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SPECIAL ARTICLE

Good morning, Doctor Google

Bom dia, Doutor Google

J. Escarrabill^{a,*}, T. Martí^b, E. Torrente^c

^a Dirección del Plan Director de las Enfermedades del Aparato Respiratorio PDMAR (Departament de Salut), Àrea de Innovación, Institut d'Estudis de la Salut, (Departament de Salut), Barcelona, Spain

^b Indesinenter, Barcelona, Spain

^c Àrea de Innovación, Institut d'Estudis de la Salut, Departament de Salut, Barcelona, Spain

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Internet: born at the end of the 20th century

Thomas S. Kuhn perfectly describes the manner in which scientific knowledge is developed.¹ Knowledge is not based on accumulation or on effort. It is not entirely reliant on one person or spawned on one specific day. Scientific revolutions occur by a process which involves the intervention of various people, facts and events which, if analyzed in isolation, might appear arbitrary or even insignificant. Attempting to identify the exact date when the paradigm shift occurs is futile.

In this attempt to observe the paradigm shift which occurred in relation to the internet, it is necessary to start the discussion by referring back to the workings of the Advanced Research Projects Agency Network (ARPANET) at the beginning of the 1960s, during the darkest days of the Cold War. It was based on the transmission of packets of information (Packet switching) via a closed network of independent nodes, without a central hub, so that the information flowing through the network was less vulnerable to the destruction of one node. In 1989, nearly 30 years after ARPANET, Tim Berners-Lee (1955) developed the World Wide Web, an application which permitted the sharing of files over the internet.² The most important element of Berners-Lee's contribution was that it allowed the free use of this design. But many could argue that this intervention did not

necessarily signal the birth of the internet. It is true that without www, the formation of the internet would have been more difficult, but still, we cannot describe Berners-Lee's network in the same terms with which we define the internet today.

In order to understand the internet (the 21st century internet) we have to digress and consider the interaction of two relevant developments which, initially, followed a parallel course: digitalization and networking. Connection (networking) is possible without digitalization (the telephone existed before the digital age, for example). But the great power of the internet resides precisely in this combination of digitalization and networking. Digitalization, which is defined as the conversion of information (sound, image or text) into a binary code, is what led to the explosive growth of the net.

But above all, digitalization allows the inversion of roles, especially with regards to who is considered the "producer" and who is the "consumer". Don Tapscott coined the term "prosumer"³ in order to help resolve this issue.

From web 1.0 to web 2.0

In this historic journey, some people have remained at the first station: consulting web pages. In the early stages of the net, web pages were "visited" and searches were very limited (exact sentences, grouping of addresses in thematic blocks), very precise and had a significant rigidity in the consultations (you could consult what you could see). The consumer's role in this first stage can be summed up in one

* Corresponding author.

E-mail address: jescarrabill@gencat.cat (J. Escarrabill).

word: "browse" and that is what is known as web 1.0. In the last few years the internet has undergone a radical transformation to what is now generically defined as 2.0. Google is the paradigm (allowing the management of information in addition to browsing) and the user is now also the producer of information (in part thanks to digitalization) in a manner in which the traditional division between producer and consumer is more difficult to establish and, finally, through the so-called syndication tools, it is no longer necessary to search for information because it is possible to receive the type of information desired in the format requested.

From replacement to radical transformation

Genís Roca suggests⁴ that this transition from web 1.0 to 2.0 is a process which is systematically repeated as digital tools are diffused the network usage becomes profuse. In the first phase there is replacement; as with the CD replacing the conventional vinyl disc, the changes in format and business model are not significant. However, when we pass on to the mp3 player and the commercialization of music online through specific programs, we are facing a radical transformation. This transformation changes the business model and the way in which we use the technology, rendering all the previous devices obsolete.

Digitalization and networking have been introduced into the health sector but we still find ourselves in the first phase of replacement. Instead of typewriters we have computers, but in many ways we continue to use them like typewriters. We save information (lots of information) but a lot of the time we access it as if it were a metal filing cabinet (the information is stored in files alphabetically or by year). We are at an early stage in the process of digitalization and network usage and, even though it could take a while, the radical transformation will profoundly alter the way in which health care is organized.

The impact of the internet on clinical practice

Conventional clinical practice is based on face to face contact in a "health care" environment (the hospital ward, the consult, emergency services...) organized in a sequential manner (and very often without the necessary coordination between the different care sectors or between the various departments in one center). These meetings are scattered (without a pre-established plan, more reactive than proactive), short (in terms of duration) and sporadic (in terms of frequency). This type of clinical practice is based on very precise coordinates of time and place. The result is time consuming (especially for the patient) and inevitably leads to coordination difficulties (due to the rigid organization of the appointment as well as the non-compatibility of the computer systems⁵).

The first impact made by the internet on clinical practice is that it radically changes the coordinates of time and place.⁶ The paradigm of the new care model is based more on contacts than on visits.⁷

The place is no longer confined to the health care space. There are alternatives to conventional hospitalization; now the patient's home is identified as an adequate place to receive care, replacing the absolute necessity of admission.⁸

However, the impact of the internet on clinical practice allows new locations to be proposed which were unthinkable until very recently. In a well-connected society, it is possible to conceive consults in shopping centers⁹ or patient follow-ups in day centers in the case of elderly patients who are more or less dependant. But mobile phone technology creates the potential for care spaces which would have been considered pure fantasy until now. The fastest rate of growth in mobile phones is taking place in developing countries.¹⁰ Mobile phones are used to communicate, to receive messages... but a cough analysis via mobile phone allows a doctor to make a differential diagnosis.¹¹ Without entering into too much detail, these examples serve to demonstrate the impact of new technologies. Until recently there was talk of telemedicine as a new paradigm, but the reality has exceeded expectations. Changes in health care location do not presuppose the application of complex methods; on the contrary, they are related to everyday tools such as the mobile phone or the television.

Internet brings us new possibilities in relation to time. Communication in everyday life is simultaneous (an SMS or asynchronous (an email), ubiquitous (the communication can be established from multiple locations) and distributed (is it possible to communicate from one to many or from many to many). Health care cannot distance itself from this general standard. Thus, the concept of "programmed visits" appears very outdated. In fact, the "programmed" visit is still the most common form of contact between patients and health professionals: the face-to-face appointment. Care organizations should be designed to allow patients access to the most appropriate team when they need it. This does not condone the promotion of systematic disorder. But the attitude needs to change with regards to the orientation of the system. It needs to be centered around the needs of the patients, ensuring access and continuity of care, involving the patient in decision-making, promoting self-care and coordinating the available care resources.¹²

The key is to be more proactive and less reactive. A very significant amount of care demand is predictable, especially when it pertains to the care of patients with chronic diseases. There are two elements that must be enhanced in order to make the system more proactive: the first is to recognize the role of diverse health care and non-health care professionals and the second is to implement the systematic use of new technologies. This new relationship framework includes the transfer of tasks from various professions to nurses who, from a more assimilated perspective, play a very important role. But the professionals in the front line are also extremely important, often the ones that are not health professionals at all (such as, for example, the people who answer the phones). The patients' general predisposition to new technologies is good and very few rejection systems based on electronic appointments or access to their doctor via email.¹³ Some studies even found that patients are more inclined to utilize new technologies than the actual doctors.¹⁴ The use of the internet in doctor-patient relationships is still not very diffuse in Europe¹⁵ and organizational aspects (arranging visits or re-fills) are still better developed than the direct consultations with the doctor to address health problems. However, changes are anticipated in the near future given that patient preferences tend towards the diversity of forms of communication with their

doctors, including the use of technologies tied in with the internet.¹⁶ The most attractive element for the patient in terms of new technologies is the ability to manage their own time.

The concept of "virtual practice" refers to the combination of tools which facilitate patient communication with their doctor regardless of the geographical location of either party. The meeting point is called the "patient portal"¹⁷, which allows asynchronous (email) and synchronous (web cam) communication and the remote monitoring of physiological variables.

Google as a Swiss Army knife

One of the most profound changes that the web 2.0 tools generate is what is known as knowledge management. At present Google, in clinical practice, is like a multipurpose tool (like a Swiss Army knife): it is a tool for browsing and consulting, a diagnostic support resource and a working tool. But, above all, Google can provide clues about the changing approach to health care practice.

Google, the internet and PubMed have brought about a revolution in scientific research: now the future can be consulted from the past (after finding an article it is easy to identify all the references made to it since the date of publication). Google (and web 2.0 in general) makes it possible to share and collaborate.⁶ Most biomedical reviews have now been equipped with a multimedia format with automatic feeds (RSS), podcasts or videos.

Google could become a valid tool to support the diagnostic process.¹⁸ Tang et al¹⁹ analyzed the efficaciousness of Google in the diagnosis of clinical cases in a series which was presented weekly in the New England Journal of Medicine and they observed that the diagnosis was correct in 58% of the analyzed cases where a search engine was used. Google could be a great help in the diagnosis of complex medical problems, especially if they are very rare.²⁰

The advantages of Google compared to PubMed have been widely debated^{21,22} but the most eclectic perspectives suggest that Google Scholar and PubMed are complimentary resources.²³ Perhaps Google Scholar allows a faster initial approximation about a problem, especially from a multidisciplinary standpoint,²⁴ and on the other hand PubMed is perhaps more specific.²⁵

Google can be a working tool, especially with regards the storage of clinical data. The implementation of an electronic medical record is being slowly established,²⁶⁻²⁸ but it develops the concept of a personal clinical history in parallel. In the first place you have the simple digitalization of conventional medical records (the health system is still where the data is deposited but it now recognizes the patient as the owner). Secondly, the patient decides where to store the data (for example, using one of the free tools such as Google health) and who has access to it. This is a significant change. The electronic medical records are what we call an "adaptation". On the other hand, the personal clinical history is a "radical transformation".

When the incidence of an illness is elevated (as in the case of the flu virus), Google Flu Trends is formidable and can offer information a lot quicker than conventional methods,²⁹

even in languages besides English.³⁰ This fact demonstrates that the internet can have unexpected uses.

The role of the patient

Google is useful for patients to diagnose their own complaints³¹ and, in some instances, they use it in a quicker and more effective manner than the doctors, especially in cases of minor illnesses.³²

Google is also used by the patients for consultation purposes and to generate content. The Economist posed the question whether the basic core of "Health 2.0" will not be mixed in with the contents generated by patients.³³ The blogging world is enormous. A simple search on Google blogs for the term "COPD" returns more than 300,000 hits. It is true that Google can present problems. The advantages that Google provides for patients and families to facilitate the diagnosis of minor diseases can be a double-edged sword. In some cases, patients who carry out frequent health-related internet searches can cause themselves anxiety, a side-effect which some people term cyberchondria.^{34,35}

Social networks

Social networks are one of the most spectacular derivatives of the internet. In fact, the social network phenomenon on the internet is without equal. Since the birth of the first recognizable virtual social network in 1997³⁶ (inaugurated in the same year as Google), its use has grown exponentially.

The data clearly corroborates this: 72% of internet users are active in at least one social network.³⁷ Taking into account the fact that, in only ten years, the number of internet users in the world has increased nearly sixfold, going from 361 million in the year 2000 to 1.967 billion in 2010,³⁸ that figure is hardly negligible.

There are all types of social networks but the majority of them share common characteristics:

- Ubiquity: users can connect when they want and where they want
- Immediacy: the contents are updated automatically
- Privacy: the networks administrators decide on the level of privacy
- Collaboration and interaction between peers

Inevitably, these social networks are having a great impact on the health sector. We find numerous examples of the use of social networks by patients, professionals and institutions both on the more general sites like Facebook, Twitter or LinkedIn and on specialized healthcare social networks.

In this way, patient social networks proliferate, virtual spaces where patients with similar conditions get in contact and share health problems and treatments.³⁹ These allow them the opportunity to share experiences and to search, receive and provide information, advice and even emotional support online. Patientslikeme⁴⁰ is the paradigm of these networks. Established in 1998 as an initiative of the brother of a patient with ALS, the idea was to encourage the exchange of experiences and knowledge between patients

with ALS and share the data with the scientific community in order to accelerate research into the disease.

On the other hand, health professionals are also becoming increasingly inclined to organize themselves around specialized social networks. This allows them to maintain contact with other professionals, consult cases and observations, ask for opinions, debate issues or solicit expert medical advice from the appropriate sources. In the United States, Sermo⁴¹ is the largest online community of doctors, with more than 110,000 doctors registered from 68 specialist fields. Esanum⁴² is, among others, the equivalent in Europe.

In conclusion, social networks offer wide-ranging possibilities in the field of health care. The most significant change that the potential of virtualization and web 2.0 introduces is the shift from centralized networks to distributed networks. In the distributed networks there are no central nodes. There nodes which are more connected than others but that situation could change with time.⁴³

Changes in the working methods

Despite all the literature dedicated to the impact Google has had on health, perhaps the most important aspect is the change in the way in which problems are tackled. Google's search engine sorts responses based on data not on opinions (being able to define precisely how many times a page has been consulted is very different from saying which ones we think are visited a lot). In addition, Google learns from the information so that the data obtained provokes changes in the next response. Also, Google is easy to use and results are available immediately.

Using the perspective of the "wisdom of the crowds",⁴⁴ Google's value system is based on who is visiting websites not the source of the information. The most valuable pages are the most visited ones. It is true that the Google thought structure is fragmented (in part owing to the intrinsic characteristics of the hyperlink), and the overload of information does run the risk of jeopardizing the coherence. But, perhaps, as Carr suggests, Google is the first step towards artificial intelligence.⁴⁵

Jeff Jarvis, in a fascinating book called "And Google, how would you do it?",⁴⁶ gives some clues as to the basic workings of Google: how links work on the network, reducing intermediaries and attention to detail (respect for which is small). The key words for the Google model are: listen, innovation, transparency, speed, little control and accessible and simple information. In short, the Google strategy is based on trust. Google takes notice of the users: basing responses on data (not opinions) and using the information to develop the next response (learning from the information). Google is easy to use and immediate.

Some critics attest, correctly, that "the best is not necessarily the most visited".⁴⁷ That is to say, the criterion of frequency is not a guarantee of wisdom or knowledge. But, despite these limitations, it would be an interesting exercise to try to imagine a health organization that was built on a similar system of attending to patients needs.

As the title of this article suggests, Google's day has just begun (in fact, digitalization and the internet have not yet

passed first grade). It is understandable that some people show glimpses of skepticism. But the future is headed in one direction and to avoid being swept along with that would be impossible (and lethal).

Conflicts of interest

The authors have no conflicts of interest to declare.

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