Defining Digital Health

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Defining Digital Health

Trying to define digital health is a complex task. The Canadian Health Infoway describes it as the use of information technology/electronic communication tools, services and processes to deliver health care services [1], whereas the Australian government states that it is simply electronically connecting up the points of care so health information can be shared securely [2]. The most commonly used definition of the term could be Paul Sonnier's description of digital health being "the convergence of the digital and genomic revolutions within health, healthcare, living, and society" [3]. From this we can see the main difficulty in trying to create a concrete definition of digital health is that the digital health revolution is still on-going, the parameters that define digital health are still in flux and have yet to settle on one tangible fully agreed upon definition.

Digital health applications consist of certain essential elements such as wireless devices, hardware and software sensors, microprocessors and integrated circuits, the internet, social networking mobile and body area networks, health IT, genomics and personal genetic information. Because of the varied nature of these elements, the term digital health can be seen as a form of umbrella term for the following terms:

mHealth

M-health, an abbreviation of the term mobile health, was coined by Robert Istepanian. It is used to describe emerging and existing communications and network technologies for healthcare systems [4]. It is most commonly used in reference to using mobile communication devices for health services and information [5]. The field of mHealth is seen as a sub field of eHealth. The applications of mHealth include using mobile devices to collect community and clinical health data, delivering healthcare information for patients, health care providers and researchers, real time patient monitoring and the provision of direct care [6].

Wireless health

Wireless health is the integration of wireless technology into healthcare, to be used to diagnose, monitor and treat patients. Wireless health differs from mHealth as it doesn't have to be mobile. Wireless health applications are useful in reaching patients living in remote areas.

Health 2.0

Health 2.0 (sometimes referred to as Medicine 2.0) is a term that emerged in the mid-2000s, it captures the subset of healthcare technologies within the Web 2.0 movement. Web 2.0 describes the emergence websites in which user-generated content, interoperability and usability [7]. Health 2.0 is used to describe the use of technology to enable care collaboration, using hardware and software tools (e.g. cloud, Saas,

and mobile technologies) to promote collaboration between patients, their carers and healthcare providers [8].

eHealth

eHealth (e-health or electronic health), like many of the terms mentioned in this article, has changed somewhat since its conception. In its infancy, eHealth described the application of electronic processes and ICT across the entire range of functions affecting health and care [9]. The most up to date description of what eHealth encompasses would be that eHealth refers to the field of medical informatics, that organises and delivers health services and information using the internet and its associated technologies [10].

ePatients

An ePatient is a health consumer that fully participates/engages with their own health care. ePatients should be seen as experts, equal to doctors, in their own personal health and healthcare process. The term denotes both people engaged in their own healthcare and those they care for (e.g. family, friends etc.) [8]. Unlike eHealth the 'e' does not specifically mean electronic, it can mean equipped, enabled, engaged, equal and other associated terms [11].

Health IT

Health IT, or Health information technology, at a basic level is information technology applied to health and care. It supports the management of health information across computerised systems and the secure exchange of health information between patients, health care providers and various other health and care stakeholders.

Big Data

Big Data is a term used to describe data sets that are so large and/or complex that the traditional methods of data processing are inadequate to deal with them. These extremely large data sets can be analysed computationally to reveal patterns, trends and associations specific to health and Big Data can also use predictive analytics in relation to human behaviour and interactions [12]. There are many challenges for Big data as it includes data capture, analysis, curation sharing storage, transfer, and visualisation, as well as data updating and information privacy.

Cloud Computing

Cloud computing is the internet based computing service that provides access to a shared pool of computer processing resources and data to computers and other devices on demand. In recent years many definitions of cloud computing have been developed. More recently a form of consensus has been

formed, this defines cloud computing as the outsourcing of IT activities to one or more third parties that have rich pools of resources to meet organisation needs easily and efficiently [13,14]. Users of cloud computing are billed for their usage of the third party infrastructure rather than purchasing and managing their own IT software, hardware and general infrastructure.

Quantified self

The quantified self refers to an individual engaged in self-tracking of biological, physical, behavioural or environmental information [15]. This information can come from a variety of areas that are tracked and analysed, such as weight, energy level, mood, time usage, sleep quality, cognitive performance, exercise, and health [15]. This self-tracking can be performed using a variety of self-sensing and self-monitoring devices (ie. Wearable technology). It allows for timelier and cost-effective data collection, and may allow for users to quantify certain biometrics previously unknown to them.

Gamification

Gamification is the use of game-design elements and game principles in non-game contexts. It seeks to improve user engagement, ease of use, productivity, recruitment and evaluation [16, 17, 18]. Its use in health and wellbeing has been primarily to encourage users to exercise more and make changes towards improving their overall health. The use of gamification has saturated the health and fitness app market [19].

Telehealth and Telemedicine

The terms telehealth and telemedicine are often seen as being synonymous with each other. Telemedicine is described, by the American Telemedicine Association, as the use of medical information exchanged from one site to another via electronic communications to improve a patient's health [20]. Telehealth is defined, by the Scottish Centre for Telehealth and Telecare, as the provision of health services at a distance (near or far) using a range of digital and mobile technologies [21]. The Agency for Healthcare Research and Quality defines telehealth as the use of telecommunications technologies to deliver health-related services and information that support patient care, administrative activities, and health education [20]. There are multiple definitions that are used interchangeably to define telehealth and telemedicine, the terms both encompass a number of technologies and applications such as two-way live and/or streaming video, videoconferencing, store and forward imaging along with the internet, email, smart phones, wireless tools and the various forms of telecommunications. Whilst telemedicine is mainly seen as being used to provide remote clinical health care, whereas telehealth is seen as involving a broader spectrum of services including care, patient/clinician contact, education, advice, intervention and monitoring [22]. A minor caveat of telehealth and telemedicine is that many technologies that exist

within their definition are analogue technologies.

Precision Medicine and Personalised Medicine

Precision medicine is a model of medicine which proposes that a person's healthcare should be customisable, with medical decisions, practices and products being personalised for the individual patient [23]. Personalised medicine is seen as being one and the same as precision medicine, it refers to a model of medicine in which patients are grouped based on their risk of disease, or response to therapy, using diagnostic tests and/or techniques [24]. The phrases are often used interchangeably, but they can also be used specifically in reference to the minor nuances that their associated models of healthcare contain.

Connected Health

Connected health refers to a model of healthcare delivery where the devices, services and interventions used in healthcare management are designed around the patient's specific needs, and their health data is shared in a manner that allows the patient to receive care in the most proactive and efficient way possible [25]. Patient data fuels the process of connected health, and the model of connected health aims to receive and manage this data in the most suitable way for the patient [25].

Digital Health

Like many of the terms outlined above digital health is still seen as having multiple definitions. It is often seen as being synonymous with many of these technology integrated healthcare services. From what has been outlined in this article it is clear that the landscape is still muddied with competing arguments around what the field actually represents. If we consider Paul Sonnier's definition as being one of the more widely accepted definitions, that digital health is "the convergence of the digital and genomic revolutions within health, healthcare, living, and society" [3], we can begin to reshape this.

We know that the terminology for technology integrated health and care services is vast, and truly defining digital health thoroughly requires much more review and analysis. But if we accept that the definitions presented above fall under the umbrella of digital health, then we can begin to understand digital health in a clearer fashion. While Digital health is the coming together of the digital and genomic revolutions, it is also the integration of digital technologies, devices, and services into the healthcare process to deliver care for patients, to and from any location, whilst securely sharing and allowing access to relevant health data for patients, their carers and health care providers. It is important to note that this a field of healthcare that's function should not be seen as a tool for healthcare practitioners and patients, but as part of the healthcare process and is used in an end-to-end care plan for every citizen. Its implementation requires expertise from multiple fields to come together to create a culture in which digital

health is fully integrated into every day health and social care.

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