Digital Natives in Healthcare

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ABSTRACT

Healthcare is a complex system that covers processes of diagnosis, treatment, and prevention of diseases. It constitutes a fundamental pillar of the modern society.

Technology drives modern healthcare more than any other force. It has always been an integral part of healthcare delivery, enabling health care providers to use various tools to detect, diagnose, treat, and monitor patients. Digital natives are the generation who were born during the digital age. They now serve the healthcare industry as professionals or patients. Understanding their worldview and attitudes can help healthcare organizations create a productive and nurturing environment for everyone. This paper explores the behavior of digital natives in healthcare.

KEYWORDS: digital natives, digital immigrants, characteristics, healthcare

INTRODUCTION

Healthcare is an indispensable part of life. It plays a major role in the growth and well being of any nation. The healthcare system is important because of its focus on human care. Its main purpose is to improve certain qualities such as availability, privacy, reliability, safety, and security. Today, healthcare industry is experiencing several challenges including rapid increase in population, ageing population, rising burden of noncommunicable chronic diseases (such as diabetes and obesity), care costs skyrocketing, and the global shortage of medical personnel. Healthcare is under tremendous pressure to deliver superior health outcomes, comply with regulations, achieve customer satisfaction, reduce cost of care, ensure patient safety, and handle financial constraints and budget reductions. Also, people have become more interested in disease prevention and health promotion, rather than disease treatment. As a result, healthcare system is being transformed from traditional reactive and hospital-centered to preventive and personalized, from disease-focused to well being-centered [1].

Modern healthcare is technological healthcare. Technology is everywhere. Technology surrounds every aspect of 21st century life. It is in the cell phones we use, the cars we drive, and even the food we eat. Although technology and healthcare have gone hand and hand for decades, healthcare is increasingly becoming more prone to technology. Technology is getting better, smaller, and faster. It is becoming more and more in demand in every sector of the economy, particularly in healthcare. Technologies in the healthcare change at a fast pace from cutting edge to ubiquity. The pace of change in healthcare technology is unprecedented, but human nature does not change at these technological timescales. Any sufficiently advanced technology is indistinguishable from magic. Most of these new technologies are modern magic: new pharmaceuticals that change moods, infusion pumps, and robotic keyhole surgery. Health technologies comprise of all the devices, medications, vaccines, processes, procedures, and systems designed to streamline healthcare operations, lower costs, and enhance quality of care [2].

In the digital age, youths seem to be constantly connected to the Internet via social media and mobile devices. Technology has been integrated into their since childhood, providing them with the skills to naturally adapt in the digital world [3]. It is no surprise that they increasingly turn to digital media to seek answer to their health questions.

THE DIGITAL WORLD

We live in the digital age where everything is touched and connected by technology. The digital revolution seeks to transform healthcare and empower citizens in taking charge of their own health. The healthcare industry is changing rapidly around the world due to breakthroughs in digital technologies that are being adopted to meet various challenges. Healthcare will become increasingly digitized in the future. Today, technology buzzwords abound— Big Data, Cloud Computing, Artificial Intelligence (AI), Machine Learning (ML), Robots, Chatbots, 3D Printing, Telemedicine, Virtual Reality (VR), Augmented Reality (AR), Blockchain, Health Wearable, and the Internet of Medical Things. These emerging technologies, while not new in other industries, are increasingly being used in healthcare because of their potential and proven value. The management of these technologies and medical devices is critical to the continued success of healthcare systems in both developed and developing nations [2].

WHO ARE DIGITAL NATIVES AND DIGITAL IMMIGRANTS?

As far as the digital world is concerned, there are two types of people: digital immigrants and digital natives. Digital natives and digital immigrants are often used to represent demographic segments of people with regard to their ability to use digital technologies. They are concepts coined by Prensky in 2001 [4]. Being a member of Generation X means you are considered a digital immigrant, while being a member of Generation Z definitely you as a digital native. Digital natives are generally individuals born after 1980s and they are comfortable in the digital age because they grew up using various technologies. Digital immigrants are those who are born before 1980s and they are fearful about using technology because the were not exposed to it or raised in a digital environment. Paradoxically, the digital immigrants invented most of the technologies and systems that digital natives now use fluently.

Compared to the digital immigrants, digital natives are expected to manage life and work differently. Digital natives have an inherent understanding of digital technologies, as they been integrated into their lives since childhood. Digital natives are naturally digital. They are most comfortable using various digital devices such as phones, tablets, social media, and other apps. They are now entering the healthcare industry and transforming it at a fast pace [5]. Figure 1 depicts the major differences between digital natives and digital immigrants [6]. Figure 2 shows some examples of digital natives [7].

CHARACTERISTICS OF DIGITAL NATIVES

Prensky identified some characteristics of digital natives: their ability to receive and process information quickly, their preference for parallel and multi-tasking, their preference for graphic rather than textual information, and their expertise in game playing. As result of their upbringing and the familiarity with technology, digital natives have a set of tech skills that differ from earlier generations. Most digital natives use the Internet two to four hours daily. Other general characteristics of digital natives are summarized as follows [8-10]:

➢ They expect constant, real-time feedback.

➢ They crave public display.

➢ They see technology as an extension of themselves.

➢ They are good with words and photos.

➢ They need public validation.

➢ They are inherently social media natives.

➢ They think and process information fundamentally differently from the previous generations.

➢ They are used to receiving information fast.

➢ Digital natives enjoy social interactions.

➢ They communicate using social media specifically Facebook, Twitter, and Instagram.

➢ They feel that they have a right to work remotely.

➢ They are more likely to prefer flexible hours.

➢ They demand instant access to information so that they can focus on what matters.

➢ They transact most of their personal business online.

➢ They blend the borders of public and private.

➢ They view the world horizontally, in equalitarian terms.

➢ They are driven by values and they cross boundaries.

➢ They seek companies whose values match with their own beliefs.

➢ They lead the sustainability movement.

➢ They often rely on easily accessible and convenient information on health-related issues.

DIGITAL NATIVES IN HEALTHCARE ENVIRONMENT

A major goal of healthcare is to provide safe, high quality patient care in a supportive environment. Today's healthcare workforce spans four generations and presents a unique situation in that each generation has different strengths and challenges: Baby boomers, Generation X, millennial and Generation Z or digital natives. Baby boomers have been labeled as not willing to learn new things and not using technology to be more productive. The millennials have been labelled as lazy, hard to work with or know-it all's. To minimize conflict into the workplace and create a healthy work environment, healthcare leaders must address the multi-generational nature of the workforce. This will help physicians and nurses to achieve their goal of providing safe, high quality patient care [11]. Healthcare leaders must also orient digital natives along the following emerging healthcare concepts:

Digital Health: Digital healthcare now and in the future will help digital natives find and evaluate information to make right decision, without compromising safety and security. Digital technologies are transforming the healthcare industry all over the world, forming a new domain known as "digital health." Digital health is a broad term that refers to the use of emerging digital technologies such as big data and artificial intelligence in healthcare. It is variably known as digital healthcare, telemedicine, health IT, eHealth, wireless health, and mHealth, to name a few. Its objective is to use digital technologies to improve health management for both patients and service providers. Digital health provides the opportunity to facilitate personalized medicine at affordable cost. It connects and empowers people to manage health and wellness, leveraging digital tools, technologies, and services to transform care delivery. It may be regarded as the space at the intersection of technology and healthcare. Digital health is a multi-disciplinary area involving several stakeholders such as clinicians, researchers, scientists, social sciences, engineers, decision-makers, pharmaceutical companies, health insurance companies, regulatory authorities, health system managers, data managers, and patients. It should be an integral part of national health priorities and strategies and benefit people in a way that is ethical, safe, secure, reliable, equitable, and sustainable. It needs to be developed with principles of transparency, accessibility, scalability, replicability, interoperability, privacy, security, and confidentiality [12]. An overview of the digital healthcare landscape is shown in Figure 3 [13].

Health information system (HIS): Public health interventions must be tailored to reflect the ways digital native currently navigate digital health information and the health challenges that concern them most. Their online health information seeking has centered on sexual health. Next to using emails and search engines, looking for health information is the most important activity among Internet users, particularly the digital natives. In the current economy, information is valuable. Having readily accessible and reliable information is critical to healthcare organizations, providers, and the patients for decision-making. HIS is an electronic system designed to manage healthcare data or activities. It refers to a wide range of technology in healthcare used to acquire, store, deliver, analyze, and transmit health data of individuals or the activities of an organization. The electronic system is used to improve patient outcomes, inform research, store and communicate information, aid policy-making, make healthcare decisions, provide instant access for medical staff, and improve doctor-patient interactions. Such a system is essential to support decision making and planning to improve health policies locally or globally. Its primary role is to manage the data collected and stored in a healthcare facility. Such a system can collect, store, manage, and transmit data such as electronic health records (EHRs), facility data, surveillance data, census data, human resource records, financial data, infrastructure data, and logistics and supply data. HIS is variably known as medical information systems (MIS), health management information systems (HMIS), health information technology, information technology systems, clinical information systems, digital health systems, and other terms used interchangeably. Health information systems keep track of everything related to patients such as the patient's medical history, medication, contact information, appointment times, insurance information, and billing accounts. Hospitalists use these systems for clinical care, education, quality improvement, and research [14]. As shown in Figure 4, the health information system has six components [15].

Health Informatics: Informatics is the study of information and the ways information is used by human beings and social systems. Health or medical informatics is the integration of information technology into all aspects of healthcare information science, from fundamental research to clinical applications. It concerns itself with the cognitive, information processing, and communication tasks of medical practice. It is an interdisciplinary field that applies principles of information science to the advancement of life sciences research, public health, and patient care. Its areas of specialization include nursing informatics, pharmacy informatics, clinical

informatic, bioinformatics, dental informatics, pathology informatics, cancer informatics, radiology informatics, and primary care informatics. This diversity of medical informatics creates a wide range of informatics careers [16,17].

Mobile/Wireless Health: Digital natives are using the Internet, mobile apps, and wearable health technology as sources of health information. Mobile applications may help promote positive health behaviors and behavior change among digital natives. Doctors, nurses, staff, patients, and medical devices are constantly on the move. There is increasing number of wireless devices being used by both hospital staff and patients. There has been an exponential rise in the Bring Your Own Device (BYOD) trend within the healthcare practitioners. Patients bring with them their wireless smart devices and expect the hospital to provide wireless Internet services for free. Wireless health could fulfill the vision of healthcare to anyone, anytime, and anywhere. It includes mobile health. Mobile health (or mHealth) refers to the practice of medicine via mobile devices such as mobile phones, tablet computers, personal digital assistants (PDAs), and wearable devices. It has emerged as a subdiscipline of electronic health (or eHealth). Ehealth is a new concept which refers to the use of information and communication technology (ICT) to enable health care. It is the delivery of health information and services over the Internet and related technologies. Ehealth provides health information to medically undeserved populations. While eHealth can be regarded as technology that supports the delivery of healthcare and provides healthcare services online, mHealth essentially provides access to healthcare. Mobile health is the creative use of emerging mobile devices and wireless communication technologies to improve healthcare delivery and support wellness. It integrates mobile technology with the health delivery with the premise of promoting a better health and improving efficiency. Mobile health has become an increasingly important issue in a number of disciplines such as health communication, public health, and health promotion. Mobile phone technologies, along with mobile Internet, offering anywhere and anytime connectivity, play a key role on modern healthcare solutions. Doctors, nurses, and other health professionals use mobile devices to access patient information, databases, and resources. Many innovative mHhealth applications exist. Applications can deal with disease prevention and wellness, monitoring and remote care, mobile decision making, and emergency interventions [18-20].

Health 4.0: A quiet revolution is taking place in the healthcare industry. It will fundamentally change how healthcare is delivered. That revolution is called Health 4.0.

Health 4.0 is a disruptive process of transformation of the entire healthcare. It is aimed at increasing efficiency, decreasing in expenditures, and providing customized care for patients in real time mode. The fourth industrial revolution (i.e. Health 4.0) shows how sensors, embedded systems, and cyber-physical systems are changing the way industrial processes work, while also affecting the healthcare domain. Health 4.0 is essentially the translation of Industry 4.0 design principles into the healthcare domain. Industry 4.0 refers to the concept of a "smart factory" characterized by the interconnection of machines, people, and information systems. Health 4.0 can provide effective ways to improve the health status of patients by taking advantage of Internet of things and cyber-physical systems technologies. Health 4.0 potentially offers a win-win situation for patients, healthcare providers, and government. At present, we are at the early stage of the adoption of Health 4.0 and all actors within the healthcare system should understand that a revolution is now underway which cannot be halted [21].

CONCLUSION
Technology is drastically changing and improving healthcare, from anesthetics and antibiotics to MRI scanners and radiotherapy. Although digital technologies will not fix all healthcare problems, they can improve the practice, decision making, and management of healthcare. Patient access to the healthcare system will be personalized in the future since digital technology has the potential to deliver more personalized health experiences. Workplace evolutions are inevitable in healthcare. Your healthcare facility will soon be managed by individuals who grew up online.

Digital natives live in the digital world and navigate it with their digital skills. Using technology most of the time seems very natural to the digital natives. Access to electronic information on health matters to digital natives. They seem particularly concerned with diet and fitness. More information about digital natives in the healthcare environment can be found in the books in [1,2,22-28] and the following related journal: *Digital Health.*

REFENRENCES
[1] M. N. O. Sadiku, *Emerging Smart Technologies*. Bloomington, IN: Arthur House, 2021, p.94.

[2] M. N. O. Sadiku, R. A. K. Jaiyesimi, J. B. Idehen, and S.M. Musa, *Emerging Technologies in Healthcare.* Bloomington, IN: AuthorHouse, 2021, pp.vii, 1.

[3] M. Puybaraud, "Digital natives: A tech-savvy generation enters the workplace," https://www.workdesign.com/2012/02/digital-natives-a-tech-savvy-generation-enters-the-workplace/#:~:text=Digital%20Natives%20have%20an%20inherent,when%20they%20wish%2C%20from%20anywhere.

[4] M. Prensky, "Digital natives, digital immigrants," 2001, http://www.nnstoy.org/download/technology/Digital%20Natives%20-%20Digital%20Immigrants.pdf

[5] M. Cut, "Digital natives and digital immigrants — How are they different," https://medium.com/digital-reflections/digital-natives-and-digital-immigrants-how-are-they-different-e849b0a8a1d3

[6] M. Prensky, "Digital natives, digital immigrants," http://ece2006technology.blogspot.com/2008/03/digital-natives-digital-immigrants-by.html

[7] "Digital natives and digital immigrants in the workplace," Unknown source

[8] J. DeGraff, "Digital natives vs. Digital immigrants," June 2014, https://www.business2community.com/tech-gadgets/digital-natives-vs-digital-immigrants-2-0916153

[9] M. N. O. Sadiku, A. E. Shadare, and S. M. Musa, "Digital natives," *International Journal of Advanced Research in Computer Science and Software Engineering*, vol. 7, no. 7, 2017, pp. 125-126.

[10] "Here come the digital natives: Their workplace habits," March 2017, https://www.paperdirect.com/blog/2017/03/here-come-the-digital-natives-their-workplace-habits/

[11] "Successfully manage baby boomers to 'digital natives' to optimize a healthy work environment," https://sigma.nursingrepository.org/handle/10755/16680

[12] M. N. O. Sadiku, U. C. Chukwu, A. Ajayi-Majebi, and S. M. Musa, "Digital health," *International Journal of Trend in Scientific Research and Development*, vol. 5, no. 6, September-October 2021, pp. 725-730.

[13] "Digital health: Heaven or hell?" https://assets.kpmg/content/dam/kpmg/pdf/2016/03/digital-health-heaven-hell.pdf

[14] M. N. O. Sadiku, O. D. Olaleye, O. A. Okhiria, and S. M. Musa, "Health information systems," *International Journal of Trend in Research and Development*, vol. 8, no. 2, March-April 2021, pp. 87-90.

[15] "Six components of a health information system," in *Framework and Standards for Country Health Information Systems*. Italy: World Health Organization, 2nd edition, 2012, p. 16.

[16] M. N. O. Sadiku, C. M. M. Kotteti, S. M. Musa, "Informatics: An introduction," *International Journal of Trend in Research and Development,* vol. 5, no. 4, July-Aug. 2018, pp. 450-451.

[17] M. N. O. Sadiku, T. J. Ashaolu, S. M. Musa, "Health informatics: A primer," *Journal of Scientific and Engineering Research,* vol. 5, no. 9, 2018, pp. 31-34.

[18] M. N. O. Sadiku, U. C. Chukwu, A. Ajayi-Majebi, and S. M. Musa, "Wireless health: A primer," *Journal of Scientific and Engineering Research,* vol. 7, no. 6, 2020, pp. 40-44.

[19] M. N. O. Sadiku, A. E. Shadare, and S.M. Musa, "Mobile health," *International Journal of Engineering Research*, vol. 6, no. 11, Oct. 2017, pp. 450-452.

[20] M. N. O. Sadiku, M. Tembely, S.M. Musa, and O. D. Momoh, "eHealth Literacy," *International Journal of Advanced Research in Computer Science and Software Engineering,* vol. 7, no. 6, June 2017, pp. 68-69.

[21] M. N. O. Sadiku, A. E. Shadare, and S. M. Musa, "Essence of Health 4.0," *International Journal of Trend in Research and Development,* vol. 5, no. 5, Sept.-Oct 2018, pp. 399-400.

[22] J. Palfrey and U. Gasser, *Born Digital: Understanding the First Generation of Digital Natives.* Basic Books, 2008.

[23] A. Dingli and D. Seychell, *The New Digital Natives: Cutting the Chord.* Springer, 2015.

[24] M. Ringel, *Digital Healing: People, Information, Healthcare.* Productivity Press, 2018.

[25] M. R. Prensky, *From Digital Natives to Digital Wisdom: Hopeful Essays for 21st Century Learning.* Corwin, 2012.

[26] J. M. Albright, *Left to Their Own Devices: How Digital Natives Are Reshaping the American Dream.* Prometheus, 2019.

[27] M. Thomas, *Deconstructing Digital Natives: Young People, Technology, and the New Literacies.* Routledge, 2011.

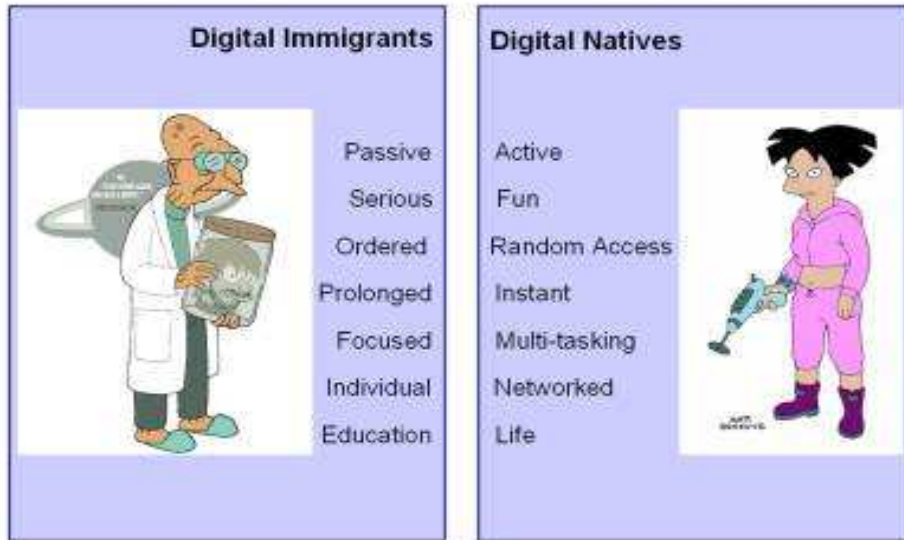[28] The Art of Service, *Healthcare Digital Transformation: A Complete Guide.* The Art of Service, 2020.

Figure 1 The differences between digital natives and digital immigrants [6].

Figure 2 Examples of digital natives [7].

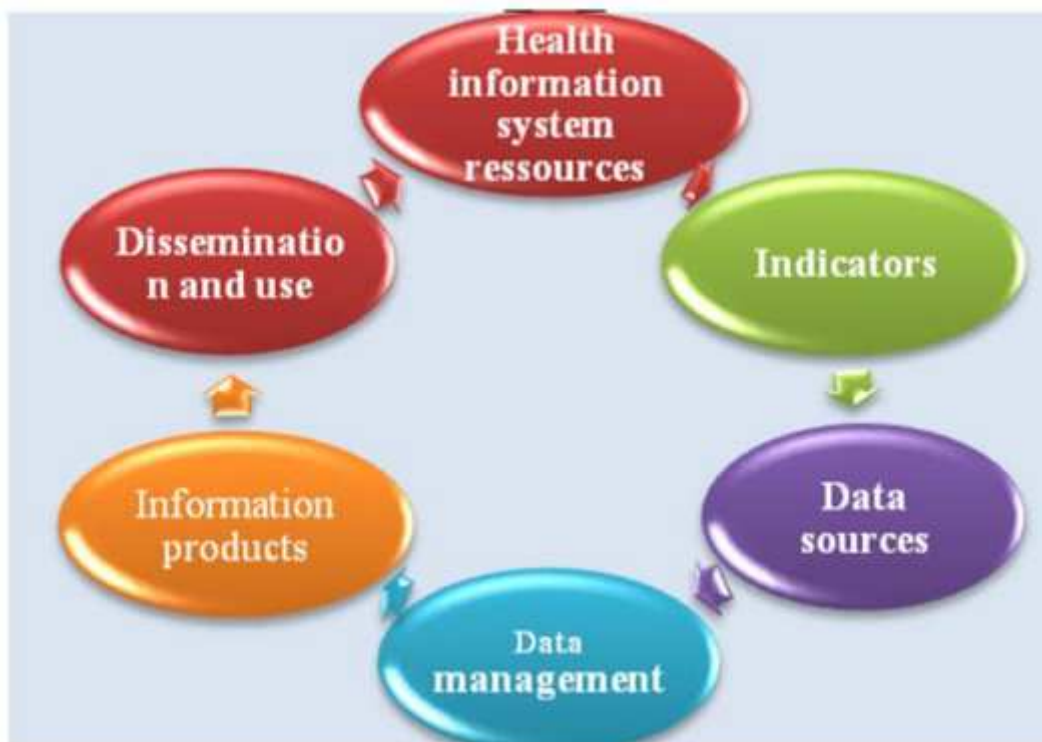**Figure 3 An overview of the digital healthcare landscape [13].**

Figure 4 The six components of a health information system [15].