University College London

Department of Information Studies

“Impact of Information Technology on healthcare, the opportunities and challenges at a user and system level.”

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TERMINOLOGY

TERM	DEFINITION
Information Technology (IT)	"the science and activity of using computers and other electronic equipment to store, retrieve, transmit and send information" *(Cambridge Dictionary, 2019).*
Personalised Health Records PHR	"Electronic application through which patients can maintain and manage their health information (and that of others for whom they are authorized) in a private, secure, and confidential environment" *(The Office of the National Coordinator for Health Information Technology, 2019).*
Electronic Health Records (EHR)	"Digital version of a patient's paper chart. EHRs are real-time, patient-centered records that make information available instantly and securely to authorized users" *(The Office of the National Coordinator for Health Information Technology, 2019).*
Public Safety Answering Points (PSAP)	"A public-safety answering point (PSAP), sometimes called "public-safety access point" is a call emergency centre for police, fire brigade, ambulance to which 999 and 112 calls are routed" *(Federal Communications Commission, 2019).*
Patient-centred care	"Patient-centered care is specifically defined as "care that is respectful of and responsive to individual patient preferences, needs, and values." *(Snyder, et al., 2011, p. 3)*
National Health Service (NHS)	"The National Health Service (NHS) is the publicly funded national healthcare system in the United Kingdom." *(Rouse, 2011).*
Chronic diseases	"A disease or condition that usually lasts for 3 months or longer and may get worse over time. Chronic diseases tend to occur in older adults and can usually be controlled but not cured. " *(National Cancer Institute, 2019)*
Cancer	"Cancer is a generic term encompassing a broad group of diseases that can affect any part of the body. It is characterized by the rapid multiplication of abnormal cells that can invade adjacent parts of the body and/or spread to other organs. It is a multiphasic and complex process" *(Ana, 2011; p. 1)*
Metastasis	"The spread of cancer cells from the place where they first formed to another part of the body." *(National Cancer Institute, 2019).*
European Union	"a group of European countries that act together in political and economic matters" *(Cambridge Dictionary, 2019).*

eCall	"The 112 eCall automatically dials Europe's single emergency number 112 in the event of a serious road accident and communicates the vehicle's location to the emergency services" *(European Commission, 2007).*
SOS	"An urgent request for help, especially because of danger" *(Cambridge Dictionary, 2019).*
Subscriber Identity Module SIM	"A SIM card is a microchip in a mobile phone that connects it to a particular phone network. SIM is an abbreviation for 'Subscriber Identity Module" *(Collins English Dictionary, 2019)*

1. INTRODUCTION

Information Technology (IT) is changing our world, but only a few disciplines are experiencing such rapid development as healthcare. As the technology matures, it becomes more mass-efficient and thus cheaper. We have often seen this in the past: the automobile democratizes mobility, Spotify democratizes access to music, Wikipedia democratizes accesses encyclopedism knowledge. *Rethmeier, et al., (2016)* questions who is going to democratize health care? It is clear that the examples mentioned above do not require interpersonal communication. Therefore, it is important to examine if the same technology can be established in the fields such as healthcare, where physical interaction between patient and clinician is crucial. A growing number of people is engaging in healthcare-related topics: people are wearing wearables, they are talking to their physicians as they want to understand the data they collect. For this reason, the importance of providing the public with more health information is widely accepted. Thus, in this essay, I evaluate not only the development of Personalised Health Systems (PHR) and Electronic Health Records (EHR) for patients but also the use of information technology in hospitals and Public Safety Answering Points (PSAP). In the following paragraphs, I take into consideration the available literature on the subject and examine the above-mentioned opportunities.

2. THE IMPACT OF INFORMATION TECHNOLOGY ON HOSPITALS

All over the world, hospitals and health facilities are transforming their institutions into increasingly patient-centred future. Nevertheless, the transformation is not easy. The field of health informatics has evolved through-out recent years, which helps us to find out how the diseases are manifested, how information is stored, acquired and how it affects patient's and clinician's daily lives *(Botos, et al., 2019)*.

With every new technology implementation, there are also new obstacles arising, as *Peleg, et al., (2011); Whatling, (2011)* declare people are driven by experiences outside of the health service, and therefore expectations are growing about the use of digital technologies that will control their wellbeing. The lack of attention paid to the transformation aspect of the IT implementation and the lack of internal experience and knowledge perpetuates the old way in which systems are used and is likely to make the transformation more expensive rather than less *(Goh, et al., 2011)*. Further challenges are the process-oriented integration of heterogeneous systems, the implementation of the IT support processes into routine work, learning from previous procedures, monitoring healthcare in real-time. Thus, the participation of clinical staff in the development and innovation of new technological systems in healthcare is mandatory.

However, Whatling, (2011) states that enhancing IT in healthcare can solve some common issues such as:

→	Reduce waiting times
→	Efficient access to information, both expert and administrative
→	Elimination of qualified, but routine work
→	Improving the ability to cooperate with other doctors experiencing similar challenges

In conclusion, hospitals collect more patient data than ever before, as sophisticated technologies are gradually spreading from large facilities to smaller, local ones. Internet-based information sharing in the form of documents, images and messages is becoming more common *(Viceconti, et al., 2015)*. Of course, the binder of all challenges and opportunities mentioned above is information technology and its precise collected data. I am going to dedicate the next paragraph to healthcare in the UK and its Information Revolution.

2. 2. HEALTHCARE IN THE UK - NHS & INFORMATION REVOLUTION CHALLANGE

National Health Service (NHS) has been showing for several years that it remains a pioneer in new technologies and care models so that British patients are among the first in the world to benefit from the latest advances in medicine *(Whatling, 2011)*. Not only does this show the attractiveness of the NHS as a place to test and develop new products, but it is also an important step towards the creation of the 21st century NHS. Concerns have been raised by *Hendy, et al., (2017)* which argues that NHS might face several issues in information revolution such as complexity of the change and very extensive compartmental shift by physicians, patients, administrators. To conclude above, the information revolution might be the successful solution and it might speed up and improve results, however, Information Technology itself will never guarantee that the information and data will be collected, analysed, understood and used in the first place.

3. PERSONALISED HEALTH RECORDS (PHR)

This new approach empowers patients to understand their health management and to exert greater responsibility for their wellbeing. A Personalised Health Records PHR is generated by clinicians, hospitals or pharmacies and includes health information controlled only by the patient. This can be contrasted with the clinician's Electronic Health Records (EHR) which is a computer record that is controlled by the clinician or health care institution. PHR has a broad range of potential advantages for patients, such as access to a wide range of reliable health information, thus data and knowledge is one of the most important PHR benefits. Such data can be very personalised to make PHRs more useful especially for patients with common chronic conditions *(Tang, et al., 2006; Lee, et al., 2013). Tang, et al., (2006)* observes a vast potential and possibilities that personalization brings to healthcare. The main features of this approach are not only perfectly organized screening but also targeted prevention of the most common diseases *(Snyder, et al., 2011; Tang, et al., 2006). Holzinger (2007)* comments that PHR brings increased work efficiency, greater accuracy and it simplifies the work of clinicians in many ways which will ultimately benefit patients. The figure below show the communication of PHR with other services:

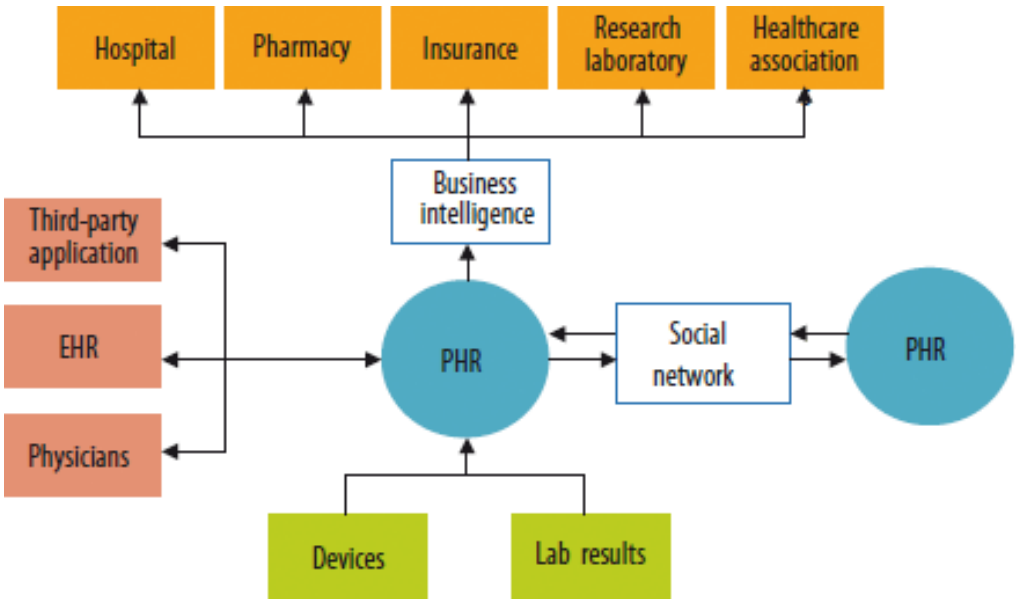

Figure 1 Communication of PHR with other services (Alemán et. al., 2012)

An important consideration is whether patients with cancer may be more anxious if they get uninterpreted imagery or laboratory results from PHR, without any medical background or face-to-face explanation *(Snyder, et al., 2011)*. Hence, in the following section, I will be focusing solely on chronic diseases and PHR.

3. 1. CHRONIC DISEASE AND OPPORTUNITIES THAT BRINGS PHR

Due to technological advances and new scientific knowledge we know that cancer is a complex disease. It arises from inherited mutations, growth and division of the body cells, which, due to many factors damage the DNA. The process is known as metastasis *(Ana, et al., 2019).* Technologies in the oncological field allow patients and clinicals to access, monitor and quickly analyse most aspects of their treatment and recovery goals, from the initial diagnosis to long-term recovery, such accessing their health records or laboratory test results. It also allows patient to schedule treatment visits of their relatives or friends, sign up to assist the patient with meals, transportation, childcare or other support services *(Snyder, et al., 2011; Ana, et al., 2019).* Personalized healthcare now offers us opportunity to adapt the treatment of the chronical disease to a specific patient, taking into account its genetic and biological uniqueness, the environment in which they live and their lifestyle *(Clauser, et al., 2011).* By adopting personalized approach to health and healthcare - from screening through chemotherapy to treatment and recovery - we can improve results and potentially reduce healthcare costs *(Cawsey, et al., 2000).*

PHR significantly helps to change health care in a way that would have been unthinkable ten years ago *(Paul Cerrato, 2019).* In addition, the role of PHR in oncology must be fully understood, including the privacy and security issues, the accuracy of past patient's cancer treatment history (particularly specific drug / doses fields), and how PHR can increase recovery treatment *(Snyder, et al., 2011).*

4. IN-VEHICLE COMMUNICATION TECHNOLOGY AS TRANSPORT TO HOSPITALS

Moving away from hospitals to roads and motorways, where the major causes of injuries and deaths in Europe happen. Efficient and prompt emergency response is crucial if lives can be saved and human suffering can be reduced. Especially in serious traffic accidents, fast help is a matter of life and death. And that's why the European Union developed an in-vehicle emergency system called eCall, that will dial the 112 line immediately after the crash *(European Commission, 2017).* Ecall became mandatory for all newly homologated vehicles manufactured with effect from 31 March 2018. In essence, it monitors how, when and where a vehicle is driven, records the data and provides the driver and/or other parties with an analysis as feedback *(Sultana, 2017).* The technical requirements of this system will be discussed in detail in the following paragraph.

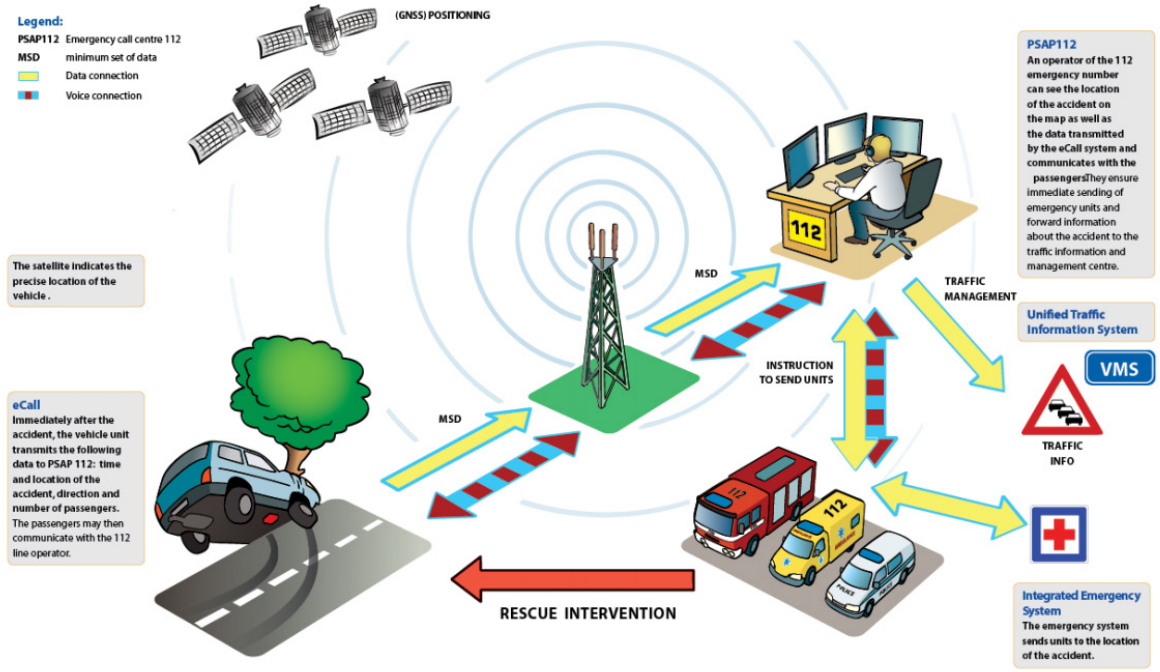

Figure. 2 The process in detail of eCall in-vehicle communication technology (Bergonzi, L. et al., 2018*)*

The whole system consists of three parts: the on-board unit which is installed in the vehicle, mobile telecommunications networks and PSAP. The system will be activated automatically after a traffic accident or it can be activated manually by the vehicle passengers using the emergency buttons. After pressing the SOS button, PSAPs receives not only your vehicle's precise location, number of passengers, model of the vehicle and other incident but also the 112 number is used to open a voice connection between the vehicle passengers and the PSAP *(BMW, 2014; Bergonzi, et al., 2018)*. Moreover, we can highlight additional features and benefits which help to speed up the emergency services.

***European Commission (2017)* states that in a traffic accident the on-board unit forwards an incident data to the most appropriate PSAPs with the following information:**

→ Time of the accident
→ Precise position including driving direction (the location of the accident is determined exactly to coordinates with an accuracy of approximately 1 meter)
→ Vehicle type (model, color)
→ Number of passengers in the vehicle (or number of seat belts fastened)
→ Activation method (manual or automatic)
→ Immediate transmission of accurate information (even if the crew is in shock or is not communicating)

Moreover, *Sihvola, et al., (2009)* point out several benefits of such technology:

→ Faster implementation of the traffic incident management process
→ Reducing the number of road accident victims (up to 10% annually within the EU)
→ Speeding up the arrival of emergency services at the scene of an accident (up to 40% in cities, up to 50% outside cities)
→ Functioning across the European Union (also in Switzerland, Norway, Iceland)

On the other hand, *Bergonzi, et al., (2018)* raises a series of technical and logistic issues, which need to be considered. It might be unwarranted calls; multiple generations of eCalls; data forwarded to the wrong PSAP; emergency staff needs to be trained in the eCalls procedures and software, or a privacy issue for some users as the Subscriber Identity Module (SIM) card is monitoring the car movement. However, the *European Commission (2017)* remarks that it is not possible to abuse the system in this way. The SIM card will be "suspended" all the time and it will only be activated when the eCall is triggered (manually or automatically). It is also very important to mention that PSAP staff needs to be trained in the eCalls procedures and Software *(Bergonzi, et al., 2018)*.

It can be assumed that eCall will continue to evolve and may expand to many industries such as logistics, where we can use Geolocating to know if the truck is going off route or has faced an accident *(Sultana, 2017)*. In conclusion, eCall saves thousands of lives a year in Europe and tens of thousands of people get out of a car accident with lesser consequences. This solution is especially valuable when the victims are unable to call for help, identify their location or when there are no external eyewitnesses such as passing drivers or patrols *(Sihvola, et al., 2009)*.

5. CONCLUSION

In conclusion, technological innovations are extremely important, and a study of the organizational, contextual and user variables affecting their implementation is vital in order to guarantee that those innovations address existing problems in the healthcare system. Investing in informatics should not be disconnected from enhancing infrastructure and delivering scientifically relevant reliable facilities. In addition, in order to maximise growth gains all corporate boards in the healthcare industry need a modern, more creative and less risk-averse strategy. Thus, using Information Technology in this way will strengthen the human factor, improve how clinicians and patients interact, provide more free time to doctors and help personalize healthcare services. Linking data between different databases and analysing it provides the possibility to discover new continuity and patterns in the origin of diseases, as well as early diagnosis, prevention and successful treatment. Technological innovations are essential, and a study of the organizational, contextual and user variables affecting their implementation is key to guarantee that such innovations respond to the current healthcare system issues. However, some challenges may include adoption and implmentation in practise. Therefore, it might take a considerable amount of time until they are widely applied in real life.

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