Universidade de Lisboa

Faculdade de Farmácia

The Overview of Digital and Health literacy Assessment Tools

Sofia Carvalho Martins

Monografia orientada a pela Professora Doutora Lenka Smejkalová, Assistant Professor, Masaryk University, e coorientada pelo Professor Doutor João Fernandes de Abreu Pinto, Professor Associado da Faculdade de Farmácia da Universidade de Lisboa.

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Resumo

Nas últimas décadas, o "digital" tem-se imposto em quase todos os aspetos do quotidiano, principalmente porque a Internet tem promovido uma rápida partilha de informação. Tal como noutros setores, a área da saúde também pode beneficiar desse desenvolvimento.

Este trabalho descreve os fundamentos alusivos à saúde e aos cuidados de saúde, focando-se na literacia em saúde, na literacia digital e no processo de digitalização dos cuidados de saúde. Estes são aspetos essenciais num sistema de saúde atualizado, onde os utentes desempenham um papel mais ativo na sua saúde: podem aceder aos resultados dos exames médicos com maior facilidade, comunicar com os profissionais de saúde de várias formas e agendar consultas médicas mais rapidamente, incluindo teleconsultas.

Devido às caraterísticas mais personalizadas deste serviço, a utilização da tecnologia nos cuidados de saúde melhorará os níveis de literacia em saúde, contribuindo para uma melhor gestão dos utentes. Contudo, esta implementação continua a enfrentar vários desafios, especialmente devido aos diferentes determinantes de saúde, que continuam a ser um dos principais fatores para a existência de grandes desigualdades. Estas, especialmente as diretamente ligadas aos diferentes níveis de saúde e literacia digital, têm sido o principal responsável por uma comunicação entre utentes e prestadores de cuidados de saúde, que em alguns casos é insuficiente, gerando resultados que poderiam ser melhorados.

Num contexto prático, foi importante analisar algumas ferramentas para avaliação dos níveis de literacia em saúde e de literacia digital, uma vez que se tornam essenciais para uma compreensão e melhoria da comunicação entre os profissionais de saúde e os utentes, melhorando a informação transmitida.

O resultado deste trabalho foi um resumo de lacunas que ainda subsistem e devem ser ultrapassadas, a fim de alcançar uma qualidade mínima de conhecimento e comunicação, que permita à população em geral compreender as informações transmitidas pelos profissionais de saúde, não obstante os seus níveis de literacia. O objetivo final foi a proposta de uma ferramenta digital mais abrangente, para auxiliar a recolha de informação dos utentes, profissionais de saúde e população em geral, para posterior análise dos dados extraídos e subsequente implementação de melhores soluções no futuro.

Palavras-chave: ferramentas de avaliação de literacia; literacia digital; literacia em saúde.

Abstract

During the last decades, "*digital*" has taken hold of almost all aspects of our daily interactions, mainly because the internet has provided a route to widespread information. As well as many other sectors, healthcare can also benefit from that development.

This work describes the fundamentals concerning health and healthcare, focused on health literacy, digital literacy and the healthcare digitization process. These are essential aspects of an up-to-date healthcare system, where patients play a more active role: they can access their medical exams' results easier, they can communicate with their health professionals in several ways and they can schedule medical appointments faster, including the online ones.

Due to this personalized and action-oriented service, the use of technology in healthcare will improve health literacy levels in society, contributing for a better patients' management. However, this implementation still faces several challenges especially due to some health determinants, which are one of the main aspects that keep contributing to the existence of large inequalities. These inequalities, especially those in straight connection to health and digital literacy levels, have been a central issue responsible for insufficient communication between patients and health providers, leading to health outcomes that could be improved.

From a practical perspective, it was important to analyse and describe selected health literacy and digital literacy assessment tools, which are essential steps towards the understanding and improvement of communication and proper use of information between health professionals and their patients.

The outcome of the work was a resume of the gaps that still remain and must be overcome, in order to achieve a minimum standard of knowledge and communication, which may enable general population to understand health information given by health providers, despite their literacy levels. It was also an objective to propose a more comprehensive digital tool, that may help gathering information from patients, healthcare providers and general population, enabling an analyses and subsequent implementation of better solutions in the future.

Keywords: digital literacy; health literacy; literacy assessment tools.

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Abbreviations

CRDs - Chronic Respiratory Diseases

WHO - World Health Organization

OECD - Organization for Economic Co-operation and Development

mHealth - Mobile Health

eHealth – Electronic Health

PDAs - Personal Digital Assistants

COPD - Chronic Obstructive Pulmonary Disease

eHLA - eHealth Literacy Assessment Toolkit

HLS-EU - European Health Literacy Survey

DigSAT – Digital Self-Assessment Tool

EU – European Union

DigComp – Digital Competences

HLVa-IT - Health Literacy Vaccinale degli adulti in Italiano: Vaccine health literacy for adults in Italian language

VL - Vaccination Literacy

USA – United States of America

AHRQ - Agency for Healthcare Research and Quality

Table of contents:

1 Introduction 8
2 Purpose 10
3 Background 11
3.1 Health 11
3.1.1 Definition of Health 11
3.1.2 Public Health 11
3.2 Determinants of health 12
3.3 Health Literacy 12
3.3.1 General Health Literacy 12
3.3.2 Vaccination Literacy 14
3.4 Digital Health Literacy 15
3.5 Digitization of Health Care Systems 15
3.6 Digital Health Literacy Statistics 20
4 Methodology 22
5 Results 23
5.1 Tools for assessing both digital and health literacy levels 23
5.2 Digital tools for assessing pure digital literacy levels 28
5.2.1 Test your digital skills/ DigSAT 28
5.2.2 Northstar Digital Literacy 29
5.3 Digital assessments for specific health areas 30
5.4 Digital tools for assessing the quality of healthcare systems 31
6 Discussion 33
6.1 Tools for assessing both digital and health literacy levels 33
6.2 Digital tools for assessing pure digital literacy levels 34
6.2.1 Test your digital skills/ DigSAT 34
Northstar Digital Literacy 34
6.2.2 34
6.3 Digital assessments for specific health areas 36
6.4 Digital tools for assessing the quality of healthcare systems 37
7 Conclusion 38
8 References 40
9 Appendix 46
9.1 Appendix I: Examples of Test questions screenshots of DigSAT 46

9.2 Appendix II: Examples of DigSAT results screenshots 49
9.3 Appendix III: Examples of HLVa-IT tool - Vaccine health literacy for adults in Italian language 51
9.4 Appendix IV: Examples of Test questions of questions from the Health Literacy Universal Precautions Toolkit, 2nd Edition from AHRQ: 52

List of figures:

Figure 1 - Examples of individuals' vaccination literacy gaps (23) 15

Figure 2 - Example from Tool 1 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 24

Figure 3 - Example from Tool 2 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 25

Figure 4 - Example from Tool 3 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 25

Figure 5- Example from Tool 4 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 26

Figure 6 - Example from Tool 5 (Digital Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 26

Figure 7- Example from Tool 6 (Digital Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 27

Figure 8- Example from Tool 7 (Digital Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA) (37) 27

Figure 9 - Type of questions done before individuals take DigSAT assessment (41) 29

Figure 10- Northstar free assessments (45) 30

List of tables:

Table 1- Comparison between DigSAT tool and Northstar assessments 36

1 Introduction

During the last years, along with other general services, health has undergone a digital astounding change, especially since the spread of COVID-19 pandemic. Concerning the isolation, it has become mandatory to adapt health care in almost all fields of medicine to continue providing patient care. (1) (2) (3)

Nowadays, health sector is moving towards a more patient-centered approach, where individuals are playing a more active role in the management of their conditions and their general well-being, as well as having voice in their treatments decisions.

However, there is still a huge progress to be done in health services digitization. (1) (2) Apps, SMS texts, emails, internet, interactive chatbots, and voice agents are some examples of digital health technologies that can contribute to remote health access. (4) The widespread of smartphones plays an important role, since individuals can access several *«downloadable or internet-based applications (apps)»* (1) allowing them to manage and monitor some chronic diseases, with the help of wearable devices, like smart watches. (3)

However, digital health still faces several barriers and concerns. (1) The existing differences in individuals' health literacy levels are one of the main factors contributing to the challenges in implementing digital in health sector. The degree of health literacy and digital literacy of an individual depends on several determinants like family and physical environment, individual age and behaviours, access to education, literacy level as well as employment and income (economic environment). (5) (6)

The posture and suitability of health professionals towards the patients they have to deal with, will also influence both the implementation of digital health in society and health literacy quality. (7) (8) Patients interactions within the healthcare system can be very stressful due to their health conditions. However, that may be also enhanced due to confusing communications that are, most of the times, at health professional's scholar level. The result is that certain patients fail to understand even basic instructions, leading to poor health outcomes. It is common knowledge among the health sector that communication should be provided in ways that anyone can understand, despite their level of knowledge, in a plain direct language as well as easy-to-read materials, turning health literacy both equitable and free of disparities. (8) (9)

According to literature, addressing health literacy properly can be achieved in two ways: by screening individual patient health literacy level and, according to that, developing a personalized intervention, or through the use of health literacy universal precautions by

healthcare professionals, to ensure the information they provide is understandable by every patient. (8)

In order to measure health and digital literacy levels in today's society, some tools have been developed. However, many of them tend to focus on very particular and scattered aspects, so there is still a lack of an integrated and global view of the existing gaps that may lead to an increased difficulty in achieving equality. For this reason, there is no current consensus about what is the best health literacy instrument. (10)

According to the United Nations Secretary-General, António Guterres, "*the digital divide is now a matter of life and death for people who are unable to access essential health-care information. It is threatening to become the new face of inequality, reinforcing the social and economic disadvantages suffered by women and girls, people with disabilities and minorities of all kinds*." (11)

Although there has been a progress in this area, several disparities persist and they should be overcome. It is highly important to understand which groups will be most negatively affected by these changes and why they are negatively affected in the first place and what are the contradictory currents in the literature, regarding not only the actual needs, but also the discrepancies regarding the evaluation of existing different tools.

2 Purpose

The purpose of this work is to explore and become familiar with the different existing digital tools that have been developed over the last years, enabling society's digital and health literacy levels to be assessed. With this in mind, and due to the COVID-19 pandemic that has been showing us the need of a good digital literacy level, the project focus on some digital tools and platforms, as well as highlights problems and gaps that still remain, taking into consideration the existing needs and barriers in society.

Another purpose is to evaluate the society engagement with technology devices and digital platforms.

The project also aims to design a new tool that gathers the best practices and characteristics selected from other tools that had already been developed. The constructed database should be centralized in this tool, in order to be easier to define the next steps regarding individuals' health care digitization, after identifying population gaps and needs.

3 Background

3.1 Health

3.1.1 Definition of Health

Throughout the19th and early 20th centuries, health concept was focused on the «*absence of diseases or infirmities*» and it was defined «*by physical parameters*». (12)

Some years later, with the contribution of the World Health Organization, the definition of Health underwent some changes, and, up to this date, has been defined as «*a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity*». (12) (13) Despite this, many critical analyses have shown that this concept is not sufficient to accommodate some challenges. (12) (14) During the last decades, due to scientific improvements, there has been a huge growth on longevity with the increase incidence of chronic diseases («*due to improvement of the survival rates for several diseases*»). This leads to critical thinking about the «*WHO's utopian vision*»: can we still look at Health as «*a state of complete physical, mental and social well-being*»? (12)

From a broader approach, the concept of Health should start to be considered as a result of «*actions, choices, intentions, and so on, embedded in a network of social ideas, expectations, social practices, and institutions*». It is argued that people should be able to «*react to all kinds of environmental events having the desired emotional, cognitive, and behavioral responses and avoiding those undesirable ones*». (12)

3.1.2 Public Health

This concept is generally considered for engaging all population instead of an individual.(15) Public Health tries to base itself on the benefits that can accrue from current knowledge, so that it can impact positively on the health status of a population. Public Health takes into account that individual behaviours and socioeconomic factors (social determinants) have impact on others health status and well-being. (15) Thus, public Health was described as a "*multidisciplinar area of practice*" and has been seen as a governmental responsibility.

Due to a joint effort between governmental entities and other organizations (such as volunteers or even private sector entities), several problems that call for collective action to

protect, promote and improve Health, have been identified so that it could be possible to use preventive measures, in order to avoid major health problems in the society. (15)

3.2 Determinants of health

When Health is addressed, several aspects must always be considered. A health status is always determined by factors such as family and physical environment (that is «*the conditions in which we are born, grow*» and live in), individual age and behaviours, access to education, literacy level as well as employment and income (economic environment). (5) (6)

These factors are often referred as social determinants of Health and vary from individual to individual, leading to several disparities or inequalities. (5)

Social Health determinants can be regarded as individual factors that influence a person's health status, and are always determined by individual behaviours («*the main proximal determinants of variations in personal health*»). (5)

3.3 Health Literacy

3.3.1 General Health Literacy

According to The Organization for Economic Co-operation and Development (OECD), literacy is defined as "*the ability to understand, evaluate, use, and engage with written texts to participate in society, achieve one's goals, and develop one's knowledge and potential*". (5)

Literacy can be divided into task-based and skills-based domains:

«***Task-based*** *literacy focuses on the extent to which a person can perform key literacy tasks such as reading a basic text and writing a simple statement*»; (5)

«***Skill-based*** *literacy focuses on the knowledge and skills an adult must possess in order to perform these tasks. These skills range from basic, word-level skills (such as recognizing words) to higher-level skills (such as drawing appropriate inferences from continuous text*)». (5)

Health literacy may be defined more specifically as «*the literacy and numeracy skills that enable individuals to obtain, understand, appraise, and use information to make decisions and take actions that will have an impact on health status*». (5) It is also known as the «*ability to access, understand, evaluate and communicate information as a way to promote, maintain*

and improve health in a variety of settings across the life-course» (16) or "*the degree to which individuals have the capacity to obtain, process, and understand basic health-related decisions".* (17)

Similarly to general literacy, health literacy vary from individual to individual, leading to several skills disparities since it always depends on the determinants of Health. Due to these inequalities, health literacy has been divided into three different domains: functional, interactive, and critical health literacy. (5)

a) The first category, refers to basic-level skills, which are sufficient for individuals to receive and understand basic and primary health information. People with these skills should be able to «*apply that knowledge to a range of prescribed activities*» and usually cope well with education and direct communication. These individuals have more success regarding «*medication adherence, participation in prevention activities and some behavioral change*». (5)

b) The second domain of health literacy, involves individuals with «*more advanced literacy skills*». Due to their greater knowledge, these individuals are more apt to select information from different sources and «*to respond to health communication and education that are more interactive and accessible through structured communication channels*». Comparing to functional health literacy, these individuals are also more capable to make decisions in the area of Health. (5)

c) Critical health literacy includes the ones who have «*the most advanced literacy skill*». This type of health literacy can have an effect not only on the individual-level, but also among the population. These individuals manage to analyze information from an huge number of different sources. With their knowledge, they are able to understand and control many events and determinants of Health (such as «*social, economic, and environmental determinants*», providing an impact on Health. (5)

Recently, The American Heart Association showed the importance of health literacy in cardiovascular disease. «*The connection between health literacy and health outcomes includes access and utilization of healthcare services, patient/provider interaction and self-care*». People with a greater health literacy tend to have better outcomes in this type of pathology. (7)

Health literacy depends on several social determinants of Health, such as education, income, language barriers, and other physical, cultural, and environmental factors. Therefore, «*building knowledge and skill related to self-care can mitigate the health impact of low health literacy*». (7) Due to differences in health literacy levels, there are a few strategies to avoid patients'

misunderstanding the information given by health providers. (7) Regarding health professionals' knowledge level, it is known that, most of the times, they are not able to communicate at a more basic level. (18) (19) Considering this, there should exist a practical training for health providers to overcome these gaps, teaching them how to tailor their communication skills. (20)

The most commonly used strategies include «*attention to the reading level in printed materials*», avoiding «*medical jargon by using plain language with clear and concise messages, and teach back*». (7) These strategies aim to ensure that the patient is understanding the information given by the health provider. (7)

3.3.2 Vaccination Literacy

It is common knowledge that people get more involved when the subject is related to a practical up-to-date topic. That is the case of vaccination, since it is one of the most relevant interventions to prevent infectious diseases and, therefore, contribute to public health, being the COVID-19 pandemic the most actual example. (21)

In spite of the well-known advantages of vaccination, according to the WHO the phenomenon of vaccination refusal and hesitancy has been increasing during last years, due to *«misinformation and distrust in the authorities»* (21) and scientists or conflicting communications from experts and the media, feeding the anti-vaccination movement (21)

Such hesitancy or refusal could be avoided through a proper vaccination literacy (VL). This concept, intends to ensure that *«everyone understands what they need to know and do to get vaccinated»* (21), promoting *«information about immunization, diseases prevention and also health promotion»*. (22) However, according to several authors, vaccination literacy is a topic that is still a challenge (Figure 10). (21) (23)

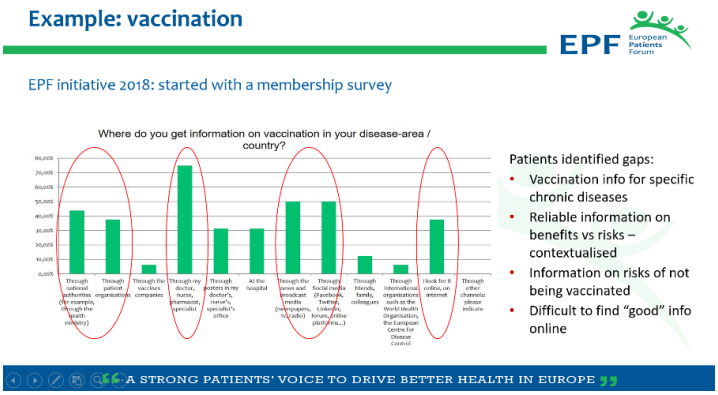


Figure 1 *- Examples of individuals' vaccination literacy gaps* (23)

3.4 Digital Health Literacy

Digital health literacy is considered as «*the ability to appraise health information from electronic sources and apply the knowledge gained to addressing or solving a health-related problem and as such has emerged as an important component of greater health literacy*» (24) or «*the field of knowledge and practice associated with the development and use of digital technologies to improve health*». (25)

3.5 Digitization of Health Care Systems

Health sector is becoming more personalized and focused on a patient-centered approach, where individuals play an important role on their self-care and management as well as sharing decision making concerning their health problems and treatments. (1) The increasing use of technology related to the health area is enhancing this personalized approach and seem to be the future.

However, there are several barriers that have to be overcame. (26) The necessity to create health platforms and systems that could, eventually, bring benefits to patients before health issues arise, remains.

Comparing to the traditional access to healthcare, digital tools have several and known advantages. (7)

The continued use of technology in the health sector, will reduce the time it takes to enable access to the health provider using online portals, which «*facilitate patient participation and offer remote visits via telemedicine services*» (24) -telehealth- electronic prescribing and

accessing medical records. (24) It will also allow to collect data related to patients' medication and symptom management. (7) (26)

eHealth has the ability to «*deliver multimedia education*» and to «*establish communication outside of the healthcare setting*». (7) All of this, will allow cutting costs and a more personalized service.

Due to this personalized and action-oriented service, the use of technology in the health area will improve health literacy in the society. Digital technology enables the individual to be an active participant in his health, allowing him to manage his chronic conditions and his general well-being through use of new technologies such as «*artificial intelligence and machine learning, virtual and augmented reality, and blockchain*». (1) (7) (17) (27) He will also have the opportunity to stay always connected with a healthcare team. (7)

While written materials can be difficult to be understood by certain individuals, particularly those with lower literacy levels or those with visual impairments, digital materials such as video and audio can enable an easier and clear communication. (24) (28) Digital formats can link to more detailed information, enhancing individuals to have more autonomy and to boost their knowledge about a specific health subject of their interest or concern.

Digital solutions enable the delivery of multi-media education, such as videos, audio, and print, at different reading levels, in multiple languages, using formal and informal teaching methods. (7)

Mobile health, or mHealth, is «*the implementation of digital health services with mobile and wearable devices, and has ample potential to enhance self-management of chronic conditions*». (3) (24) It is also defined by the WHO as the «*medical and public health practice supported by mobile devices, such as mobile phones, patient-monitoring devices, personal digital assistants (PDAs), and other wireless devices*». (1) (29) (30) mHealth will probably be one of the most important tools that will be needed for the implementation of personalized medicine. (1) For instance, the use of wearable devices could be really useful in managing cardiovascular diseases (24) (18), diabetes or chronic respiratory diseases (CRDs) (1). Wearable devices can control blood pressure, body temperature, physical activity, glycemia levels or even support people who are undergoing tobacco cessation. (1) (24)

Regarding the coronavirus disease 2019 pandemic (COVID-19), digital health, particularly telemedicine, acquired special relevance. This type of health intervention allowed to replace numerous conventional medical appointments by virtual ones, avoiding unnecessary

postponements. Assessments on patients with «suspected infection or with chronic diseases», were, this way, made possible with reduced risk of infectious exposure and, therefore, becoming a safer option for both health care providers and patients. (1)

Telemedicine is defined as *«the use of electronic information and communication technology by medical personnel to provide and support health care to patients when they are far away from the health care institutions»*. It involves several technologies such as «videoconferencing, wearable devices, internet platforms, mobile applications, store-and-forward devices, streaming media, and terrestrial and wireless communication» and can be used with different purposes. Telehealth can be used to promote and encourage health literacy and education. Other advantages are the decreasing demand and waiting time in healthcare services, the reduction of health-related costs, as well as the guarantee and the increased access to health care for individuals living in remote locations that usually struggle to access to hospitals or other health services. It also enables faster medical appointments where physicians can evaluate individuals' treatment adherence and disease progression. (1)

«Telemedicine is therefore a broad concept that involves diagnosis, treatment, monitoring, education, health promotion, and disease prevention». (1)

The majority of the studies found that e-health interventions improved self-management, adherence to therapy and symptom management ability. (1)

Chronic respiratory diseases (CRDs) such as chronic obstructive pulmonary disease (COPD) and asthma are very prevalent. Telemedicine is one of the digital ways that can be useful managing this type of patients, as it enables continuous care and, therefore, avoiding exacerbations caused by delayed healthcare. (1)

Cigarette smoking is the main causal factor for the onset of COPD. Regarding this, promoting smoking cessation is probably one of the best ways to prevent the progression of this disease. Mobile applications as an add-on to psychopharmacological therapy seems effective to achieve this result. At the same time health providers can also provide psychosocial support, a major advantage concerning this process. (1)

It is known that pulmonary rehabilitation brings important benefits in COPD patients. Telemedicine can be used as a rehabilitation programme to achieve such benefits, decreasing COPD exacerbations, and, therefore, reducing deslocations to emergency services and COPD-related hospitalizations. The benefits from the telerehabilitation seem to be similar to outpatient

pulmonary rehabilitation, improving *«health-related quality of life, respiratory symptoms, and exercise tolerance»*. (1)

Most often, telerehabilitation programs in COPD patients involve the *«delivery of exercise in a clinical or home-based setting using video conferencing»* and patient monitoring through the use of simple devices such as *«pulse oximeter, a laptop/tablet or smartphone, step counter or a wearable physical activity monitor»*. (1)

Telemedicine also seems to be effective in asthma patients, namely improving inhalation technique, increasing adherence to medication, enhancing self-management as well as health education and literacy. (1)

Although all the advantages associated to this use of technology, the implementation of mHealth or other type of digital health still face several challenges. (1) (24) Digital health literacy requires specific skills complementary to general and health literacy, such as computer literacy, the ability to use computers or other technologies and search engines. (3) (24) Beside this, it also required that an individual has the ability to evaluate a wide variety of sources. People who have poor literacy, health literacy and numeracy skills will definitely struggle to access digital literacy, so as mHealth. (24)

There are several concerns and barriers about the implementation of digital health in the society. The most common is the need for support in understanding the medical content presented and the need for improved digital skills (lack of digital literacy). However, there are several other barriers that we could talk about. Security and privacy of data issues continue to be a concern in society. (31) (32) (2) (1)

Due to these barriers, studies defend that it should exist a direct measurement of patient's skills, such as digital «*health literacy, digital access, health literacy, and numeracy*» (32), so that it could be possible to evaluate their engagement with this type of health solutions.

It is known that certain groups of people have increased difficulty in accessing digital literacy, due to the impact of social determinants of health. For instance, in the United States of America, approximately 90% of U.S. health care systems offer patients an online portal access to their Electronic Health Records data. (32) These type of technology enables patients to check their appointments summaries, to see the results of some health tests that were required by an health professional, to access their allergy lists. It also enables to schedule their appointments in a faster and easier way and, if needed, ask the physician to update or renew patients' medication. Despite this, it is known that only 15-30% of patients use portal features. (32)

The COVID-19 pandemic situation is one of the best examples to measure the impact of digital health on individuals and also a critical factor to highlight health literacy and health access disparities and a significant digital divide in a global way. The lack of adequate health literacy will affect the way individuals use and select information and manage their health care. (1) (11) (33)

During the COVID-19 public health crisis and the consequent upgrade in the area of digital health (27) (31), it was possible to provide «*people with ongoing access to vital health services, while minimizing their potential exposure to infection and allowing them to maintain social distancing*». (34) However, as described above, this also evidenced health inequalities that contribute to poor health outcomes.

During this period, there have been two major digital health modes: telehealth (which has enabled interactions between health providers and patients) and several data base containing health information (which is available online or via mobile health apps) (34). The smart phone is also playing major role democratizing access to health information. (7) (11)

The diffusion of telehealth and other technologies suggests that the health future will be digital. The question that has been asked by many researchers and practitioners is, «*will that future also advance health literacy and equity*?». (33)

As previously mentioned, there are several different factors that can contribute for health disparities. For instance, digital diffusion will not be equally accessed by every individual. Access to technology can be limited by «*poverty, under-resourcing of health systems and neighborhoods, homelessness*», lower-income, rural communities, sociodemographic characteristics, etc. (34)

Beyond patients' factors, health providers can also contribute for these inequalities. Many times, due to their higher knowledge in the health sector, health providers lack training and skills in understanding how «*their patients and communities may experience or interact with technology*» (34) or which is their health literacy level. These can lead to misunderstandings. Individuals should be able to understand information that is given to them, according to their needs, behaviours and literacy level. Often, health-care providers are also unable to offer digital approaches to their patients due to their geographical location (for instance, they can have limited access to broadband). (33)

The final goal in public health, is always reducing or eliminating illness, disability, and premature death. Therefore, improving health literacy among the society should be the main

goal. In fact, this has been an objective in the United States for about two decades, but still needs several improvements. (33) The Institute of Medicine's report "Crossing the Quality Chasm" highlighted equity—the absence of disparities—as a key pillar of quality. (11)

Digital health adherence will also depend on individuals' personal interests and skills. Not everyone is prepared to «*navigate digital spaces*» and there is no unique technology that «*meets the information needs of an entire population*». (33)

According to Choi & Bakken (2010) study, it was evident that websites that include technical features designed for low-literate users, may improve «*understanding of health issues*». (33) In addition, acceptability to patients appeared to be better in studies that used audiovisual features or improved graphical representations of the portal content.

3.6 Digital Health Literacy Statistics

Demographics of race, ethnicity, age, sex, education, and geographic location (determinants of health) are also commonly associated with digital health and health literacy inequalities. (33)

An example of the influence of these factors is described by Devlon N. Jackson, Neha Trivedi & Cynthia Baur in an article that reports an American study about these disparities and provides us some metrics about it.

According to this study, «*male, non-Hispanic African American, 65 years of age and older, having less than a high school education (persons aged 25 years and older), and residing in a rural area had a lower rate of reporting internet access*». (33)

It also shows that, despite the internet access has increased from 52% of the U.S. population in 2000 to 90% in 2019 (Pew Research Center, 2019a), 10% of the overall population still does not use the internet (Anderson et al., 2019). These happens for several reasons. First of all, there are still individuals who do not see how the internet could be relevant to their lives (around 34% of the 10% who do not use the internet). Secondly, much of them find digital technology too difficult to use (32% of the 10% who do not use the internet) or even too expensive to purchase the internet or computer (19% of the 10% who do not use the internet). (33) Non adherence internet users are essentially 65 years age and older individuals, with lower income and with poor literacy (less than a high school education), and residents in a rural area (33)

Moreover, racial and ethnic minority groups, older adults, rural residents, those with lower levels of education and income are less likely to have broadband access. (33)

This highlights two major factors for digital health non-adherence: (a) first, individuals who reside in rural areas, apart from less access to healthcare systems, are also less likely to take advantage of the use of internet. Apart from the possibility of having internet, the quality of the device and the connection matters. In comparison to urban areas, rural areas broadband internet is also much more limited; (b) secondly, low adherence occurs essentially in older age groups, that have more difficult with technology and also have lower literacy levels. («*among the overall U.S. population. Non-Hispanic African Americans, females, 65 years of age and older, having a high school education (persons aged 25 years and older), and residing in a rural area also had lower rates of access to broadband internet*»). Elderly people are more likely to struggle to use digital technology and wearable devices. This age group is one that would benefit most from health technology, since they tend to suffer more chronic health conditions or be at higher risk for preventable ones (such as diabetes or hypertension). With the right level of health and digital literacy, they would also be able to remotely manage their conditions in a better way and to get more reliable knowledge about their own diseases. (33)

In contrast, individuals with better socioeconomic conditions, who usually tend to have better literacy levels, are more likely to seek health information online and to have access to better health care conditions. These individuals can also access digital technology easier and afford wearable devices. (33)

4 Methodology

For the development of this work, it was necessary to review the state of the art on health care digitalization process. A search on platforms called search engines was conducted between 4th January 2022 and 31st October 2022 with the purpose to obtain articles, publications and books related to the topic. Pubmed and Google Scholar were the two main platforms used in the first instance, in search for the following terms: health literacy, digital literacy assessment, digital health literacy, digital revolution, health literacy disparities, digital tools, digital health-related tools, health-related tools.

With the purpose to discover different digital and health-related tools, in addition to Pubmed and Google Scholar, regular Google, a database of health literacy measures (35) and other web tools were also used. Many tools were excluded because they were not available for consultation or the studies didn't present any results.

The chosen digital tools and assessments were described from four different types of classifications, according to their features:

- Tools for assessing both digital and health literacy levels;
- Digital tools for assessing pure digital literacy levels;
- Digital assessments for specific subjects;
- Digital tools for assessing the quality of healthcare systems.

A critical position on the tools found, enabled comparisons between some tools to define which the strongest points in each of them are.

5 Results

5.1 Tools for assessing both digital and health literacy levels

One toolkit (36) was developed to assess individuals' eHealth literacy based on combination of newly scales and assessments and existing ones. With this combination it was meant to understand the «*competencies, knowledge and skills*» that one uses while adopting eHealth solutions. (36)

The study "Assessing Competencies Needed to Engage with Digital Health Services: Development of the eHealth Literacy Assessment Toolkit" (36) was developed with the purpose to create and validate an eHealth literacy assessment toolkit (eHLA). This toolkit was developed from 2011 to 2016 with the purpose to evaluate the eligibility of an individual so as to participate in projects employing eHealth solutions. (37) This assessment suffered adjustments in order to improve it according to continuous testing that was performed during that period of time. During the period of testing, while filling the questionnaire (eHLA) individuals were submitted to cognitive interviews - while the respondents were filling the assessment, the interviewers should pay attention and note the items where they had more doubts or hesitations. At the end, the interviewers were supposed to clarify the reasons for those difficulties or hesitations, by undergoing the cognitive process behind the answers. (36)

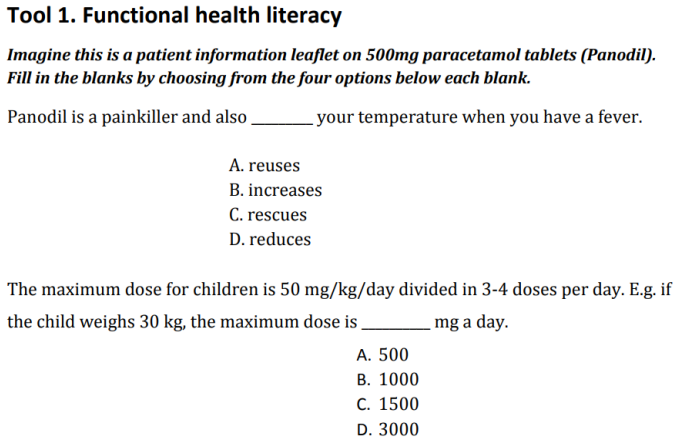
During this study 475 assessments were performed, of which, 375 (328 paper and pen and 47 digitally) were collected from the community (general population) and the remaining 100 were collected from a sample of outpatient clinic. The final version consists on a total of seven different tools/ parts which are divided into two different types: four out of seven are health-related tools and the other three are digital related tools. «*The 4 health-related tools are functional health literacy* (tool 1), *self-assessed health literacy* (tool 2), *familiarity with health and health care* (tool 3), *and knowledge of health and disease* (tool 4). *The 3 digitally-related tools are familiarity with technology* (tool 5), *technology confidence* (tool 6), and *incentives for engaging with technology* (tool 7).» (36) These tools are either self-reported, such as questionnaires, or a performance test of relevant skills. (38)

Health Related Tools/ Questions from the assessment:

Tool 1—Functional Health Literacy: This tool was developed with the purpose of testing individuals' functional health literacy (chapter 3.3), which refers to basic-level skills, which are sufficient for individuals to get and understand basic and primary health information. These skills include the ability of individuals to «*read, write, understand, and perform a simple calculation in a health context*» (36)

The final version of this health-related tool consists of 10 multiple choice items in each of them a word or a number has been replaced with a blank. Figure 1 depicts part of tool 1.

The test score ranges from 0 to a maximum of 10 points, 1 per each correctly answered item. (36)



Tool 1. Functional health literacy

Imagine this is a patient information leaflet on 500mg paracetamol tablets (Panodil). Fill in the blanks by choosing from the four options below each blank.

Panodil is a painkiller and also _____ your temperature when you have a fever.

A. reuses
B. increases
C. rescues
D. reduces

The maximum dose for children is 50 mg/kg/day divided in 3-4 doses per day. E.g. if the child weighs 30 kg, the maximum dose is _____ mg a day.

A. 500
B. 1000
C. 1500
D. 3000

Figure 2 *- Example from Tool 1 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

Tool 2—Health Literacy Self-Assessment:

This tool is a short version of selected 20 items, used without changes, from the more comprehensive HLS-EU-Q47 questionnaire, «*which measures self-reported health literacy*». (36) Tool 2 aims to give a rough measure of health literacy as defined by the HLS-EU framework matrix, which consists of 3 areas—health care, disease prevention, and health promotion (Figure 2). Respondents select the level of difficulty they find themselves concerning several healthcare, disease prevention and health promotion items, ranging from very difficult (1 point) to very easy (4 points). Once the final version of this tool has 20 items, scores can range from 20 to 80. (36)

Tool 2. Health literacy self-assessment

(eHLA item number / original item number in HLS-Q47)

	On a scale from very easy to very difficult, how easy would you say it is to:	Very difficult	Difficult	Easy	Very easy
3/2	Find information on treatments of illnesses that concern you?	❑	❑	❑	❑
5/16	Follow instructions from your doctor or pharmacist?	❑	❑	❑	❑
6/37	Understand advice on health from family members or friends?	❑	❑	❑	❑

Figure 3 - *Example from Tool 2 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

Tool 3—Familiarity with Health and Health Care:

This self-reported tool (Figure 3) was created with the main purpose to assess individuals' familiarity with the healthcare system and typical concepts and terms used in the healthcare area and consists on a total of 23 items. Since the chosen scale goes from 1 (not at all familiar) to 4 (completely familiar), the total score ranges from 23 to 92 points. (36)

Tool 3. Familiarity with health and healthcare

Rate on a scale from not at all familiar to completely familiar.

How familiar are you with the following items:	Not at all familiar			Completely familiar
	1	2	3	4
Rehabilitation	❑	❑	❑	❑
Spleen	❑	❑	❑	❑
Medical ventilator (respirator)	❑	❑	❑	❑
Withdrawal (symptoms)	❑	❑	❑	❑

Figure 4 - *Example from Tool 3 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

Tool 4—Knowledge of Health and Healthcare: This final health-related tool consists of 12 multiple-choice questions. In each question there is one correct option (ranking 2 points), two incorrect answers (0 points each) and the last option "I would consult with someone else" that gives partial credit to respondents (1 point) (Figure 4). (36)

Accordingly, the final score can range from 0 to 24 points. (36)

Tool 4. Knowledge of health and disease

Choose the option that you believe is the right one for each of the seven questions.

Which of the following is one of the livers main functions?

a. ❑ Detoxing of the blood.
b. ❑ Oxygenate blood
c. ❑ Urine production
d. ❑ I will ask someone else, since I'm unsure about the answer

Nephrology is the doctrine of?

a. ❑ Liver diseases
b. ❑ Kidney diseases
c. ❑ Nervous diseases
d. ❑ I will ask someone else, since I'm unsure about the answer

Figure 5- *Example from Tool 4 (Health Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

Digital Related Tools/ Questions from the assessment:

Tool 5—Familiarity with Technology: This tool is intended to evaluate individuals' familiarity and knowledge level concerning technology (Figure 5). It consists of 20 items, in which the options vary from "*not at all familiar*" (1 point) to "*completely familiar*" (4 points). Due to this, final scores ranges from 20 to 80. (36)

Tool 5. Technology familiarity

Rate on a scale from not at all familiar to completely familiar.

How familiar are you with the following items:	Not at all familiar			Completely familiar
	1	2	3	4
Keyboard	❑	❑	❑	❑
Settings	❑	❑	❑	❑
Operating system (e.g. Windows)	❑	❑	❑	❑
User name	❑	❑	❑	❑

Figure 6 - *Example from Tool 5 (Digital Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

Tool 6—Technology Confidence: These 5 items self-reported tool is used to assess the degree of confidence an individual has relating to the use of technology. Options vary from "*not at all*

confident" (ranking 1 point) to "*completely confident*" (ranking 4 points), leading to a final score that goes from 5 to 20 points (Figure 6). (36)

Tool 6. Technology confidence

On a scale from not at all confident to completely confident, rate your use of computers.

How confident do you feel …?	Not at all confident			Completely confident
	1	2	3	4
Using a computer in general?	❑	❑	❑	❑
Using touchscreen?	❑	❑	❑	❑
Finding information online?	❑	❑	❑	❑

Figure 7- *Example from Tool 6 (Digital Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

Tool 7—Incentives for Engaging with Technology: The final tool of this assessment is also self-reported and was develop to evaluate each individual motivation regarding technology engagement. The validated version has 6 items with response options from 1 to 4, with 1 being "*completely disagree*" and 4 being "*completely agree*." (Figure 7). (36)

Tool 7. Incentives for engaging with technology

On a scale from completely disagree to completely agree, rate your experience of computers.

How much do you agree or disagree with the following statements:	Completely disagree			Completely agree
	1	2	3	4
I'm interested in using computers.	❑	❑	❑	❑
I'm fond of my computer.	❑	❑	❑	❑
I'm not afraid to try out new functions on computers.	❑	❑	❑	❑

Figure 8- *Example from Tool 7 (Digital Related Tool) from the validate version of eHealth literacy assessment toolkit (eHLA)* (36)

In summary:

- It was developed like self-reported assessment;
- No limited time set for respondents;
- Officially validated in Denmark, Taiwan, Germany, France, Norway, Australia.

5.2 Digital tools for assessing pure digital literacy levels

5.2.1 Test your digital skills/ DigSAT

DigSAT was developed by the European Commission with one simple goal: increase the number of Europeans with basic digital skills, and therefore support the goals of the Digital Decade - 80% of Europeans have at least basic digital skills by 2030. (39)

"Test your digital skills" or DigSAT (Self-Assessment Tool) is an online test that was developed by the European Commission with the aim to assess individuals' level of digital skills/ competence. (40)

This test takes around 20 minutes and is available both on the Digital Skills and Jobs Platform and Europass in 29 languages (the 24 official EU languages as well as Icelandic, Norwegian, Turkish, Serbian and Macedonian). (41) Individuals can take the test as many times as they want. In Appendix I, there are some examples of the type of questions that are asked in this toolkit.

Although it already exists the Framework 2.1 version, this assessment was created according to the "*The Digital Competence Framework 2.0*" (it was "the main reference point for a variety of initiatives, aiming to enhance digital competence at EU or national level"), which divides digital skills into five different subjects (42) (43)

- Information and data literacy
- Communication and collaboration
- Digital content creation
- Safety
- Problem solving

This test allows respondents to better understand their abilities but also their weaknesses and, according to these, find appropriate high quality training opportunities from the Digital Skills and Jobs Platform catalogue. After receiving the test results (that are in accordance with the DigComp 2.0 key components of digital competence) and according to their digital literacy skills, individuals are also able to access plenty of training and information, so that they can fill the gaps identified in the test and, therefore, they may achieve a specific learning goal. (40)

The courses are suggested according to the subjects' gaps, as identified in the test, which makes this test much more personalized to respondents needs. (40)

Beyond this, DigSAT is also personalized to each individuals' ambitions and needs: at the beginning of the test, respondents *«will be asked to answer a few questions with basic information about their dream job and their educational level, and then they can also answer few self-reflection questions»* to adapt the test to their needs. (40) Figure 8 shows the type of questions before each individual takes the test.

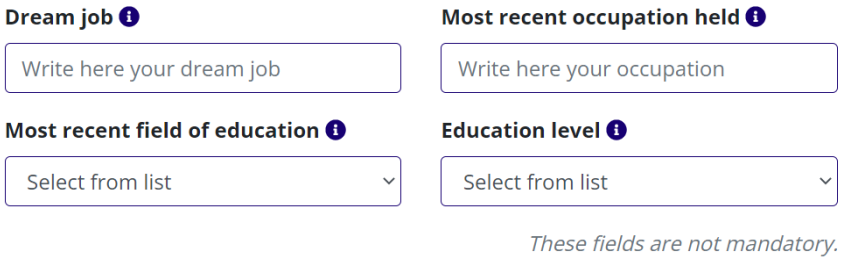


Figure 9 *- Type of questions done before individuals take DigSAT assessment* (40)

5.2.2 Northstar Digital Literacy

Northstar Digital Literacy is an online platform that has several types of digital skills assessments. On this website, individuals have access to online self-guided modules that enables them to assess their abilities to perform tasks based on digital skills such as basic computer digital literacy standards. The available modules are essentially from three areas: Essential Computer Skills, Essential Software Skills and Using Technology in Daily Life. For each of these areas, respondents have access to more than one assessment (Figure 9). (44)

This platform was specially created «*in response to the needs of job seekers*» (44) who may lack digital knowledge, which can be an impediment when it comes to getting a job. Currently, Northstar assessments are being implemented and available at *«public libraries, workforce centers, adult education sites and nonprofits»*. (45)

Individuals who take Northstar assessments are able to get a certificate that can *«provide an important credential for employment»*. (44) When individuals do not pass the tests, they can access personalized and relevant instruction according to the areas in which they weren't good enough, allowing them to repeat the assessment once they have boosted their competences. Northstar also includes learning resources with «*self-directed instruction and practice for individuals*». (44)

Different organizations can also apply a "*Northstar location*" by paying an annual fee. This enables people to access «*data about their end-users' assessments*» and to award certificates. This feature has demonstrative videos and information and «*also interactive practice to support learners*» (remote teaching guide). (46) When an assessment at a Northstar location is completed, individuals receive links that give them access to lessons for practice where they may have some gaps. Northstar lessons can be «*adapted for small group or one-on-one tutoring, as well as distance learning*». (47) People who subscribe a Northstar location can also track their digital literacy improvement.

Some basic tests are free and anyone can access them. Moreover, all assessment tools are available both written and as audio. In Appendix II, there are some examples of typical results presentation after taking an assessment.

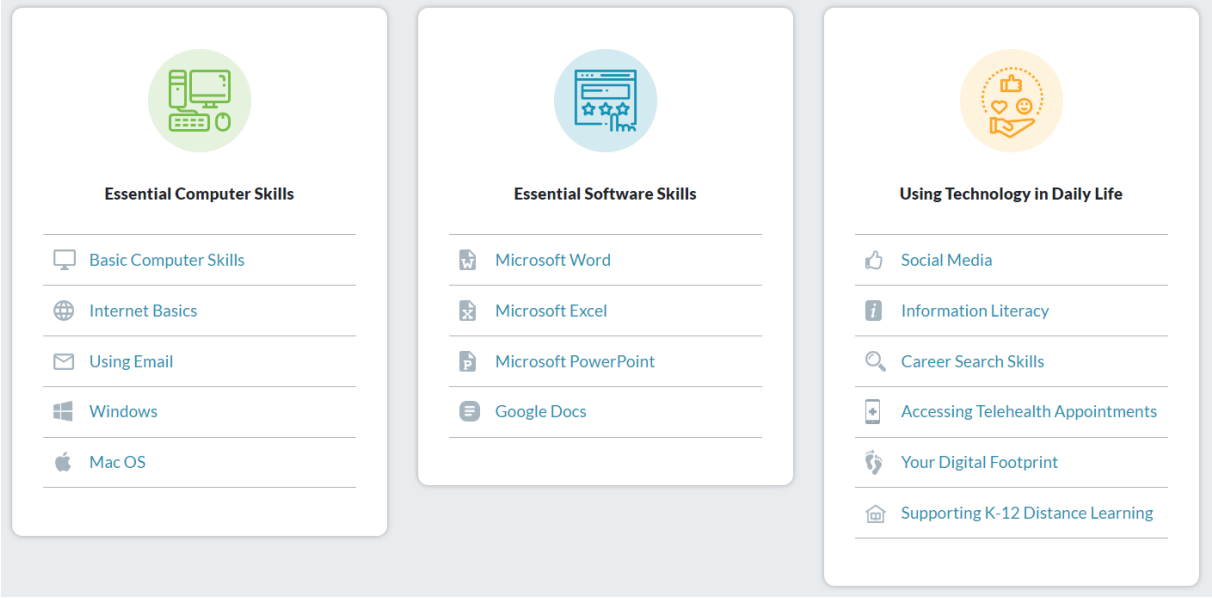


Figure 10- *Northstar free assessments* (44)

5.3 Digital assessments for specific health areas

HLVa-IT is a tool that was created and adapted for the Italian community. One of the goals of this survey was to measure the vaccination levels. Two studies were performed in different samples of Italian population: one of them in a sample of general adults (age 50-75) (22), and the other one in Nursing Homes professionals with a mean age of 45 years old (21).

This survey is a self-rated one-page that was developed as a paper-and-pencil test (22) aiming to measure vaccination literacy. However, more recently it was also performed in a

digital way (21). It considers three vaccination level scales, according to the level of knowledge of each individual and their immunization: functional, interactive and critical. It is formed by 14 items (questions) which are divided according to the three literacy scales considered: functional vaccination literacy (items number 1 to 5), interactive/ communicative vaccination literacy (items number 6 to 10) and critical vaccination literacy (items number 11 to 14). (21) (22)

Functional questions are more related with *«language capabilities, involving the semantic system, while the interactive/critical questions regard more the cognitive efforts, such as problem solving and decision making»*. (22) The answers are supplied by the interviewee according to a scale with four possible choices (4-never, 3-rarely, 2-sometimes, 1-often, for the functional scale; 1-never, 2-rarely, 3-sometimes, 4-often, for the interactive scale). The final score is «*obtained from the mean value of the answers to each scale, and is comprised between 1 and 4*», (22) where higher values correspond to higher vaccination literacy levels. Additionally, there are some questions that can refrain the respondent from filling the following section – filter questions. (21) (22)

In Appendix III, there are some examples of the type of questions that are asked in this assessment.

5.4 Digital tools for assessing the quality of healthcare systems

Beyond individuals' health literacy, we can also talk about Organizational Health Literacy which is "the degree to which organizations equitably enable individuals to find, understand, and use information and services to inform health-related decisions and actions for themselves and others". (48)

The Agency for Healthcare Research and Quality (AHRQ) is a federal USA agency with the mission of developing tools, data and knowledge in order to improve the healthcare system, so as to help consumers, healthcare professionals and policymakers, enabling them to make informed decisions. One of the AHRQ goals is to improve healthcare system by understanding their challenges and lacks, so that they become safer and with more quality. (49)

AHRQ developed a Health Literacy Patient Survey "Health Literacy Universal Precautions Toolkit, 2nd Edition". This toolkit was developed to help healthcare systems and health professionals to better understand how they could improve the way they explain health related information to their patients, reducing the complexity of healthcare. This toolkit aims to

ensure that healthcare systems are able to promote reasonable and good understanding to all their patients, assuming that anyone, regardless of their health literacy level, might experience difficulty understanding and using health information. (8) (9) (50) (51) (52)

«Adopting a universal precautions approach overcomes the problem that health care providers cannot accurately identify patients with limited health literacy skills»(52), that is, this kind of approach provides all patients with health information in clear, plain language, free of medical jargon. (8)

This toolkit was developed over a two-year period and contained 20 tools. However, the updated version has now 21 different tools, in a range of different areas of knowledge: verbal and written communication, self-management and empowerment and supportive systems. (50) (51) (8) *«Tools 1 through 3 detail how to start on the path to health literacy improvement; Tools 4 through 10 were designed to assist with improving spoken communication; Tools 11 through 13 assist with improving written communication; Tools 14 through 17 provide ways to improve self-management and empowerment; and Tools 18 through 21 assist with improving support systems within the environment».* (8)

A few studies were performed to assess this toolkit. (8) (52) The first study (52) was conducted between August 2013 and January 2014 by demand of AHRQ, with the purpose to demonstrate the utility of the toolkit, as well as identify possible refinements. In this study, 12 primary care practices were selected to use some of the tools from the AHRQ toolkit, after initial definition of the main gaps that had to be improved in healthcare systems.

The second project (8) developed by the University of Massachusetts Amherst in 2019, intended to apply some selected tools from AHRQ toolkit in a primary care office, so as to evaluate the improvement in healthcare staffs' knowledge about health literacy, regarding their patients' health literacy level. This study has also contributed to assess the usefulness of this kind of tools, improving healthcare communication quality, towards a universal precaution approach. It was conducted in a small sample of 6 participants, both primary care providers and registered nurses working within the primary care office. To better assess sample's knowledge improvement, participants were given a health literacy questionnaire before taking training, and another one after a training session.

In Appendix IV, there are some examples of the type of questions that are asked in this toolkit.

6 Discussion

6.1 Tools for assessing both digital and health literacy levels

The eHealth literacy assessment toolkit (eHLA), is not a recent tool since it suffered some adjustments as a result of many cognitive interviews. These cognitive interviews may have helped to assess the majority questions and hesitations from individuals who did the assessment, allowing, eventually, to help extracting pertinent data regarding health literacy levels from the population sample used. However, it was not possible to access those results and infer individuals' knowledge concerning eHealth solutions, since they were made available. One of the advantages of this toolkit is that it is possible to do the assessment in two different ways: digitally or in paper (which allows cognitive interviews as well as face-to-face observation). Another advantage, is that this toolkit allows to obtain data not only for the individuals' health literacy level, but also some knowledge about their digital literacy level (it combines health-related and digitally-related tools). Besides this, eHLA also considers individuals' motivations and difficulties, while searching for health information or the use of technology.

One of the questions from the toolkit that stood out, was the one where individuals had to calculate the daily maximum dose of medical product, something that may be a valuable knowledge for any patient taking medication. However, in comparison to other existing tools, eHLA does not point to other educational tools. Therefore, the respondent cannot get direct education support according to the gaps identified in the result of the test.

eHLA was also evaluated in a study (53) designed to provide robust evidence of available eHealth literacy instruments. This study strike that this tool although receiving «sufficient ratings for relevance, comprehensiveness, and comprehensibility» content, there was low-quality or very low-quality evidence of this. For this reason, the study concluded that the ratings are not sufficient trustworthy and that further psychometrics studies should be undertaken. (53)

6.2 Digital tools for assessing pure digital literacy levels

6.2.1 Test your digital skills/ DigSAT

This online assessment from the European Commission takes around 20 minutes. However, while taking it, even if time seems unlimited at the beginning, if respondents take too long, each question of the tool starts having limited time (one minute and half per each question). One of advantages of this tool is that it is available in 29 different languages (the 24 official EU languages as well as Icelandic, Norwegian, Turkish, Serbian and Macedonian), which allows the creation of a large database, since it is more likely that each individual will answer the questionnaire if it is available in their mother language. In addition, the fact that it is free may also help to have more people interested.

This assessment is in accordance to each individuals' literacy level and each individuals' ambitions. Although this assessment is meant to be in accordance to individuals' literacy levels and ambitions, a striking conclusion can be drawn: tests for people with entirely different qualifications are not that different. In fact, people with low literacy levels will probably experience difficulties while taking it.

A positive aspect is that the test covers a wide variety of questions within the digital world. At the end, it also enables individuals the opportunity to have personalized trainings according to their gaps and difficulties while doing the assessment. (40)

Since this toolkit is in line with the goals of the Digital Decade, this will probably lead to a right assessment of the digital literacy levels of the European population, highlighting its lacks and barriers, and, therefore, helping to define new measures in order to combat these barriers.

6.2.2 Northstar Digital Literacy

One of the advantages of Northstar Digital Literacy is that it has several types of digital skills assessments. Due to this, individuals can assess their digital knowledge in a wide range of different topics. This enables them to better understand their weaknesses and the subjects they have to boost. Besides this, at the end of each test, respondents receive a certificate with

their grade, including information about what they should practice to improve. After this, they can also access paid personalized trainings regarding their weaknesses.

Another advantage is that these assessments have both written and audio information, which can lower some barriers for people with lower literacy levels. These audios may also, eventually, enable people with visual impairments to access this digital tool, since they can hear the questions.

Some basic tests are free and anyone can access them. Northstar platform also gives individuals the opportunity to have access to credentialing valid certificates, which can be used for employment. (45)

Although some assessments are directly created for some specific brand users (such as Mac assessments), some questions in more general tests continue to be too specific and geared towards certain brands. For instance, even if the test "Using Email" has questions from different email extensions and platforms, the big majority of them are about Gmail. Another example is the assessment "Basic Computer Skills", where some pictures of laptops and tablets correspond to Apple devices, which are quite different from several other brands. This can lead to a collection of bad information regarding the degree of digital literacy of an individual, since it is possible that someone is able to know how to work with computers and laptops from other brands apart from Apple.

Another limitation is that people with low literacy levels can struggle while taking the assessments or even the trainings, since Northstar tools were not developed specifically for them. (45) As an example, in a report (54) focused on Low-Income Job Seekers, most of them refered difficulties using Northstar platform. According to the study, many individuals who were taking courses struggled *«navigating the unfamiliar website without instruction»* since Northstar was not integrated into most training programs but was an extra add-on. Individuals also found difficult *«taking an entirely self-paced/self-supported class»* and would prefer more structured help than the one provided by Northstar. Several participants also referred that they didn't know where and what to click on and did not understand the language used. (54)

***Table 1**- Comparison between DigSAT tool and Northstar assessments*

	Free	Repeatable	Time of the assessment	Available languages	Available trainings after the assessment	Personalized to each individual	Audio
"Test your digital skills" or DigSAT from European Comission	Yes	Yes	≃ 20 minutes	29 languages (the 24 official EU languages as well as Icelandic, Norwegian, Turkish, Serbian and Macedonian).	Yes	Yes	No
Northstar	Yes	Yes	N.A	English	Yes	No	Yes

6.3 Digital assessments for specific health areas

One of the advantages of the HLVa-IT is that this tool intends to assess the main obstacles experienced by the population while accessing information about vaccination.

The first study (22), had the advantage of being conducted in a general population. However, since the age group used was very small, this may have limited the results that could be inferred from it. That study used a paper-and-pencil test version, which may also have limited the number of people who accessed it, since some individuals may prefer taking this type of assessments digitally. The most recent (21) was administered online and its score *«presented a significant correlation with knowledge on vaccines and vaccinations, as well as with vaccine acceptance»*. This confirmed the robustness of the tool in measuring VL in different populations and modes (paper and digital).

One positive point of the survey is that it considers three vaccination level scales, according to vaccination level of knowledge of each individual. This could make possible to extract relevant information to assess the best way to improve individuals' vaccination literacy, according to their needs and gaps of knowledge. Despite this, the most recent study (21), considered that some items seemed to belong to the same domain, despite the proposed three literacy scales. Besides this, HLVa-IT seems to be a reliable tool to assess VL. (21)

Considering this, it would of interest performing more assessments in a more representative population, using both general and specific populations. (21) Concerning the COVID-19 pandemic, it would also be positive to evaluate VL in a global perspective.

6.4 Digital tools for assessing the quality of healthcare systems

One of the advantages of Health Literacy Universal Precautions Toolkit, 2nd Edition is that it tries to infer, through the application of a survey to the patients, how health care systems and health professionals could improve the way they provide them health information. With the information collected with this tool, it will probably become easier to see how health care systems should improve themselves in the way they should train themselves in order to help their patients (regardless of their literacy level), so that it could be easier for them have reasonable knowledge regarding health care as well as medical terms.

In the study conducted in 2019, (8) it was performed a one-hour education session to the sample used with the purpose of improving health literacy knowledge and awareness. Results from both assessments performed (prior and after the training session), highlighted that all participants improved their scores from the first assessment to the final one with an average increase of their knowledge of 21.4% between the two tests. Furthermore, by filling a final survey with some specific statements, all of them agreed with the effectiveness of the education session. The use of this tool, also allowed to verify that several office forms were written using high level language and, therefore, needed to be adapted to patients with lower health literacy levels (5^{th} to 6^{th} grade), as recommended by Health Literacy Universal Precautions Toolkit from AHRQ. Both of these aspects, contribute to prove the robustness and effectiveness of the toolkit. (8) However, concerning the small sample size used, further studies in a bigger and more representative sample should be taken to confirm it. For instance, in the study performed between 2013-2014, (52) the results weren't so good. During the 6 months period of this study, several barriers were identified: competing demands/staff capacity, bureaucratic challenges, technological challenges, limited quality improvement experience and limited support from leadership. In a general way, healthcare providers *«reported staffing and time constraints as a significant impediment to implementation activities»,* (52)which led to an insufficient implementation of the toolkit. Furthermore, some tools were also considered to complex, with dense information, even for people with ability in this type of quality improvement methods. While using the toolkit, some practices found that it was not as easy as they would expect to adapt some documents according to the toolkit recommendations, due to technological constraints. It was also evidenced, that some tools would provide better results if they were implemented in tandem. (52) Even if practices seeking to become health literate and considered the Toolkit helpful in charting a direction for quality improvement efforts, all of the above-mentioned barriers, suggest that it should undergo further improvement.

7 Conclusion

Despite the enormous evolution in healthcare during the last 50 years, there are still several health literacy discrepancies among society, due to different determinants. Several individuals still have basic health literacy skills, which leads to insufficient communication with healthcare professionals, without a clear and plain language approach. Due to this, those individuals will struggle to understand what they are expected to do regarding their health needs.

Health literacy universal precautions approach provides all patients with health information that is free of medical jargon and presented in clear, plain language. By implementing this approach, healthcare providers will be able to assist all their patients, providing understandable information, regardless those patients' knowledge. Health systems are still one of the main structures responsible for spreading reliable health information and, therefore, need to adapt themselves to their patients. With this end in view, health staff should enrol training sessions to make sure they become aware of existing discrepancies, and become more prepared to deal with them. A proper and effective communication may result in a better use of healthcare resources, helping to improve patients' quality of life and, consequently, contributing to reduce health care costs.

During the last years, several tools have been developed to assess not only health literacy levels, but also digital literacy levels and healthcare system gaps. Despite this, the big majority of them tend to focus in just small aspects of the overall problem. Additionally, some of them, are too complicated even for individuals with high literacy levels. There is still a need for a more comprehensive, easy to use, tool.

There is also a need to improve digital literacy. Without a basic level of such literacy, individuals will not be able to keep up with digital progress and, consequently, will not have the ability to deal with digital health systems. With this in mind, the first step should be the development of a new digital tool, with different type of assessments, in order to be able to monitor the needs and gaps of all parties (health professionals, individuals, health care systems, governmental entities, etc). For instance, before the assessment, it would also be important to find a way to evaluate individuals' education level and their contact with the digital. This type of questions could be asked, for example, by selecting the proper option regarding their level of education, type of job (if applicable) and the level of contact with digital technologies, such as regular use of a computer, access to internet, use of smartphones, etc. This would help to

establish a correlation between individuals' level of knowledge and the results obtained from the main survey, leading to the implementation of better solutions.

The main tool would consider a combination of different assessments. Firstly, it would be important to find a way to assess not only individual's levels of digital literacy, but also their health literacy levels. With this in mind, some questions from the survey should be more digitally related and, in contrast, other items should highlight the difficulties or strong points of individuals regarding health content, medical jargons and pharmacy topics, commonly used in health care systems. In addition, a part of this assessment tool should also have questions related to patients experience in health care systems. This would certainly help to better understand which areas should be improved, in order to provide a better service and improve patients' knowledge and understanding of health, taking into account the skills and the literacy level of each individual. Additionally, it would also be advantageous to include some specific questions to assess population's literacy level in some specific health areas that are known for being controversial, such as vaccination.

The implementation of such vast tool would be challenging, requiring, for instance, a task force where entities from different health areas could contribute with the best of their knowledge to the overall result. Such a tool, should be developed in line with the goals of the Digital Decade from the European Commission and should also be available in all European countries' languages.

From the results of this assessment tool, an educational perspective should also be considered. For instance, according to the weaknesses highlighted during the survey, individuals might be directed to tailored training, so as to boost their knowledge in specific areas.

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9 Appendix

9.1 Appendix I: Examples of Test questions screenshots of DigSAT

I know how to use online learning tools to improve my digital skills (e.g. video tutorial, online courses).

- ○ I don't know how to do it
- ○ I can do it with help
- ○ I can do it on my own
- ○ I can do it with confidence and, if needed, I can support/guide others

Today, Google Chrome is the most frequently used browser. Select which of the following statements is correct.
Choose one answer only

- ○ It has an incognito browsing mode which makes it possible to browse the dark Web where illegal material is available, among other things.
- ◉ It can be expanded with a large number of additional applications. These can be downloaded from the Chrome Web Store and directly installed on the browser.
- ○ It is available free of charge only for specific operating systems (Windows and Android).
- ○ Until a few years ago, it was the default browser in Microsoft Windows and, therefore, one of the more frequently used and more popular browsers.

To what do the terms HD, Full HD or 4K refer?
Choose one answer only

- ○ To the central processing unit.
- ○ To the hard drive capacity.
- ○ To the type of memory supported by the motherboard.
- ○ To the screen resolution.

What is point-to-point communication?
Choose one answer only

- ○ An encrypted communication between the sender and the receiver.
- ○ A term to designate a communication which has been intercepted by third parties.
- ○ An insecure communication.
- ○ A communication which can be accessed only by the sender and the receiver, without an intermediate party being able to intercept, damage or change the messages.

Is it possible to separate a compressed file into different parts without unzipping it first?
Choose one answer only

- ○ No, this would affect the structural integrity of the files it contains.
- ○ Not usually: only with the 'Split' option of the 7z tool.
- ○ No, it needs to be unzipped to divide them into various parts and then these must be compressed again.
- ○ Yes, it can be divided into various parts without its functioning being affected.

The benefits of using infographics are:
Choose one answer only

- ○ They incorporate a lot of text, because this is the most popular type of content.
- ○ Graphics are used to explain processes, make comparisons, establish timelines, explain product components, instructions, etc.
- ○ They are easy to use, because this type of content is license-free and can be used without limitations.
- ○ Preferred by groups with visual impairments.

When using the computer, which of the following health recommendations are correct?
Choose one or more answers

- [ ] Increase font size to make the letters big enough.
- [ ] Work at night or in a dimly lit room so that you can see the screen properly.
- [ ] Work for an hour and a half, and then rest for another half hour.
- [ ] Use the on-screen keyboard instead of a physical keyboard.
- [ ] Keep your back supported against the backrest of the chair, especially the lumbar zone.

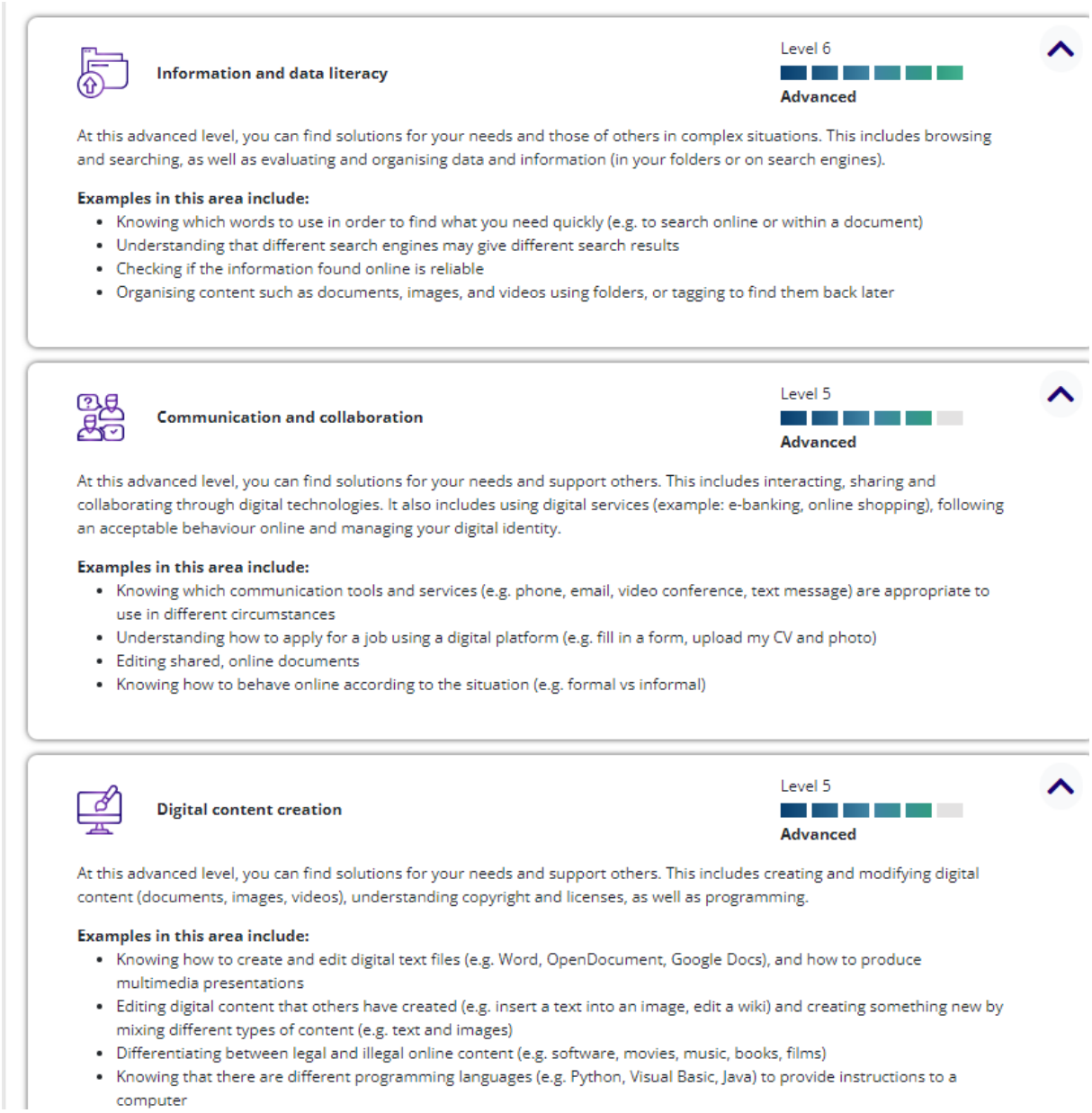
An RSS reader or aggregator makes it possible to manage and read all our subscriptions to web pages or blogs on a single site.

- ○ True
- ○ False

The PIN of the SIM card blocks access to the device.

- ○ True
- ◉ False

9.2 Appendix II: Examples of DigSAT results screenshots



Information and data literacy

Level 6

Advanced

At this advanced level, you can find solutions for your needs and those of others in complex situations. This includes browsing and searching, as well as evaluating and organising data and information (in your folders or on search engines).

Examples in this area include:

- Knowing which words to use in order to find what you need quickly (e.g. to search online or within a document)
- Understanding that different search engines may give different search results
- Checking if the information found online is reliable
- Organising content such as documents, images, and videos using folders, or tagging to find them back later

Communication and collaboration

Level 5

Advanced

At this advanced level, you can find solutions for your needs and support others. This includes interacting, sharing and collaborating through digital technologies. It also includes using digital services (example: e-banking, online shopping), following an acceptable behaviour online and managing your digital identity.

Examples in this area include:

- Knowing which communication tools and services (e.g. phone, email, video conference, text message) are appropriate to use in different circumstances
- Understanding how to apply for a job using a digital platform (e.g. fill in a form, upload my CV and photo)
- Editing shared, online documents
- Knowing how to behave online according to the situation (e.g. formal vs informal)

Digital content creation

Level 5

Advanced

At this advanced level, you can find solutions for your needs and support others. This includes creating and modifying digital content (documents, images, videos), understanding copyright and licenses, as well as programming.

Examples in this area include:

- Knowing how to create and edit digital text files (e.g. Word, OpenDocument, Google Docs), and how to produce multimedia presentations
- Editing digital content that others have created (e.g. insert a text into an image, edit a wiki) and creating something new by mixing different types of content (e.g. text and images)
- Differentiating between legal and illegal online content (e.g. software, movies, music, books, films)
- Knowing that there are different programming languages (e.g. Python, Visual Basic, Java) to provide instructions to a computer

Safety

Level 4

Intermediate

At this intermediate level, you can deal independently with both straightforward and unpredictable situations. This includes protecting your devices (example: mobile phone, laptop), personal data, health and environment while using digital services.

Examples in this area include:

- Identifying suspicious e-mail messages that try to obtain your personal data
- Refusing access to your geographical location
- Configuring settings of a firewall on different devices
- Reducing energy consumption of your devices (e.g. change settings, close apps, turn off Wi-Fi)

Problem solving

Level 5

Advanced

At this advanced level, you can find solutions for your needs and support others. This includes solving technical problems, identifying technological solutions and using technologies creatively. It also includes understanding your digital skills needs.

Examples in this area include:

- When facing a technical problem, you are able to find solutions on the Internet
- Selecting the right tool, device or service to perform a given task (e.g. select a smartphone for your needs, choose a tool for a professional video call)
- Knowing that digital technology can be used as a powerful tool to produce creative outputs (e.g. creating videos, infographics, blogs)
- Using online learning tools to improve your digital skills (e.g. video tutorial, online courses)

9.3 Appendix III: Examples of HLVa-IT tool - Vaccine health literacy for adults in Italian language

HLVa-IT

"Have you ever read vaccine materials, such as leaflets or posters in doctor's or public health units offices, recommending vaccinations?"

□ NO □ YES

If yes, fill in the box below, marking with an X the boxes corresponding to your choice (choose only one answer for each question)

READING THE MATERIAL:	Never	Rarely	Sometimes	Often
1. Did you find that the material as a whole (texts and/or images) was difficult to read?	□	□	□	□
2. Did he find words you didn't know?	□	□	□	□
3. Did you find that the texts were difficult to understand?	□	□	□	□
4. Did you need much time to understand them?	□	□	□	□
5. Did you or would you need someone to help you understand them?	□	□	□	□

"Have you ever thought or been advised to vaccinate yourself against one or more diseases?"

□ NO □ YES

If yes, fill in the box below, marking with an X the boxes corresponding to your choice (choose only one answer for each question)

WHEN SEARCHING INFORMATION:	Never	Rarely	Sometimes	Often
6. Have you consulted more than one source of information?	□	□	□	□
7. Did you find the information you were looking for?	□	□	□	□
8. Did you understand the information found?	□	□	□	□
9. Have you had the opportunity to use the information?	□	□	□	□
10. Did you discuss what you understood about vaccinations with your doctor or other people?	□	□	□	□
11. Did you consider whether the information collected was about your condition?	□	□	□	□
12. Have you considered the credibility of the sources?	□	□	□	□
13. Did you check whether the information was correct?	□	□	□	□
14. Did you find any useful information to make a decision on whether or not to get vaccinated?	□	□	□	□

9.4 Appendix IV: Examples of Test questions of questions from the Health Literacy Universal Precautions Toolkit, 2nd Edition from AHRQ:

Instructions:

Please answer the questions below about the care provided by this practice. Your answers will help us learn how well people in your provider's practice explain things to you and make it easy for you to take care of your health.

First, we would like to know how well the providers and other staff in this practice explain things to you and how well they listen to you.

1. In the last 6 months, how often did people in this practice explain things in a way that was easy to understand?

☐Never
☐Sometimes
☐Usually
☐Always

2. In the last 6 months, how often did people in this practice use medical words that you did not understand?

☐Never
☐Sometimes
☐Usually
☐Always

15. In the last 6 months, did anyone in this practice explain the purpose for taking each medicine?

☐Yes
☐No → **go to question 17**

16. How often was the explanation easy to understand?

☐Never
☐Sometimes
☐Usually
☐Always

17. In the last 6 months, did anyone in this practice explain how much to take of each medicine and when to take it?

☐Yes
☐No → **go to question 19**

35. In the last 6 months, were you referred to another doctor, lab, or other facility?

☐Yes

☐No → **go to question 37**

36. In the last 6 months, were you asked if you would like help making an appointment with the other doctor, lab, or other facility?

☐Yes

☐No