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Health from your pocket? Opportunities and limitations of health-related apps

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Health from your pocket? - Opportunities and limitations of health-related Apps

Institut Arbeit und Technik

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Key Facts

- Nowadays more than half of all Germans (52.6%) inform themselves about health topics online.
- It is expected that in 2011 every third mobile phone sold will be a smartphone.
- At the moment there are more than 300,000 applications available since the introduction of the Apple online store in July 2008; by the end of September, they have been downloaded seven billion times. In Germany, about 1400 Health Apps are available, internationally there are already more than 7000.
- Health Apps play a minor role currently, but have, according to the online shop, growth rates of up to 156.6% (Android Market).
- Although many telemedicine solutions share the same or a similar value proposition they rely on different technical innovations. Smartphones / apps can serve as a uniform interface and thus decrease deficiencies in user acceptance and competence.
- Economically and from a consumer point of view, there lies a great potential in the development of health-related apps, which is (still) not fully utilized.

Zentrale wissenschaftliche Einrichtung der Fachhochschule Gelsenkirchen in Kooperation mit der Ruhr-Universität Bochum

Fachhochschule Gelsenkirchen

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Introduction

Mobile phones are currently strong sales, particularly the so-called smartphones.[1] These are powerful devices which expand the functionality of mobile phones significantly by the use of GPS, position sensors, and Internet access. One reason for this is likely to be recent development that shows a triumphant track-record: the apps[2]. App is the abbreviated version of application and refers to any form of programs that can be downloaded directly via an online shop to the mobile device or mobile phone. This is not one a new development since apps have existed since the 90s.[3] However the mass distribution of apps is not older than two years and owes its origin to a large extent Apple's iPhone. Because of its launch, the smartphone market has opened to the masses and mostlythrough the online trade of the Californian company, the Appstore, the applications were able to reach their current popularity. But in order obtain this success an important step had to evolve earlier: the amalgamation of mobile communication and the Internet.

Digital communication and the health industry

There is no doubt about the fact that the Internet is widely regarded as one of the key technical and social revolutions of recent decades. Due to its “multimedia” abilities the Internet is considered as an "Unified Medium" and thus occupies a special position in the current media and communications landscape: It unites and bundles many traditional and socially established forms of communication within a single media access. The advantages of such a grouping and the associated acceleration are not thematically limited and can be identified particularly in the field of health communication. It is "neither a new nor a particularly original finding" that the multimedia features of the Internet "have the potential to revolutionize communication structures in health care and thus improve quality and efficiency of medical care, education and administration." (See Eysenbach 2001).

The health industry is like no other industry characterized by personal services, as in the center of the service spectrum is the doctor/patient relationship and the relationship between nurse/therapist and patient. Personal services are based on interaction and communication between a provider (doctor/nurse/therapist) and service users (patients), medical, health and care are therefore known as "forms of

[1] Year-over-year smartphone sales are up 95% worldwide. Over 80.9 mill. of the over 400 million handsets sold in the third quarter 2010 were smartphones. Nokia is leading the field (33%), Apple gets to 17, RIM to 15%. Rising star is Google: one quarter oft he sold smartphones runs Android. http://www.heise.de/newsticker/meldung/Apple-und-Android-schliessen-im-US-Smartphone-Markt-auf-1128518.html

[2] All following apps are chosen as an example, whereby this list does not claim to be exhaustive and the apps will not be rated due to their quality.

[3] http://www.manager-magazin.de/unternehmen/it/0,2828,669929,00.html

interaction work" (cf. Büssing / Glaser, 2003). In health care, already long-established forms of communication - such as public health education or a medical conversation between doctor and patient - are in variations also part of the digital communication. The special types of communication are not so much reinvented, but rather are upgraded due to the given special media features (interactivity, immediacy etc.) (see Eysenbach 2001). But this continuous evolution does not only lead to a change of the peculiar nature of communication, it rather upgrades the value of communication within the System of Health Economics: "The limits of medical, health, communicative and economic rationality expand themselves to the interactive medium 'Medicine 2.0'. [...] The stepchild of medicine, the health communication with the patient, educates, his father slowly, but for the long term." (See Krey 2010).

In 2006, 52.6 per cent of the German population gathers information on specific health topics online (Federal Statistical Office, 2007), given the exponential growth of electronically stored content, it seems not very unusual that the Internet is widely regarded as the "most important medium in terms of Health Information." (Eysenbach 2006). Nowadays the consecutive increasing personal responsibility of citizens is commonly present in many areas of society, but this trend unfolds a particularly enduring quality within the healthcare industry. As dependent users of the health system the patients become enabled to act as independent and equal actors themselves, gain a large share of responsibility for his health efforts, actively seek health information and education and make use of all available information resources. This cultural change over the past 30 years is one of the major driving forces for the increasing emancipation of the laity by professional expert systems - not only in terms of health care (cf. Gerhards 2001).

Digital Health Communications - Comprehensive but impenetrable?

Figure 1 on page five is intended to provide a systematic overview of the complex communication systems and technologies within the healthcare industry. Important dimensions of this communication model is constituted by the various stakeholders (Health Professional, ie, the physician; Client, ie the patient), their role within the communication process (sender, receiver, or both) and the corresponding information-promoting medium. Here it should be noted that the traditional media presentation of health information (ie, via TV, radio, press, "Web 1.0" etc.) is generally mediated monodirectionally and hence is authoritative (see Fig 1, lower half of the model). It is typical for this authoritative pattern that in this case the patient is not enabled to react to the usually undoubtful authority of health experts. In this form of communication, the patient has primarily the function of the passive consumer - technical competence and the professional diagnosis of a doctor is not to question. In most cases the

diagnosis cannot be addressed precisely since the patient has no direct access to the necessary background knowledge.

In such cases, the doctor/patient relationship is commonly characterized by a distinct asymmetry of knowledge and power. The doctor acts in the function of purely active information "channel", and the patient is forced to be content with the role of the passive "receiver". (see Hurrelmann 2000)
Because of the special opportunities of interactivity the modern, digital way of health information offers an original character as they are usually cross-linked and are thus characterized by a participatory model. In this instancethe individual actors interact on "equal footing". As far as the patient wishes, he gets more involved in diagnosis and treatment, consults with the doctor and discusses the necessary steps of a future medical treatment. In the best case the attending physician communicates the necessary background knowledge only to the extent as required by the patient. In addition, the patient uses this information on a proactive basis in order to complete the overall picture of the diagnosis (see v. Reibnitz / Schnabel / Hurrelmann 2001). The advantages of a networked and direct distribution of information are obvious but are marred by inevitable emergence of (technical) barriers, because the diversity and complexity of digital communication can be both a curse and a blessing.

Necessarily the successful and comprehensive control of such a complex system demands a high degree of competence on the part of the user. In our modern Communication Society it is a common problem that certain parts of society have disadvantages or are even marginalized by the participation as communicative and technical skills are socially distributed in an unequal way. People from disadvantaged backgrounds or seniors, who are less trained in dealing with new media, come to mind. In addition to the required media literacy on the user side there is also an over-supply of services and methods for obtaining information and hence can create an access barrier. This may especially deter less technically savvy users as this “cornucopia of options” may appear inscrutable and more like an "impenetrable jungle". Here lies the great potential of apps, because they may provide a simplified, uniform access to the complex and diverse forms of communication the Web and expand it beyond by adding aspects of mobility. In the short history of the Internet only the introduction of "social software" (Wiki, blog systems) had a similar impact on user competence, as now everyone was enabled to publish digitally, even without extensive technical knowledge (Web 2.0). This it hardly surprising that in technical discussions about a future "Web 3.0" in addition to a simplified semantics mobility aspects are seen as integral components.

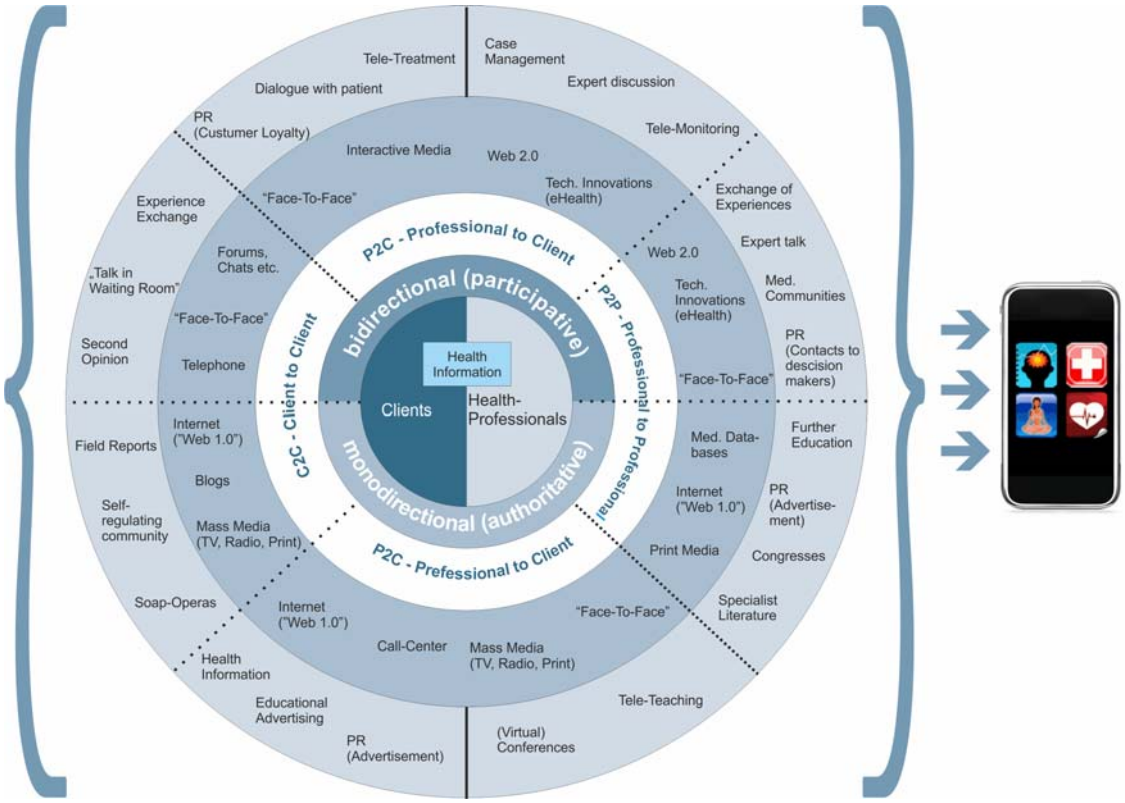

Figure 1: Schematic overview of the different forms of health communication and the used media channels - basically, apps can offer simplified access to all the listed areas and thus support the pooling of information.

Source: Own presentation

Apps: Data and Facts

Since the introduction of the Apple online store in July 2008 there are more than 300,000 applications available; and by the end of September they have been downloaded more than 7 billion times. One could hardly imagine a branch that does not utilize the benefit of programs: Games, office applications and financial programs are just some to mention. This is also recognized by Apple and therefore advertises with the slogan "There is an app for that." But ever since other manufacturers have joined this business trend and offer their own online business applications for their systems: whether it is for Google's Android operating system, the Blackberry from RIM and Nokia devices. But this does not display the full picture, as with the increasing popularity of tablet PCs - here Apple once again takes the lead with the iPad - the success-story of apps still continues.[4] The iPad not just uses the App Store, it also

[4] Within 80 days more than 3 mill. devices were sold. http://www.apple.com/pr/library/2010/06/22ipad.html

expands the possibilities due to the larger display. Meanwhile, other manufacturers such as Samsung or the WeTab GmbH have brought more and more tablet PCs to market, however Apple remains the market leader in this segment.[5] In terms of apps a similar picture can be painted, whose overall performance can be illustrated with striking data: In 2009 3.1 billion apps have been downloaded worldwide, but the number of downloads has already risen to 3.9 billion in the first six months of 2010. Even in Germany, the demand for apps has developed rapidly: Forecasts for the year 2010 speak about an increase of 425 million to 755 million (BITKOM 2010a). Many of the applications are provided free or for a small fee. Despite the current average price of EUR 2.82 per download the business with apps holds a huge market potential: In Germany, the sales volume for 2009 was 190 million euros. For 2010, sales are forecast at 343 million euros. The different websites usually have a similar structure: A manufacturer may provide the application for a certain amount, the provider of online retailing, holds a certain percentage of it back.[6]

If this is true for all the various apps, then it is not surprising that this also applies to the health sector. Google's Android Market summarizes them in the category "Health", the App Store distinguishes the categories of "Health & Fitness" and "Medicine". Numerical this means 628 or 725 offered programs for the German market (as of 12/11/2010). The range varies strongly and includes very different approaches: health encyclopedias, pedometer, help for back strain, 3D models of human body parts, BMI calculator, medication list, or pollen calendar; the variety of offers is large and is growing constantly and the possibilities are far from being fully utilized. The market of apps for the health sector has been opened up for a short time. However, looking at the trend in recent months it can be stated that the area of Health Apps has enormous growth rates. For the American market, the following data stresses this general tendancy:

Tab. 1: Growth Rate of Health Apps in USA

Health Apps in USA			
Provider	**Februry 2010**	**September 2010**	**Growth Rate**
Apple	4.276	7.136	66,6%
Android	505	1.296	156,6%
Blackberry	140	338	141,4%

Source: Dolan 2010

Compared to the entire app market Health Apps currently play a more subordinate role. According to market survey conducted by the Nielsen Group this category of

[5] Apple rapidly captured 95% global share during Q3 2010 for table-Pc´s.http://www.bloomberg.com/news/2010-11-02/apple-increases-tablet-share-to-95-percent-as-android-slips.html

[6] Apple and Google both keep 30%.

applications is not even among the 13 most popular types available. The market is dominated by games, news and navigation (Purcell, Entner and Henderson, 2010). If you take the growth rates of recent months into consideration, a positive trend becomes clear: In the Apple Store, during the period February - September 2010 the number of almost 3,000 apps increased to 7136, representing a growth rate of 66.6%. In regard to Android and the Blackberry Store the facts speak an even clearer language: Although the absolute numbers are still rather low, the growth rates of 156.6% (Android) and 141.4% (Blackberry) are quite impressive.

However, a key question remains open: Who actually uses the applications? For the American market can be stated that 82% of all 18-years-old have a cell phone, 35% have downloaded an app and 24% actually use apps. The regular use of apps is directly connected to the age factor. While 79% of 18-29-years-old actively use apps, this percentage decreased to 67% for the 30-49-years-old and to 50% for users who are older than 50 (Purcell, Entner and Henderson, 2010).

Regarding Health Apps a similar trend can be recognized: 17% of mobile phone owners have used their phone to look up health or medical information, among 18-29 years the percentage is 29%. 9% of all mobile phone owners have these kinds of applications on their phones, in the group of 18-29 years it is 15% (Fox 2010).

What kinds of Health !LJps are l·Øailable?

The offered amount of apps with medical and health reference covers a broad spectrum. The following figure is an attempt to form categories for the already existing offers and to tabulate the contents:

Fig. 2:Health Apps Categories

	Function of the Smartphones	Health & Medicine	Health & Lifestyle
Information	Smartphone provides information	health encyclopedia, journals, medical series, ICD-10, Red list	diet tips, yoga school, relaxation exercises
Documentation	+ Users can enter additional data	Blood sugar diary, blood pressure logs	Running diaries
Coaching	+ App responds individually to the data entry	Diagnosis app	Run training programs, nutrition programs, behavior tests
„Therapy“	Smartphone as therapy device	Tinnitus Coach, acne-app	Track record by using GPS

Source: Own Presentation

In general, the content forms two broad categories:

- Health & Medicine: This category embraces all the apps that have a strong medical reference. The offer ranges from general information on certain diseases to specialized information on specific diseases or drugs. The offerings are targeted at a specific peergroup.
- Health & Lifestyle: This includes apps that understand health in a broader context, treat and provide marginal areas of the health care industry such as fitness, wellness or nutrition. The offerings are targeted at a wider audience.

The table shows a second level of categorization, the interaction that makes the user with the smartphone. Four categories can be formed here:

- Information: Apps in this category are characterized by the fact that they simply make information available to the user. With the acquisition of these apps the user is provided a spectrum of information ranging from broad-based information to subject-specific information. Thus the target group consist of users who are interested in health topics as well as healthcare professionals, who can receive targeted information about specific medical conditions and therapies, etc.
- Documentation: Apps in this category provide a documentation function in addition to the pure information function. In the field of medical apps, this may be, for example, applications like blood sugar diaries or blood pressure logs. In

the lifestyle section, these apps that can register training sessions or help to create running diaries.

- Coaching: In this context, coaching means that the documentation function is expanded, so that the app can responds to individual user input. This content is used in different areas. For example an individual training plan for the next few days can be produced based on the entered training data. Other apps try to analyse certain behaviours based on inputs, in this case the first steps towards diagnosis are already made.
- „Therapy“: This category does not necessarily include the previous functions but is distinguished by a special characteristic: A feature of the smartphone will be used to implement a health application. In the medical field, for example, acoustic signals or lighting effects of the display are used therapeutically. In the lifestyle area the GPS feature of smartphones is predominantly used. With the help of apps running or cycling routes can be recorded.

Where is potential for medical apps?

Looking at the various types of communication channels the following statements about medical apps can be made: A very large number of apps use the medium to provide pure information. With the acquisition of the app is the user can access any type of information anywhere. This can be understood as the simplest kind of apps and is expandable to include many topics. Therefore, this type of apps will probably be of very high importance in the future, because in addition to provision of technical information, the health industry (hospitals, health, fitness studios) can use them to indicate their special offers.

Other forms of communication, where multiple users are connected indirectly or directly or integrate external devices are in Germany still not widespread. In other countries such interaction apps are much more likely to be found:

- In the U.S. there are apps that support medical professionals to share their knowledge and to discuss by video conference despite long distances.
- A Dutch company is currently testing an app that allows ECG recording by a smartphone and the immediate forwarding of the recorded data.
- There are multiple applications, which record data by using Bluetooth, for example, by measuring blood pressure or EEG in order to transfer the data via GPRS to a health center. The app uses existing infrastructure and fits in the chain of medical care.
- Medical apps are also in some hospitals on the rise: They can be utilized as data collection of laboratory results, X-rays, medication, etc., and the usage of tablet PC’s can support the medical staff during their visit.

- In the lifestyle sector there are currently apps in development that try to measure the pulse with the help of the earphones. Records the vital signs are made as well and hence the athlete is offered an all-in-one solution: Just one device has to be used instead of a phone, MP3 player and heart rate monitor.

These examples indicate which direction the progress may take. In Germany the development of interactive apps is still in its infancy, however, there is a large amount of potential - a fact that is supported by data, which are part of the research project "eHealth@Home". Within the project every telemedicine application and action throughout Germany has been recorded and classified according to different criteria.[7] Many of the identified projects make usage of mobile devices or transmit medical data via mobile communications networks.
Many individual telemedical solutions that share the same or similar value proposition make usage of different technical innovations. There lies a considerable potential for medical apps as the smartphone or the app itself can act as a uniform and easy-to-learn interface between medical technology and the users and thus compensate deficiencies in user acceptance and competence.
After analyzing which of these telemedical projects could be supported by asmartphone or an app, the following statements can be made:

- In 201 of 259 projects there is the chance to integrate apps or conduct the procedure entirely with the use of it.
- The largest target groups are: 35.8% chronically ill, elderly 19.9%, cardiovascular disease patients 13.4%
- The most frequent fields of application: 28.8% Cardiology, Care & Home Care 17.4%, neurology and diabetology 10.0%
- The stations of the value chain are as follows: Prevention: 22.4%, diagnosis: 24.9%, treatment: 34.8%, supply 67.2%
- Vital signs that are monitored: blood pressure 34.8%, ECG 28.4% and weight 25.9%

Thus, the majority of the telemedical solutions could be – at least in part - conducted with the help of an app or be supported by such programs. The majority focuses on cardiovascular diseases. For example, the Deutsche Telekom subsidiary T-Systems has developed an app where patients or doctors can monitor the ECG. Besides the iPhone an ECG monitor is necessary, so that the data can be sent directly to the own mobile phone or the physician. Even Apple seems to have recognized the potential of medical

[7] Usage of mobile devices (31,4 %), wireless commuinications (GSM 21,32%; UMTS 19,77%; GPRS 16,28%; HSDPA 1,94%)
Source: EHealth@Home Map (http://www.iat.eu/ehealth)

applications and has applied for a patent which is to allow future generations of the phone to accomplish the pulse measurement without additional hardware.[8]

Opportunities and barriers of health-related Apps

Why do Apps have the chance to have a lasting effect on the health economy market since they are not really a new development? Programs to install on your computer have been there for a long time. There are two new developments though: The way of distribution and the aspect of mobility by using Smartphones as end devices. There are multiple reasons for those two trends. The dissemination of Smartphones and Tablet-PCs has reached new heights and therefore for the most part you only need one device. In some cases you need to upgrade the hardware and usability of the device to use certain applications. The most applications though can be managed with one central device and the app. By now most users emphasize the usability of comparable devices which is an important point. It is not necessary to look for a user friendly interface every time a new product enters the market when you already have those in place. This means you not only have an easy access to the software but also to the hardware.

That everyone can be a provider is another specific characteristic. With the appropriate idea and programming skills you can send in your app and after approval you can find in the store. Specifically this procedure has been criticized in the past: “Apple is responsible for marketing and distribution and additionally selects which Software is showcased and highlighted or is even advertised for. Apple is the contact for clients […]. It is an all around closed world with Apple as a gatekeeper and supervisor.” (Spehr, 2010, Translation by editor).

Apple’s biggest competitor, the Android-market, takes a different approach. The primary way of distribution is also an Online-Shop but Android Users have different alternatives to choose from. The one thing you need is a Google account. Another specific characteristic: Google offers a toolkit to its customers to develop Apps based on program building blocks. On one hand this simplifies the access and ensures a faster growing number of apps but on the other it makes quality control even more difficult.

One major problem concerning all online stores is lack of transparency. There is external quality control to some degree but the store itself often has only a small number of reviews. There are two main problems with that: It is impossible to see who wrote the reviews – therefore it is possible for the author of the App or someone he hired to write the review, secondly especially concerning medical apps there is no professional review to evaluate the benefit.

[8] http://www.maclife.de/iphone-ipod/iphone/misst-das-kommende-iphone-die-herzfrequenz

Furthermore it has to be noted that the increasing growth of medical technology and achievements may not lead to social and medical exclusion of population groups. Not all income groups are capable of buying and maintaining Smartphones. The further development of medical apps should not lead to a substitution of existing proposals in the field of health care, instead it should serve as a reasonable auxiliary service.

The following table summerizes the pros and cons:

Tab. 3: Apps pros and cons

Pros	Cons
The Smartphone can be used as a remote control, to make stationary E-Health applications mobile (sometimes including the adjustment of hardware)	Missing quality control (non-transparent rating system/ plenty of offers, whose purpose is not clear)
Easy access (soft- and hardware)	Increasing growth of technology may lead to social exclusion
Small obstacles for the seller (broad market / development-kits are provided)	Hardware restrictments (e.g. the iPad has no camera and USB-port / pulse tracker has to be integrated in the earphones)
Many similar offers -> you can select the best	Access to the specific online-store depends on the provider (mischief of abuse)
Many free offers / low average price	

Source: Own Presentation

Conclusion and perspective

In summary, it can be said that health-related apps bear great potential, which is (still) not fully utilized. Keeping the relatively young age of development in mind, it becomes clear the correct path has been chosen. Apps are reasonable implementations, both economically and from a consumer point of view. Thus, the operative range of applications in the field of lifestyle and wellness products is widespread: In addition to pure information functions like GPS, an app may generate individual user generated content (track records). In the field of tele-medicine smartphones and apps may help to make stationary E-Health applications mobile.

From the supplier's point of view the Health App market offers many opportunities: Enormous growth rates in the development show, that many companies are aware of the importance. Therefore two reasons for this can be pointed out: First of all many people are ready to invest in their health. Secondly, there are more and more potential app-users: For the year 2011 a growth of 39% for the sales of smartphones is predicted, so that, for the first time, the limit of 10 mill. will be exceeded (BITKOM 2010b).

In Germany the development of medical apps has just started. Experiences from abroad have shown, that new generation apps are capable to switch from information to interaction. This is the point, where Germany is challenged and has to position itself adequately; the technical infrastructures is utilizable, but there is still a lot of place for implementation.

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