risks of self-tracking

Condensed version of the TA-SWISS study on the quantified self



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TA-SWISS, Foundation for Technology Assessment and a member of the Swiss Academies of Arts and Sciences, deals with the opportunities and risks of new technologies.

This abridged version is based on a scientific study carried out on behalf of TA-SWISS by an interdisciplinary project team led by Prof. Dr. Heidrun Becker, Center for Health, Zurich University of Applied Sciences (ZHAW). The abridged version presents the most important results and conclusions of the study in condensed form and is aimed at a broad audience.

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Quantified Self – Schnittstelle zwischen Lifestyle und Medizin

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A brief introduction to the concept of the quantified self

An inscription on the Temple of Apollo in Delphi reminds us how important it is to "know thyself". Do new forms of self-tracking that enable us to better quantify ourselves actually help us "know ourselves" better? Ever-smaller tracking sensors can now be incorporated into mobile phones, bracelets, wrist straps, clothing and other everyday items. Mobile sensors that can be worn round the clock to actively measure and record physical activity, sleep and a broad variety of bodily functions are the foundation of the "quantified self" – they provide us with knowledge about ourselves and our activities so that we can assess and optimise our fitness, well-being and health.

Opportunities …

If we know a lot about ourselves, we may be able to detect threatening diseases at an earlier stage and are also more likely to pursue a healthy lifestyle. Apps that display not only our current performance, but also progress made in our physical fitness training, for example, have a motivating effect and help users set themselves realistic goals and ultimately achieve them.

Digital self-tracking also opens up new opportunities in the healthcare sector. For example, self-management can support the treatment of chronic diseases. Real-time monitoring of selected health-related parameters may allow patients to be treated more efficiently and thus enjoy more freedom and independence in their everyday life.

This large volume of body data in combination with data from other sources could become an important basis in medical, therapeutic and pharmaceutical research for identifying new patterns and making more precise diagnostic classifications. These data might also serve to better support decision-making in healthcare policy.

Risks …

If individuals are overshadowed by statistics, society runs the risk of becoming standardised, as diversity is eroded in favour of an ideal norm. As people increasingly orient themselves on measured data, it influences their understanding of what is "normal" and "abnormal". Those who deviate from what is regarded as "normal", for example because a physical impairment prevents them from walking a certain distance each day, are at risk of becoming disadvantaged by being excluded socially, denied favourable terms of insurance or discriminated against on the employment market.

Many trackers do not deliver the necessary degree of precision, which means that users may be obtaining false data. This is especially problematic when such devices are used for medical or therapeutic purposes for which they have not been designed.

The data protection afforded by the majority of quantified self devices and their applications is insufficient. This represents a risk to the user's private sphere. It is especially difficult for users to enforce their rights because many devices come from Asia or the USA, where data protection standards are different from those in Europe.

… And a few recommendations

A quality label should be developed by the manufacturers of trackers to document the trackers' measurement precision, quality of data content, level of data protection, and certification and control processes. A label of this kind could also create a competitive advantage for products "made in Switzerland".

As part of the comprehensive revision of Switzerland's data protection legislation, the rights of users need to be strengthened and the rules relating to burden of proof amended in favour of users.

Consumer and patient protection organisations should test self-tracking devices and applications and publish the results of their tests.

Further studies should be conducted to determine the extent to which self-tracking can promote better health and possibly even reduce healthcare costs. Public debate on self-tracking should also be encouraged.

Self-tracking devices that have been proven to function effectively, economically and in line with their intended purpose should be included in the list of products and services covered by basic health insurance.

Ever higher, faster, better: daily life as a constant test of strength

Thanks to miniaturisation, sensors are becoming smaller and smaller so they can easily be integrated into mobile phones, watches, bracelets, clothing, etc. They can be used to measure many different daily activities: the number of steps we take, how long and how deeply we sleep, how many calories we burn when cycling, and so on. The comprehensive recording of body data has given rise to a highly diversified business field.

"Almost there, only 1 more star to get to 3 stars and improve your fitness age. Keep it up!" This is the kind of encouragement users who wear the "TomTom Adventurer" fitness tracker on their wrist receive via their mobile phone or PC. This device differentiates between various sporting activities, ranging from downhill skiing and jogging to cycling and swimming, and evaluates a broad variety of parameters: in addition to GPS location data it uses acceleration and movement sensors, and measures the steepness of the terrain. At the same time, it measures the user's heart rate.

With the aid of sophisticated algorithms, the precise formulae for which are kept secret by the manufacturer, conclusions can be drawn from the recorded data concerning the type of movement and the intensity of the user's training programme. Combined

with personal details such as sex, age, height and weight, other parameters such as calorie consumption and fat burning can be calculated from which recommendations can be derived for the user's training programme. Recommendations might include "Exercise for 15 minutes in the 'stamina' pulse range in order to obtain an additional fitness point", or "Wow! You've really pushed it today. Take things a little easier tomorrow!"

Broad variety of models from different manufacturers

A broad variety of tracker devices is available today: from bulky digital chronometers to elegant watches with concealed internal electronic readings and delicate bangles that do not appear to be connected electronically at all. The various models cover the wide-ranging requirements of users and are produced by manufacturers from a range of different sectors. Products like TomTom and Garmin, for example, emerged from the road navigation sector. Giants in the electronics industry such as Samsung, Apple and Xiaomi now also produce fitness trackers and smart watches, while the Californian company Fitbit was established specifically for the purpose of manufacturing self-monitoring devices for recording fitness and health data. Sporting goods manufacturer Nike also produces a tracker called "FuelBand". In addition, an ever-increasing number of apps are being brought onto the market that enable smartphones to record fitness and health data.

Users' needs vary enormously, since it is not only sportsmen and sportswomen who make use of fitness trackers. Devices are now on the market that measure the conductivity of the skin, from which the user's level of nervous tension can be calculated. Users receive bio-feedback from these devices which, according to the manufacturers, enables them to visualise their stress levels and thus take targeted steps to reduce stress. Trackers can also be used for monitoring body weight.

Self-monitoring is now also being introduced in the healthcare sector. Medical wearables, i.e. electronic components installed in shoes or clothing, or worn close to the body, and sensors placed directly on the skin, can be used for a variety of purposes such as measuring the blood sugar levels of diabetics. Wearables are also available for monitoring cardiovascular diseases and asthma. They communicate the collected data via "cloud" platforms and provide doctors with information about their patients' condition.

Self-measurement, often referred to internationally as the "quantified self" or "QS", can take a variety of forms, but it is always based on a common principle: enabling people to actively measure their bodily functions and activities with the aid of devices and applications. The analysis of the information thereby obtained allows the users to learn more about themselves, their bodies and their behaviour in the areas of fitness, well-being and health.

Anchored in the past

People's desire to understand themselves and their fellow human beings better based on the most objective data possible is nothing new. The anatomical studies carried out by Leonardo da Vinci, whose drawing of the "Vitruvian Man" depicts the ideal human body proportions, exemplifies this. This world-famous Renaissance drawing was long a standard for studies of aesthetics while also serving as a tool used by physicians in the world of medicine to identify physical disproportions.

The earliest large-scale systematic measurements of the human body were carried out within the scope of military recruitment. The set of measurements of more than 38,000 recruits gathered by the French army from the mid-seventeenth to the mid-eighteenth century is regarded as the oldest collection of recordings of individual body mass. In 1817, Belgian statistician Adolphe Quételet measured the chest circumference of around 5,000 Scottish soldiers – which led to him being acknowledged as the founder of biostatistics. In 1832 he developed the "Quételet Index", which is still used today as an approximate benchmark for normal weight and grades of underweight and overweight and is better known as the "Body Mass Index" or "BMI". Scientists also used soldiers as test subjects to study the mechanics of the human gait. For example, studies to determine the correlation between step length and speed were carried out in the 1860s on a large number of soldiers of different height, with and without backpacks, as well as on trained and untrained troops in both undulating and flat terrain.

Over the course of time, increasingly sophisticated equipment was used for the precise collection of data. Rulers and scales were supplemented by the mechanical pedometer, which was invented in 1780 by watchmaker Abraham-Louis Perrelet from Le Locle, who a few years earlier had developed the automatic pocket watch, which used the movements of its wearer to wind itself up.

Interpretation of measurement values is by no means easy

Nowadays, libraries are filled with scientific works dealing with the biophysics of human locomotion, the required number of calories for various types of sport and the burden placed on the circulation system during physical exertion. Thanks to highly advanced and miniaturised sensors, it is now possible to record a broad variety of body data. Nonetheless, measuring movements accurately and interpreting sensor data correctly are still challenging tasks.

Tests have shown that measurements recorded by fitness trackers have an average error rate of 10 to 20 percent. What this means in practice is that some models can be fooled to misinterpret actions such as rhythmic clapping as walking. In some cases, hand movements when playing a musical instrument or cooking can reduce the precision of trackers, and body hair or a film of sweat on the skin can falsify measurements.

Reliability of measurement is crucial, especially if a tracker is to be used for medical purposes, but even here the degree of precision is often insufficient. Studies have shown that apps designed to dose insulin for diabetics sometimes calculate erroneously or make false diagnoses.

Other risks exist in connection with the transmission of data to platforms in the cloud. Here, for example, a test revealed that 20 percent of wearables transmit data in unencrypted form. This means that it is child's play for hackers to intercept data from these devices and obtain users' personal details (name, date of birth, e-mail address, weight etc.).

Those who decide to evaluate and store their data on a platform expose themselves to additional risks. In addition to the measured performance or recorded health data, wearables often include the user's location, and mobile phones also record the owner's usage behaviour. In theory it is possible to combine these data with publicly accessible details about the user and thereby produce a comprehensive personality profile, which is likely to be of interest to health insurance providers, the user's employer, fitness centres, sporting goods outlets, etc.

Flood of data fed from various sources

Self-tracking also has to cope with the problem that data from a variety of sources have to be combined. Aside from the fact that the data formats used by the various types of self-trackers are seldom compatible, there is often other information in addition to that recorded by the tracker itself that has to be considered, such as data from mobile phone apps and details that are recorded manually (e.g. body fat measurements made with special tongs). This combination of different types of data represents one of the main practical challenges of self-tracking.

The enormous volume of data collected is another obstacle. For example, to assess possible heart diseases, monitoring devices have to measure the person's heart rate, and this calls for around 250 measurements per second. The volume of data per patient increases by around 9 gigabytes each month.

At an advantage thanks to self-optimisation?

Making the best out of the existing circumstances has become a widely accepted guiding principle in western society. The concept of "quality time" is now widespread, and practically everything from investment to personal time management and diet can now be optimised. This focus on quality control and improvement is being combined with the desire to monitor and increase personal physical performance.

By paying attention to a healthy lifestyle and offsetting the lack of physical exercise that has become widespread today due to the fact that so many activities are carried out seated at a desk, better health and personal well-being are promoted. According to a recommendation of the World Health Organisation, adults can reduce the risk of contracting chronic diseases by taking some form of exercise for at least two-and-a-half hours a week. If employees fall ill less often, this not only has a positive effect on healthcare costs, but also benefits the economy as a whole.

If we know ourselves well enough and monitor our bodies closely, we are also able to identify signs of health problems at an early stage. Self-empowerment means taking responsibility for ourselves and shaping our own lifestyle. There is clear evidence that people who want to lose weight or give up smoking, for example, can benefit from the motivation provided by self-tracking, but a fine line exists between a rational and an obsessive desire for improvement. The desire to measure not only the distance we walk each day, but also our pulse, lung function, sleep patterns and other body data is a manifestation of the general efficiency demands that are characterising our daily lives to an ever increasing extent. Viewed in this light, self-tracking may represent a further expression of a modern-day way of life that is fixated on growth and economic viability. This development, which social scientists are calling "objectivisation of the zeitgeist", also embodies the trend towards assessing the human body on the basis of data and measurements. This is naturally also associated with the risk that those who do not conform to the "ideals" could be exposed to discrimination.

The TA-SWISS study, "Quantified Self", was carried out within the framework of a cooperative effort between the Zurich University of Applied Sciences (ZHAW) and the Institute for Futures Studies and Technology Assessment (IZT) in Berlin, under the leadership of Heidrun Becker (ZHAW). The members of the project group evaluated the existing literature, from which they made an assessment of the current situation and future trends. They also conducted surveys among specialists as well as users of fitness-tracking and health-monitoring devices, from which they were able to gain insight into the use of these devices and the associated consequences.

Reflecting the body's physical condition in figures

Providing better support for patients, simplifying the collection of crucial health data, identifying patterns of disease early on: these and other healthcare objectives have significantly boosted the "quantified self" movement. Today, however, the majority of self-tracking devices focus on wellness rather than medical applications.

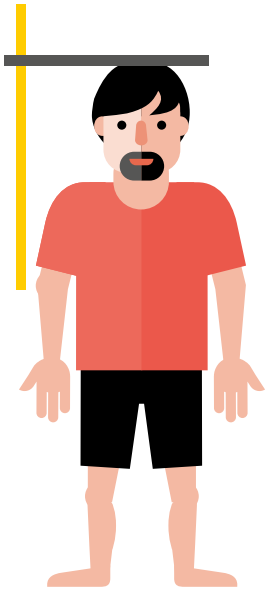
Around 2.2 million people in Switzerland suffer from chronic diseases. Cardiovascular diseases, certain forms of cancer, diabetes and chronic lung diseases are particularly widespread. This indicates significant potential for self-measurement applications. Regular measurements of blood sugar levels are an integral part of the treatment for diabetes mellitus, for example, while lack of exercise has been established as a cause of numerous widespread illnesses.

The need for supporting people suffering from chronic diseases was a major driver behind the development of the "quantified self" movement. In the healthcare sector, the main aims are to promote exercise, encourage people to lose weight or maintain their weight at an ideal level, promote a healthy diet, and support those who suffer from chronic diseases.

Reservations on the part of patients …

People suffering from chronic diseases tend to distance themselves from self-monitoring applications and prefer to use conventional instruments such as devices for measuring blood pressure and blood sugar levels. They handle their personal medical data very carefully and take steps to protect them. Fear of discrimination and exposure compels them to exercise the highest possible degree of discretion. The often inadequate data protection afforded by many self-monitoring applications is one of the main reasons for their reticence towards these devices.

The scepticism of the chronically ill is underscored by medical specialists who complain about the insufficient reliability of many self-monitoring devices. Another major drawback concerns the fact that wearing comfort and measurement accuracy often rule one another out. The reason for this is that more bulky devices are often required for recording precise data. These devices cannot readily be integrated into bracelets or clothing, and instead have to be attached to the body with the aid of a chest strap or belt.



… and the assessment of healthcare professionals

A survey conducted among healthcare professionals in the course of the TA-SWISS study revealed that they never, or only very rarely, recommend the use of self-monitoring devices. They only resort to the use of these devices if the patient is not suffering from a life-threatening illness or needs to be encouraged to change his or her habits. Many devices illustrate the correlation between quantified behaviour and the resulting condition – for example, between more exercise and weight reduction. Recognising and visualising such correlations makes it easier for users to set themselves realistic goals and subsequently achieve them.

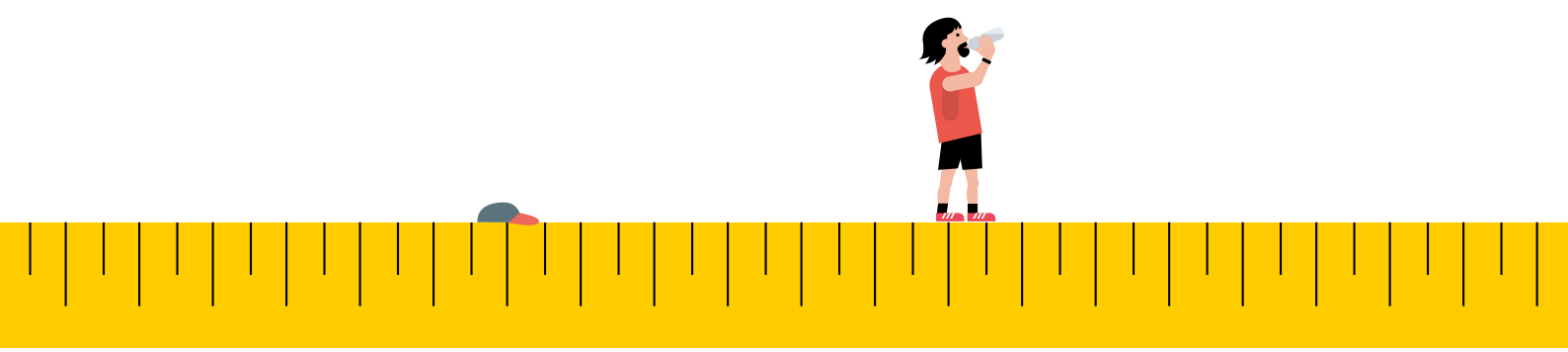
Doctors warn that, particularly in the case of anxious people, an excessive preoccupation with oneself or one's own measurement data is more likely to give rise to hypochondria. The surveyed medical professionals also confirmed, however, that the question of self-measurement has recently been addressed more frequently in the course of their consultations with patients. Many of them have been privately gathering experience with trackers and apps and are keeping an eye on their development. In their view, a great deal of potential exists in the visualisation of disease data.

Prevention and personal responsibility

Today, efforts in the healthcare sector tend to focus on prevention rather than cure. The emphasis is now on early detection, and doctors are urging us to take personal responsibility for our health. Self-monitoring is clearly a suitable instrument for this prevention approach. It opens up potential for reaching certain groups of people more effectively than before, because the technology affords a new means of addressing health. This applies in particular to men over the age of 50, who often have an increased tendency to develop cardiovascular diseases.

There are also signs that the importance of self-measurement is growing in the areas of therapy and recovery. Here, corresponding applications are being used to an increasing extent for monitoring and treating patients. The data could be directly transmitted to electronic patient files and thus facilitate decision-making and choosing the ideal time for intervention. In the medium term, self-measurement devices can be expected to blend in seamlessly with eHealth and telemedicine applications.

Research could also benefit from self-measurement devices. The enormous volume of body and health data represents a knowledge source that can be used for identifying health-relevant patterns in the



population. If in the future these devices are able to deliver reliable data and enough people are prepared to place their data at the disposal of scientists, such "citizen science" would make it possible for researchers to gather the necessary data for carrying out comprehensive studies more easily than in the past.

Lifestyle profile

At present, the majority of "quantified self" devices and applications are committed to a zeitgeist that emphasises lifestyle and fitness and only focus to a lesser extent on health. This is largely underscored by the fact that it is mobile phones that are by far the most frequently used appliance for self-measurement, and not devices designed specifically for the measurement of body data.

Unlike patients, who record specific data of relevance to their diagnosis, healthy people often measure a broad variety of parameters. In the survey of users, roughly half those questioned stated that they primarily self-track for fun and out of curiosity. In this respect they also differ from patients, who tend to regard measurements as something of a burden. The respective objectives also differ: patients primarily document their current condition, for example in order to determine a suitable moment for taking medication, whereas healthy users tend to evaluate their data from a future-oriented perspective in order to assess their behaviour or improve their performance.

But even playful self-measurement by healthy people is not entirely free of risks. An excessive preoccupation with one's own body data can ultimately manifest in pressure to perform, even though many apps are designed to warn against problematic behaviour and prevent burnout. Furthermore, self-tracking can potentially change a user's perception of his or her own body. On the positive side, self-measurement facilitates the early identification of potential health problems, but in a worst-case scenario it can lead to an undesirable dependency on data, as a result of which the user is no longer able to correctly interpret the signals relating to his or her own body. In any case, self-measurement fosters the user's perception of his/her body as a scientific object that can be modified on the basis of scientific data – and which possibly has to be shaped in accordance with social demands.

The lucrative business with body data

Manufacturers who produce trackers, IT companies that provide platforms for the evaluation and storage of recorded data, software developers, insurance providers and public health authorities all have a clear interest in the data obtained through self-measurement.

The origin of the "quantified self" movement can be traced back to an article that appeared in the journal, "Wired", in 2007 and which reported on the increasing dissemination of devices that record personal data. During that same year, the authors initiated a blog that soon evolved into a source of information about self-measurement. The movement rapidly spread from high-tech companies in Silicon Valley to other regions and has meanwhile taken hold in more than 30 countries. Today there are around 250 "quantified self" groups in more than 130 cities with a total membership in excess of 80,000. In Switzerland, Geneva and Zurich each have a "quantified self" organisation, the members of which periodically get together at what they call "meet-ups". But it is now no longer only groups of high-tech enthusiasts who take an active interest in the "quantified self" movement. Self-measurement devices and applications have since become very widely disseminated.

Rapid growth of both demand and supply

On the supply side there is now a broad variety of players: in the past few years, numerous new companies have moved onto the market and, in addition to basic applications, have been increasingly developing comprehensive healthcare services. Telecommunication companies are also entering the market.

Google's parent company, Alphabet, has established a subsidiary called Verily, which since April 2017 has been able to collect large volumes of medical data with its own smart watch. In their turn, Microsoft and other commercial suppliers are placing their cloud platforms at the disposal of third parties who want to store and evaluate health-related data. The "quantified self" marketplace is still very young: in a recent survey, more than half the involved companies stated that they only became active in this field in 2013 or later. By contrast, well-established players from the healthcare sector are finding it difficult to gain a foothold in this market.

Bright future for fitness trackers

The most widely used trackers are in the form of bracelets, smart watches and straps that can be worn around the upper arm or chest. Mobile phones are also widely used for recording fitness data. In a survey among developers of healthcare applications, 70 percent of the respondents stated that sensors in smartphones and tablets are the preferred hardware for tracking health data. By contrast, fitness trackers are not yet very widely used in Switzerland.

Nonetheless, a bright future is predicted for wearables and fitness trackers. According to a study conducted by PriceWaterhouseCoopers (PwC), the number of sold devices on the overall European market is expected to increase by 25 percent per annum. This would roughly double the total volume of the European market in the period from 2015 to 2018, namely from 4.5 billion euros (or around 5 billion Swiss francs) to more than 9 billion euros.

Lifestyle apps popular among a younger public

In addition to medical applications intended for use by healthcare professionals and people with chronic illnesses, there are currently around 400,000 apps covering the areas of lifestyle, fitness, sport and nutrition. Generally speaking, apps are primarily used on a regular basis by people under the age of 29, and even the use of wellness apps does not appear to deviate from this general rule. Figures from the USA show that wellness and fitness apps are used especially frequently by younger people. Better educated people and those with higher incomes also make very frequent use of lifestyle and sport apps.

It is not possible to estimate the sales figures for healthcare and wellness apps. One thing is clear, however: the use of apps is booming. In Germany, revenue from the sales of apps surpassed the billion euro mark for the first time in 2015 – a 41 percent increase versus the previous year. However, a large proportion of this app software probably rather belongs to the games segment. It is not possible to estimate the contribution of healthcare and wellness apps towards this figure.

Cost savings thanks to health data?

The assumption that a healthy lifestyle with sufficient exercise and a balanced diet contributes towards lower healthcare costs is plausible and has been quantitatively established. The study conducted by PwC estimates the long-term savings potential for Europe resulting from the use of electronic healthcare services that are available on mobile end devices ("mHealth") at more than 99 billion euros. Around two-thirds of this amount is attributable to prevention and wellness – the main areas of use of "quantified self" applications. Other studies have confirmed that savings potential is associated with self-measurement, although they do not cite any exact figures. The early detection of diseases, preventive education and close monitoring are the most likely factors resulting in cost savings.

Apart from the scientific estimates of the cost-saving potential resulting from self-monitoring, players in the business world also appear to be convinced of the cost-reduction effect of self-measurement. In any case, several Swiss health insurance schemes now offer their clients discounts on supplementary insurance if they are willing to collect and verify their sporting activities by recording "quantified self" data. With some of these bonus models, it is sufficient for the client to submit his/her daily exercise data to the insurer with the aid of a pedometer and an app provided by the insurer. CSS, for example, credits 40 cents for every day on which the client surpasses 10,000 steps (or 20 cents for 7,500 steps). The maximum premium reduction is around 150 Swiss francs a year. Bonus programmes of this sort are currently only permitted in the supplementary insurance segment. In the mandatory health insurance segment, however, financial rewards for physical exercise are not permitted because they would infringe upon the principle of solidarity in that people with reduced mobility would be automatically excluded.

Turning data into cash

With the concept of “big data”, measurement values and statistics have evolved into a kind of currency with which good money can be made. Health data are of interest to a broad variety of players: for example, to companies in the medical and pharmaceutical sectors which conduct research into disease causes and therapies and can obtain findings from large quantities of data. Government bodies can also make use of health data when planning healthcare systems.

Furthermore, new platforms are being created on which health and body data can be stored and evaluated. Here, an increasing number of large companies are becoming active that had not previously been active in the fields of biosciences and medicine. In the past few years, for example, Amazon, Google, Facebook and IBM have moved onto the preventive healthcare market. Pharmaceutical companies have intensified their cooperation with IT giants in order to develop eHealth and mHealth products and reach out to new target groups.

In addition to established IT companies, various small startups and independent software engineers are now generating income through the development of healthcare apps, and self-measurement is also of interest to the advertising industry. In fact, advertising is making a significant contribution towards the earnings of manufacturers of apps. No meaningful sales figures are available for the various products on the market, but as the example of Facebook shows, providers are certainly able to benefit from free products thanks to advertising: in the second quarter of 2017, Facebook reported revenue amounting to more than 9 billion US dollars, 98 percent of which was attributable to advertisements (of every kind). Advertising on mobile devices represented 87 percent of all ad revenue.

Self-determination calls for transparency

If body data are to be collected within the scope of medical treatment and therapy, the measurement devices used must be able to meet higher demands than those used for recording fitness or lifestyle data. According to law, appropriate distinctions have to be made. And data protection is of decisive importance, both for consumer and medical products.

Legally, self-measurement devices and applications have to be separated into two different categories. Those devices that are intended for use as accessories for monitoring a healthier lifestyle and improving the ability to cope with everyday life are classified as standard consumer products, whereas measurement instruments designed to collect vital parameters (for example for diagnostic purposes), to support a specific therapy or for the early detection of a deterioration in a patient’s condition are classified as medical products and are governed by significantly more stringent quality standards than consumer goods.

Requirements of legislation on therapeutic products

Medical products have to comply with the applicable legislation on therapeutic products and are subject to inspections by the relevant supervisory authority, Swissmedic. Switzerland’s registration and supervisory regulations are largely aligned with EU law. In the near future, Switzerland will also be harmonising its medical products ordinance with the more stringent EU provisions.

The decision whether a given device has to be classified as a medical product is based on its officially declared purpose. Measuring devices as well as medical software (e.g. an app) can be classified as medical products. If the publicity material for a device and its accompanying evaluation software gives the impression that the device is designed for a medical purpose, exemptions from liability in the app store no longer apply, even if the product description includes the declaration, “This is not a medical product”. Swissmedic ensures that the

applicable provisions of the legislation on therapeutic products are complied with and is empowered to prosecute violations.

In addition to the provisions governing the measurement accuracy of trackers and applications, even higher requirements apply with respect to data protection. If a patient uses a medical product as part of therapeutic treatment, the canton concerned regulates how the doctor has to handle the collected data. On the other hand, if within the scope of "eHealth" someone voluntarily transmits health data to his/her virtual patient file, the provisions of the federal legislation governing electronic patient files are applicable.

Consumer products in cross-border trade

Measurement devices that record stress levels, consumed calories, level of fitness or general lifestyle are classified as consumer products and are thus subject to the provisions of consumer law. Here, a variety of provisions apply, especially under the Federal Product Safety Act, the Federal Product Liability Act and the Swiss Code of Obligations.

If a faulty product causes damage or injury, the provisions of the Federal Product Liability Act apply, which for compensation claims refers to the Swiss Code of Obligations. But if the sales outlet refuses to acknowledge the defect, the person concerned (e.g. the user of a fitness tracker) may be confronted with significant problems relating to provision of evidence, as well as with considerable costs and litigation risk. If the product has been purchased from a foreign supplier, the practical obstacles can be even greater. The majority of commercial fitness trackers and apps come from the USA and Asia.

The results of various tests show that the degree of precision of many self-measurement devices is insufficient. Users of these products therefore run the risk of obtaining false information about their bodily functions and the resulting physiological parameters. Service providers whose services are based on a faulty or inaccurate application could also find themselves confronted with liability problems if damage or injury should be caused.

Who owns my data?

In Switzerland, personal data are not classified as an object and this means it is also not possible to own them as "property". Personal data that someone makes publicly accessible may be used by third parties, and this also applies to data collected within the scope of "quantified self" measurements. Even health data which are afforded special protection through legislation can be used by third parties under certain circumstances, for example if the person concerned has consented to their use.

However, it is often very difficult for people to find out what happens to their personal data. For example, many suppliers offer apps at very low prices or even free of charge, but the applicable terms and conditions often specify that the supplier is authorised to use the collected data or even to sell them to other companies. The fact that suppliers often change their general terms and conditions without informing their customers contributes towards this lack of transparency.

Valuable knowledge

Self-measurement opens up significant potential, especially in the medical sector, for providing patients with more effective treatment while at the same time affording them greater freedom of action in their daily life: patients can enjoy greater autonomy if their data are transmitted in real-time to a healthcare professional who closely monitors their state of health. For heart patients, for example, wearables are already available on the market that constantly record their electrocardiogram and thus detect any occurrence of cardiac arrhythmia. Thanks to the use of these devices, in many cases it is possible to shorten the duration of hospitalisation and treat the patient in his or her own home, with the resulting gains in terms of quality of life.

Data collected within the scope of self-measurement can also benefit medical research, both with regard to the potential development of new methods in the fields of prevention and therapy and to healthcare policy decisions as well. This means that "quantified self" data could provide a valuable resource that would benefit not only individual citizens, but also society as a whole.

The normative power of the data

The development of the use of “quantified self” data will ultimately depend on whether the benefits of self-measurement outweigh the disadvantages. Personal data can often awaken a desire for gain, such as the bonus programmes offered by health insurance schemes for supplementary insurance that were addressed above. In the USA, some insurance providers offer companies better conditions if their employees participate in “quantified self” programmes and work on improving their fitness. Such moves could create a division and deconsolidation of society – with those people benefiting who are willing and able to document the corresponding physical performance, while those who are unable to do so because of their age or an infirmity (or who are unwilling to collect or supply their personal data on principle) would be excluded.

Pressure could also arise in the private sphere. For example, if people not only document their physical performance on corresponding platforms, but also disclose body data that are closely linked to blood relatives (i.e. genetic data from other sources).

Product quality and data protection

In order to exploit the positive potential of self-measurement devices and apps, comprehensive data protection is essential. And for consumers it is essential to know what these devices measure and how accurate their measurements are.

A bright future has been predicted for the trend towards self-measurement and self-optimisation. The following measures are recommended in order to utilise the opportunities and minimise the risks:

Introduction of a quality label for recommended products

In the often confusing market of self-trackers and apps, many products fail to meet the necessary quality requirements. With the aid of a quality label it would be possible to inform customers about products that have been tested and certified. The label should contain information about the validity and precision of the device's measurements and include details regarding data protection, data security, the comprehensibility and transparency of the supplier's general terms and conditions, and the certification and inspection procedures involved.

Here it would be necessary for manufacturing associations to develop a binding quality label for those devices that are classified as consumer products. By producing a corresponding directory, Swiss manufacturers could create a high degree of transparency and secure a competitive advantage for themselves. The option of transferring responsibility to the state should only be considered if efforts to introduce a suitable quality label should fail.

More stringent controls for medical products

The relevant supervisory authority, Swissmedic, and the data protection officer should intensify their monitoring of the medical products market. Prior to the introduction of a medical "quantified self" product, the manufacturer and relevant authorities should not only examine its potential health risks, but should also verify whether it complies with the requirements relating to data protection and data security in order to eliminate any potential infringements of users' privacy rights.

Healthcare professionals should rely on tested medical products so as to recommend safe and secure models to their patients.

Testing of products by consumer and patient protection organisations

Consumer and patient protection organisations should regularly test products designed for measuring lifestyle and wellness data and subsequently publish their test results. This would help customers decide which device or app to choose.

Better data protection and reduced litigation risk

Legislators should use the ongoing total revision of the Federal Data Protection Act as an opportunity to improve the rights of users under procedural law with regard to the various devices and apps. It is often very difficult for users to provide evidence that their health data have been unlawfully used by third parties. The most suitable solution here would appear to be reversing the burden of proof, i.e. it should be up to the manufacturer or supplier of a service to prove that a violation of the user's rights has not occurred. The new burden of proof regulation should be incorporated into the Federal Data Protection Act.

Promotion of accompanying research into self-measurement

At present the positive potential of self-measurement is still a claim rather than an established fact. Research needs to be carried out in order to determine the extent to which self-measurement truly contributes towards lower healthcare costs and a higher quality of life. It is also important to assess the social impacts of self-measurement in step with its ongoing development.

Anchoring “quantified self” in the healthcare system

Self-measurement and knowing how to use it correctly should be integrated into the healthcare system and the education of healthcare professionals. Training and further education institutions should incorporate the topic of “quantified self” into their curricula and develop suitable courses and job profiles for teaching the required skills.

Inclusion of approved “quantified self” applications in health insurance schemes

Over the long term (i.e. beyond 2022), the Federal Office of Public Health should add medical self-measurement devices and apps that have been proven to be effective, purposeful and economically viable to the list of products and services covered by Switzerland’s basic insurance scheme.

Need to encourage public debate

Does self-measurement help us live a healthier, more enjoyable and longer life, or does it harbour the risk of self-deception, standardisation and external control? Both are feasible. The ongoing public debate should steer the new technology in the direction we want it to go.

Study «Quantified Self – Schnittstelle zwischen Lifestyle und Medizin»

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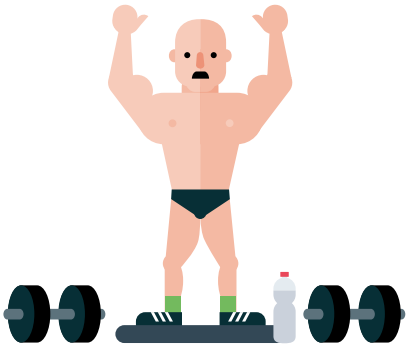

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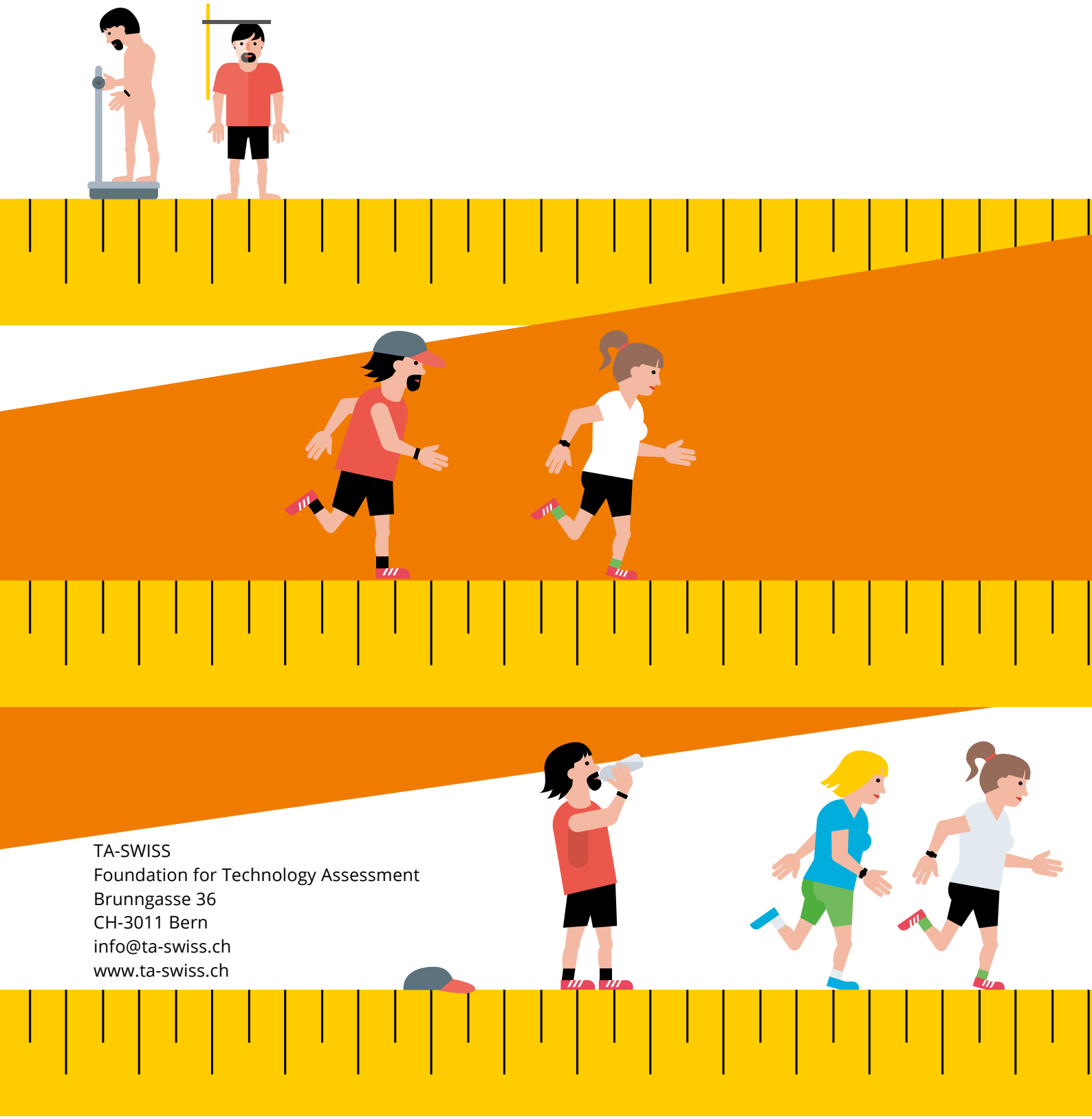

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