Gheorghe I.R., Popa-Velea O., Diaconescu L.V., Mihăilescu A.I., Ioachim M.F., Dodaj A., Jeleč M., Balčytienė M., Barsevičienė S., Zdrojewska A., Heinze-Jakubowska M., Suchocka M., Petsa K., Theodorou C., Mettouris C., Velkova-Monova A., Vodenicharova A., Kundurzhiev T., Lyubomirova K., Petrova-Geretto E., Yanakieva A.

Electronic Health Literacy Handbook

Bucharest, 2025

Gheorghe I.R., Popa-Velea O., Diaconescu L.V., Mihăilescu A.I., Ioachim M.F., Dodaj A., Jeleč M., Balčytienė M., Barsevičienė S., Zdrojewska A., Heinze-Jakubowska M., Suchocka M., Petsa K., Theodorou C., Mettouris C., Velkova-Monova A., Vodenicharova A., Kundurzhiev T., Lyubomirova K., Petrova-Geretto E., Yanakieva A.

Electronic Health Literacy Handbook

ISBN: 978-973-0-43331-9

Bucharest, 2025

Co-funded by the European Union

HELPED-iT

KA2: Cooperation for innovation and the exchange of good practices
KA220-HED: Cooperation Partnerships in Higher Education
Project number: 2024-1-RO01-KA220-HED-000254430
Start: 01.11.2024 End: 30.04.2027

Erasmus+ Project:
Electronic Health Literacy Perspectives, Education and Digital Tools

Consortium:

- "Carol Davila" University of Medicine and Pharmacy, Romania
- Sveučilište u Zadru, Croatia
- Klaipedos Valstybine Kolegija, Lithuania
- Akademia Humaistyczno- Ekonomiczna w Lodzi, Poland
- University of Cyprus, Cyprus
- Medical University-Sofia, Bulgaria

More information at:
www.ehelpedit-project.eu

Authors

"Carol Davila" University of Medicine and Pharmacy, Romania

Iuliana-Raluca Gheorghe, Senior Lecturer
Discipline of Health Care Marketing and Medical Technology

Ovidiu Popa-Velea, Prof.
Head of the Medical Psychology Discipline

Liliana Veronica Diaconescu, Senior Lecturer
Discipline of Medical Psychology

Alexandra Ioana Mihăilescu, Senior Lecturer
Discipline of Medical Psychology

Marinela Filofteia Ioachim, Assist. Prof.
Discipline of Health Care Marketing and Medical Technology

Sveučilište u Zadru, Croatia

Arta Dodaj, Assoc. Prof.
Department of Psychology

Marijana Jeleč, Assoc. Prof.
Head of the Department of German Studies

Klaipedos Valstybine Kolegija, Lithuania

Monika Balčytienė, Researcher
Head of the Oral Care Department

Šarūnė Barsevičienė, Researcher
Lecturer in the Oral Care Department

Akademia Humaistyczno- Ekonomiczna w Lodzi, Poland

Aleksandra Zdrojewska, Lecturer
Faculty of Nursing

Magdalena Heinze-Jakubowska, Lecturer
Faculty of Nursing

Magdalena Suchocka
Project Manager at International Project Department

University of Cyprus, Cyprus

Katerina Petsa, Researcher

Charalampos Theodorou, Researcher

Christos Mettouris, Researcher

Medical University-Sofia, Bulgaria

Angelika Velkova-Monova, Prof.
Vice-Rector for Academic Affairs

Alexandrina Vodenicharova, Prof.
Dean of the Faculty of Public Health

Todor Kundurzhiev, Prof.
Vice-Dean on Education, Faculty of Public Health

Karolina Lyubomirova, Prof.
Head of Occupational Medicine Department, Faculty of Public Health

Elisaveta Petrova-Geretto, Assoc. Prof.
Department of Bioethics, Faculty of Public Health

Antoniya Yanakieva, Prof.
Head of Health Technology Assessment Department, Faculty of Public Health

Abbreviations

AI - Artificial Intelligence
CDC - Center for Disease Control and Prevention
CRAAP - Currency, Relevance, Authority, Accuracy and Purpose
DHLAT- Digital Health Literacy Assessment Tool
DHLI - Digital Health Literacy Instrument
eHL- Electronic Health Literacy
eHEALS - eHealth Literacy Scale
eHLA - eHealth Literacy Assessment toolkit
eHLF - eHealth Literacy Framework
eHLQ -eHealth Literacy Questionnaire
eHLS - Electronic Health Literacy Scale
EHR - Electronic Health Records
ICT- Information and Communication Technology
TEHLI- Transactional eHealth Literacy Instrument
VR - Virtual Reality
WHO - World Health Organization

Table of Contents

Introduction

In today's rapidly evolving healthcare landscape, digital technology plays a critical role in patient care, medical research, and public health initiatives. From electronic health records (EHRs) and telemedicine to mobile health applications (mHealth) and artificial intelligence (AI) in diagnostics, technology is reshaping the way healthcare professionals interact with patients and manage medical information. However, along with these advancements comes the growing challenge of health misinformation and disinformation, making it essential for healthcare providers to guide patients toward credible, and evidence-based sources.

The eHL Handbook was created, as part of an Erasmus+ Cooperation partnership project, entitled *Electronic Health Literacy Perspectives, Education and Digital Tools*-**eHELPED-iT** (Project No. 2024-1-RO-01-KA220-HED-000254430).

The eHL Handbook aims to raise awareness about the importance of Electronic Health Literacy (eHL) among medical and allied health students, as well as among other interested stakeholders.

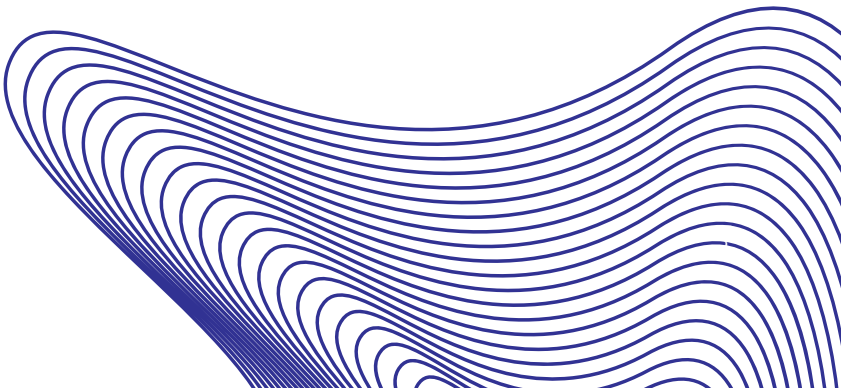
The eHL Handbook offers a comprehensive and up-to-date resource, structured around an integrated eHL framework, to outline essential knowledge and practical strategies for enhancing eHL at the individual, organizational (university), and societal (community) levels.

Other results of the **eHELPED-iT** project are:

- *An eHL Web Platform* for medical and allied-health students, which will offer the opportunity of getting suitable knowledge about self-interventions for improving their eHL levels, and self-assessing the eHL levels, correlated with individual-specific characteristics- imposter syndrome and self-efficacy as well as context-specific- characteristics of the source credibility;
- *An eHL Curriculum* for medical and allied health students and for faculty and teaching staff in universities, which will include practical strategies for increasing the knowledge of eHL and enhancing eHL skills;
- *An eHL Policy Toolkit* which will consist of a set of recommendations for decision-makers in universities and policy makers.

With the increasing reliance on digital resources in healthcare, strong eHL skills will allow you to:

- Identify and use reliable health information sources, such as peer-reviewed journals and official medical websites, while recognizing and avoiding misinformation and disinformation;
- Promote preventive care, encouraging individuals to participate in screenings, and lifestyle improvements;
- Encourage evidence-based health behaviours, ensuring individuals have the knowledge and confidence to make informed decisions about their well-being.



Chapter 1. Understanding Electronic Health Literacy (eHL)

1. Background

The world has entered in what is called the digital age for many years. People are familiarized to use digital devices (phone, computer) for different purposes: to send and receive emails and photos, search for information, watch videos or a movies, to write on their blog, to produce a podcast, to play online games. For students, digital tools in academic settings mean to search and find information from multiple sources, write essays, create PowerPoint presentations, take part in distance learning, online courses and training, and much more. Since school, ICT skills (information and communication technology) are taught. Even more than that, nowadays, we are talking about the digital generation (of which you are also a part, GEN Z, the Digital nomads) with reference to people who grew up being connected to the world around through smartphones, computers, tablets. All these are included in digital literacy, which means the ability to use, access, evaluate and communicate through digital platforms.

As the internet and digital technologies continue to grow in importance, particularly in the context of healthcare delivery and patient empowerment, eHL has emerged as a vital skill for both patients and healthcare providers.

With advances in information and communications technology, the concept of e-health literacy has evolved to encompass various social, cultural and situational factors, interactions with technology and its potential impact on individual health throughout life. These have also been reflected in the development of definitions regarding eHL (at least 13 definitions [1]). Following technological advances regarding how health information is transmitted, a new term, *Digital health literacy*, was introduced. However, both terms refer to individuals' usage of health information provided electronically or digitally.

2. What is eHL?

Electronic Health Literacy was first defined by Norman & Skinner (2006), and was described ***as "a skill to access, understand and use health information from electronic sources"*** [2].

e-Health Literacy [3]:

- includes attributes such as active information seeking, two-way interactive communication and information utilization and sharing;
- has as antecedents: characteristics related to personal factors, health status, attitudes towards the Internet, socioeconomic and cultural factors;
- enhances healthcare interest, promotes health behavior and induces active decision-making, which ultimately improves quality of life.

Here are some **examples**, when eHL is used:

- making an online medical appointment;
- accessing/ using health records;
- providing/ receiving results of medical online analysis;
- instructions on how to prepare for a test or surgery;
- health-related internet, media and TV programs;
- health care apps (using mobile phone apps to monitor chronic conditions, as tracking blood sugar levels);
- smartwatch, useful for both healthy persons and people with a medical condition: counts your steps, monitors your sleep, temperature, heart rate, ECG analysis, it can even remind us to take our pills.

Moreover, eHL is not a static skill; it evolves as technology and health information systems continue to advance. Therefore, the development of eHL must be viewed as an ongoing process, with individuals needing continuous education and support to stay updated with new digital tools and practices [4].

3. What are the eHL skills?

eHL skills are becoming increasingly essential for both personal, academic life, and future professional career.

According to WHO, there are many differences in terms of eHL skills of the population in European countries.

In 2023, 55% of individuals in the EU aged 16 to 74 possessed at least basic digital skills. However, there were notable variations across the EU, with digital skill rates ranging from 83% in the Netherlands to just 28% in Romania.

The disparity in basic digital skills between those with higher education (80%) and those with little to no formal education (34%) was 46 percentage points (pp) on average. The widest gaps were observed in Portugal (66 pp), Greece (63 pp), and Malta (59 pp), while the smallest gaps were seen in Estonia (12 pp), Finland (14 pp), and Lithuania (22 pp) [5].

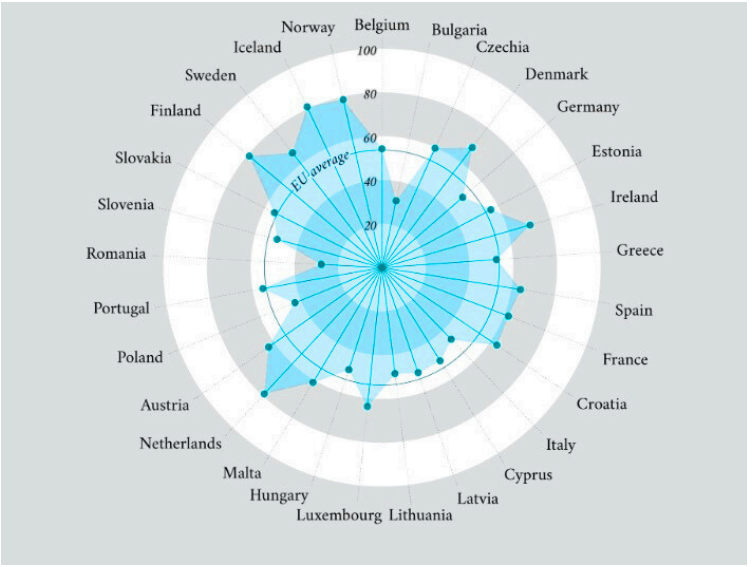


Fig. 1. The digital skills of the EU countries in 2021
Source: https://data.europa.eu/sites/default/files/img/media/12.digital-skills3-01.png

For healthcare and allied health fields, eHL is described as a twofold construct, taking into consideration the main groups involved: the beneficiary (patient/client/customer) and healthcare providers (health care professionals) [6].

For **patients (consumers)**, eHL implies:

- the ability to use Information and Communication Technology (ICT) and digital resources to access, collect, understand and process available health information;
- to develop functional, relational, and critical thinking skills to retrieve and use relevant health information;
- to interact effectively with healthcare providers in the digital environment;

- to collaborate with healthcare professionals by sharing personal health-related data;
- to actively participate in establishing the treatment plan;
- to actively engage with following an agreed treatment plan.

For **healthcare and allied healthcare providers**, eHL implies:

- providing patient-centered healthcare services through digital services;
- using mostly four different main types of technology: mobile-based, web-based, telehealth, and electronic medical records;
- ensuring trustworthy health information useful for health promotion, risk prevention, treatment plans in the digital environment;
- promoting digital health education for patients;
- developing and providing user-friendly resources (easy to understand and adapted for diverse audiences);
- collaborating with technology developers to create intuitive and accessible apps, websites, platforms;
- providing trustworthy and evidence-based information.

Reflection Questions

- What does eHL mean to you?
- What does eHL mean to your family members?

eHL skills for medical and allied health students are:

Information Evaluation and Critical Appraisal [7]

Students must effectively evaluate digital information for:

- accuracy;
- credibility;
- quality.

Given the vast availability of online health content, students need to differentiate between reputable sources and misinformation or disinformation, reducing risks associated with clinical errors or communication misunderstandings. This competency involves critically appraising digital sources, recognizing evidence-based guidelines, and identifying potential biases or conflicts of interest in information presented online.

High-quality healthcare depends on professionals accurately interpreting and applying credible information.

Reflection Questions

- Do you read just what you understand?
- Do you understand what you read?

Data Management and Privacy Awareness [8]

Students across health and allied health professions require skills in responsibly collecting, managing, and safeguarding sensitive patient data. They must be aware of ethical guidelines, patient privacy regulations, and confidentiality standards, especially regarding electronic health records (EHRs) and digital communications. The ability to ensure patient privacy, handle sensitive data securely, and comply with regulatory standards (e.g., GDPR and EHDS-The European Health Data Space) is vital, directly influencing patient trust and care quality.

Effectively managing digital data involves collecting, organizing, interpreting, and securely storing patient data, which medical, nursing, and psychology students encounter regularly in clinical environments. Beyond technical proficiency, students should grasp ethical dimensions, such as confidentiality, truthfulness and informed consent in digital contexts.

Reflection Questions

- When is it ethical to consult a patient file while working on a dissertation thesis?
- What actions should one undertake when one discovers an error in patient's files?

Technology Adaptability and Digital Communication (Telehealth) [9]

Healthcare technologies, such as electronic medical records, decision-support systems, telehealth and mobile applications, are advancing rapidly. To effectively integrate these evolving digital tools, students should rapidly adapt to new circumstances, that is, they should develop their adaptability to rapid changes. Proficiency in digital communication enhances patient engagement, improves satisfaction, contributes to more accurate clinical assessments, active and informed adherence to treatment plans and better health outcomes.

The expansion of telehealth has underscored the importance of strong communication skills in digital settings. This includes the ability to convey information clearly, empathetically, and professionally through digital platforms, email, and via videoconference.

Critical Thinking and Clinical Decision-making in Digital Environments [10]

Students must synthesize and interpret complex data sets gathered from digital sources to make accurate clinical decisions.

The vast amount of digitally generated patient data necessitates strong critical thinking skills to prevent over-reliance on automated or algorithm-driven recommendations. Excessive dependence on AI-driven technologies can weaken students' critical thinking and independent decision-making abilities, leading to reduced effort in critically evaluating information sources and mechanical compliance.

Future healthcare and allied-health professionals must not only recognize the benefits of AI-generated insights but also understand their limitations, ensuring they can interpret and assess this information effectively. By adopting a conscious and informed approach to artificial intelligence, a professional can maintain their clinical judgment and advocate for the responsible use of technology in your academic and professional practice.

C Case study

You are a medical intern, seeing a patient, who shows up worried after reading medical information from a health chatbot. The chatbot provided symptoms suggestive of a rare and severe illness.

What do you do?

- You critically evaluate the AI-generated information using your eHL skills, but also clinical reasoning.
- You eliminate false information in order to reduce the patient's worry, while communicating your clinical reasoning.
- You comfort the patient, correct the false information, and suggest evidence-based treatment actions.

Ethical eHL skills

Ethical eHL includes understanding ethical, legal and professional standards, including issues related to social media use, patient confidentiality, digital consent, and telemedicine.

Students must navigate ethical issues such as digital consent, patient autonomy, the use of artificial intelligence, and potential biases within technology-enhanced care.

Participating in workshops may highlight ethical standards explicitly and utilize scenarios that help students to reflect critically on moral dimensions of digital healthcare decisions, reinforcing both ethical sensitivity and professional integrity.

Patient (consumer) Education and Digital Empowerment

Using digital technologies to properly educate patients (clients/consumers) can empower them, increase their involvement, and help them to comply to treatments. Students should be able to select and suggest user-friendly digital tools, such as applications and instructional platforms, and guide patients ethically across these technologies [11].

Developing eHL is especially important for students, since they are able to guide patients in accessing trustworthy health information, so enabling more informed health decisions and improved adherence to treatment plans [12].

Case study

Imagine you are consulting a patient recently diagnosed with diabetes, who feels overwhelmed managing their condition. You remember learning about digital patient education, so you carefully select a trusted, easy-to-use mobile app designed to help patients track blood glucose. You take time to show the patient how to use the app, explaining each step, and encouraging them to ask questions.

One week later, the patient calls you via the telehealth system, saying the app improved their treatment understanding. Using a suitable digital tool, you have empowered them to take charge of their own health.

4. eHL frameworks and models

Several theoretical models and frameworks help in explaining eHL, its components, and its impact on health behaviours. Among the most recognized are Norman and Skinner's eHL Model and the Digital Health Literacy Instrument (DHLI) Model [2, 13]. Each of these frameworks provides a unique perspective on how eHL influences individuals' ability to navigate digital health environments and how it affects overall health outcomes.

The Lily Model

Norman and Skinner's Lily Model of eHealth Literacy defines eHL as a multidimensional concept that integrates six core literacies: traditional literacy, health literacy, information literacy, scientific literacy, media literacy, and computer literacy [2].

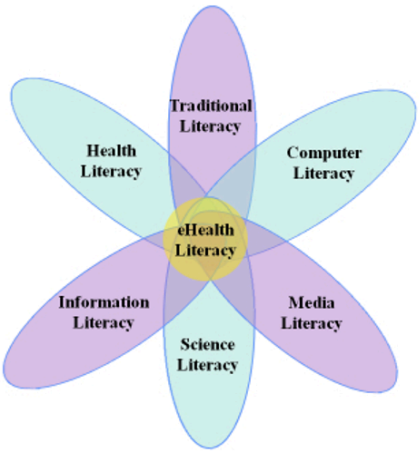


Fig. 2. eHealth literacy Lily Model
Source: [14]

- *Traditional Literacy*- Traditional literacy refers to basic reading and writing skills, which are fundamental to understanding any form of written health information. In the context of eHL, individuals need the ability to comprehend digital health materials such as medical articles, prescription instructions, and patient education resources.
- *Health Literacy*- Health literacy is the ability to obtain, process, and understand basic health information to make appropriate health decisions. In a digital context, this includes interpreting medical test results, understanding healthcare policies, and navigating health insurance systems. Enhancing health literacy allows individuals to take greater control over their well-being and communicate more effectively with healthcare providers.
- *Information Literacy*- Information literacy involves the ability to locate, evaluate, and use information effectively. With the vast amount of health-related content available online, individuals must discern credible sources from misleading or false information. This skill is particularly crucial in an era of widespread health misinformation, where unverified online claims can lead to dangerous self-diagnosis and inappropriate treatment choices.

- *Scientific Literacy*- Scientific literacy refers to the understanding of basic scientific concepts, methodologies, and principles. In healthcare, this includes interpreting clinical studies, recognizing the validity of medical research, and understanding the limitations of scientific findings.
- *Media Literacy*- Media literacy is the ability to analyse and critically evaluate messages presented in various media formats, including social media, television, and online news articles. Given the prevalence of health-related content in mass-media, individuals must develop the ability to identify bias, recognize sensationalized health claims, and avoid falling for misleading advertisements. For example, social media influencers and alternative health practitioners often promote unproven treatments, which can influence public perception of medicine.
- *Computer Literacy*- Computer literacy refers to the ability to use digital technologies, including computers, mobile devices, and healthcare applications, and specific for clinical activity: telemedicine, electronic health records (EHRs), and digital health monitoring tools.

Practical Activity

Self-Assessment Grid

Adapted from the Lily Model for medical and allied health students

- Rate yourself from 1 (Needs Improvement) to 5 (Expert) for each skill.
- Identify weaker areas and follow the suggested action steps.
- Track progress and seek opportunities for hands-on eHL experiences.

Lily Model Component	Self-Assessment Questions	Rating (1-5) (1 = Needs Improvement, 5 = Excellent)	Action Plan for Improvement	Progress Tracking
Traditional Literacy	Can I read and comprehend patient records, research articles, and prescription instructions?		Read medical textbooks, journal articles, and patient education materials regularly.	Read 3 articles/week, summarize key takeaways.

			Use medical dictionaries (e.g., MedlinePlus) to improve understanding of terminology.	Review & practice medical terminology weekly.
Health Literacy	Can I interpret lab results, and understand conditions of patients?		Practice explaining medical concepts in simple terms to peers. Take a health literacy workshop or online course (e.g., WHO, Coursera).	Enroll in a health literacy course. Practice patient-friendly explanations in clinical settings with your colleagues or peers.
Information Literacy	Can I understand health policies or different disease-related content?		Use peer-reviewed sources like PubMed. Apply the CRAAP test (Currency, Relevance, Authority, Accuracy, Purpose) to evaluate sources.	Regularly use academic sources for research. Share & discuss a credible vs. non-credible source with peers.
Scientific Literacy	Can I interpret research findings, clinical trials, and statistical data?		Enroll in an evidence-based medicine (EBM) course. Read systematic reviews and meta-analyses.	Summarize 1 research paper per month. Synthesize one systematic review paper by taking notes.
Media Literacy	Can I critically evaluate health information from Social Media, news, and advertisements?		Follow reputable medical organizations (e.g., WHO, CDC) on Social Media.	Fact-check health news articles weekly.

			Cross-check viral health claims before sharing or using them.	Discuss misleading health claims with professors, colleagues or peers.
Computer Literacy	Am I confident in using health apps or telemedicine?		Gain hands-on experience with EHR systems during clinical rotations. Explore medical apps (e.g., Epocrates, Medscape, MyChart).	Read 3 articles/week, and summarize key takeaways. Review & practice medical terminology weekly.

Reflection Questions

- Which component of eHealth literacy do you feel most confident in, and why?
- What challenges do you face when using digital health tools or interpreting online medical information?
- How do you currently verify the credibility of health information you find online?
- In what ways can you improve your ability to explain medical information to peers with low eHL?
- How can you integrate digital health resources (e.g., apps, online platforms) into your future academic or professional activities?
- What strategies can you use to educate peers about distinguishing between credible and misleading health information?
- How has your understanding of eHL changed over time, and what steps will you take to continue developing these skills?

The Digital Health Literacy Model

The Digital Health Literacy Instrument (DHLI) model expands on Norman and Skinner's work by emphasizing interactive and critical digital health literacy skills [13]. It assesses skills across multiple dimensions, including:

- *Navigating digital health information (searching for, finding, and using health information online);*
- *Evaluating digital health content (assessing the credibility and relevance of online health sources);*
- *Protecting personal health data (understanding privacy concerns and cybersecurity risks);*
- *Engaging in digital health services (using telemedicine, patient platforms, and mobile health applications).*

The DHLI framework is particularly relevant in today's digital healthcare landscape, where the ability to assess and apply online health information is crucial for health empowerment and self-management.

The structural model of eHL

Technological advancements, the evolution of the concept of eHL, the identification of a wide range of factors that contribute to eHL have led to the highlighting of aspects that show the complex structure of the eHL construct (Fig. 3).

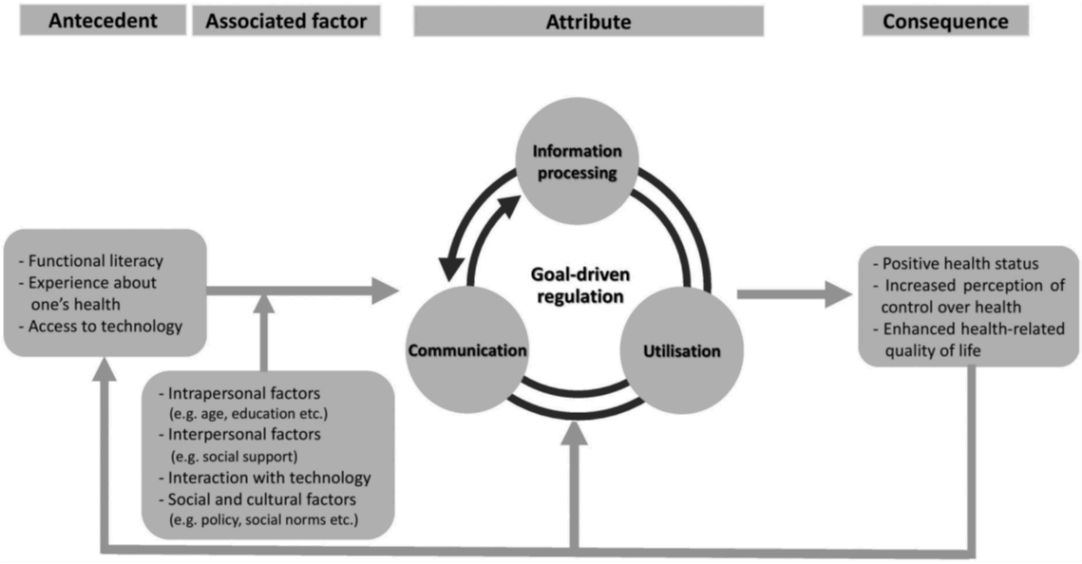


Fig. 3. The Structural Model of eHL
Source: [1]

According to the Structural Model, eHL has [1]:

- *Attributes*: goal-based regulation, information processing, communication, and use.

- *Goal-based regulation* implies the ability to set health-related goals along health-related interests and initiatives and to monitor progress toward health-related goals
- *Information processing* involves the ability:
  - to structure information in a manageable manner by searching for and navigating through information, followed by evaluating the quality of the information in terms of its accuracy and relevance;
  - to understand and interpret if the information makes sense (by comparing the information and integrating similar experiences);
- *Communication* - includes the ability of the sender and receiver (including non-medical individuals, health professionals, and digitalized health systems) to reciprocal exchange of information (e.g. medical conditions, treatments, clarifications);
- *Utilisation* – the acquired information is used for informed decisions related to disease management and rehabilitation, for adopting preventive measures and healthy behaviours;

- *Antecedents* (functional literacy, experience about one's health, access to technology): the level of functional literacy to have health knowledge and information; previous experience that influences the concern for information seeking and motivation to address health issues; experience in accessing technology so that the person has the digital skills necessary for eHL
- *Associated factors* which may influence eHL (will be detailed in Chapter 2 and Chapter 3)
- *Consequences*: positive health outcomes, increased perception of control over health, and improved health-related quality of life. eHL enables increased knowledge, skills, and positive attitudes, whereby individuals can actively engage in activities related to their health and positive health outcomes. Greater involvement in solving their own health problems leads to a perception of a substantial control and autonomy.

In addition, **The Transactional Model of eHealth Literacy**, which outlines four competency levels, contributes to an individual's eHL level [15]:

- *Functional level*: the ability to successfully read and write about health using technological devices;
- Communicative level: the ability to control, adapt, and communicate about health with others in online social environments;

- *Critical level*: the ability to evaluate the relevance, trustworthiness, and risks of sharing and receiving health-related information through the digital ecosystem (e.g. the Internet);
- *Translational level*: the ability to apply health-related information from the digital ecosystem (e.g. the Internet) in different contexts.

Practical activity

Self-assessment grid for medical and allied health students based on the Transactional Model of eHL

- Rate yourself from 1 (Needs Improvement) to 5 (Expert) for each skill;
- Identify weaker areas and follow the suggested action steps;
- Track progress and seek opportunities for hands-on eHL experiences.

Competency Level	Self-Assesment Questions	Your Rating (1-5)	Action Steps for Improvement
Functional Level	Can I read and interpret digital health records, lab reports, and medical literature? Am I confident using electronic health records (EHRs), telemedicine platforms, and medical apps?		Improve medical terminology and eHL with online courses.
Communicative Level	Can I communicate effectively with my colleagues or physicians in digital environments (e.g., telehealth, email, online platforms)?		Participate in role-play exercises and telehealth communication workshops or trainings.

	Do I customize my digital communication for different audiences (e.g., simplifying for nonmedical peers, using technical terms with peers)?		
Critical Level	Can I evaluate the credibility of online health information and identify misinformation? Am I aware of biases, conflicts of interest, and risks in the digital health content?		Take courses on evidence-based medicine, and fact-checking techniques. Develop skills in critical appraisal of digital health resources.
Translational Level	Can I apply digital health knowledge to future clinical decision-making, and public health interventions? Can I guide patients and caregivers in using health apps, wearables, and digital health platforms to improve their health?		Engage in case studies, clinical simulations, and digital health application exercises. Learn to assess and recommend patient-friendly digital health tools.

5. eHL benefits

The eHL benefits **for individuals** are:

- Empowering Patients Through Digital Health Tools [16]

One of the most significant advantages of eHL is its capability to empower individuals to take control of their own health. People with high eHL levels can:

- Take proactive preventive measures rather than waiting for health issues to arise;
- Comprehend medical instructions related to medications, nutrition, and physical activity;
- Effectively use mobile health apps, wearable devices, and online platforms to monitor their health;
- Evaluate and apply digital health information to improve adherence to treatment plans.

- Strengthening Communication Between Patients (Consumers) and Healthcare Providers [16]

Effective communication between patients and healthcare professionals is critical for quality care. eHL improves this interaction by enabling patients (consumers) to:

- Engage with digital healthcare platforms, such as telemedicine services, electronic health records (EHRs), and secure messaging systems;
- Access and interpret personal health data, allowing for more informed discussions with physicians;
- Understand medical terminology and digital health reports, leading to stress-free and better treatment adherence;
- Participate in shared decision-making, expressing concerns, asking relevant questions, and collaborating with healthcare providers;
- Improve access to healthcare services, particularly through telemedicine, benefiting individuals in remote or underserved areas.

- Enhancing Public Health Responses [17]

eHL plays an essential role in improving public health efforts, especially during crises such as pandemics. Individuals with strong eHL skills can:

- Seek reliable health information from trusted sources like the World Health Organization (WHO) and national health agencies;

- Follow evidence-based recommendations, such as disease prevention measures;
- Encourage greater public participation in health initiatives, strengthening community health resilience.

- Managing Misinformation and Disinformation [18]

eHL helps individuals critically assess online health information, ensuring they can:

- Distinguish between credible sources and unreliable content, reducing the spread of misinformation and disinformation;
- Question misleading health claims and verify accuracy before acting on information;
- Engage with reliable digital health resources and online health communities;
- Share accurate health information within one's social circles, contributing to a well-informed and proactive society.

The key outcomes of eHL for medical and allied-health students are:

Category	*Outcome*
Personal Health Management	Improved self-care and disease management
Access to Healthcare	Better navigation of digital health resources
Health Decision-Making	Informed decision-making based on reliable and evidence-based information
Patient-Provider Communication	Enhanced interactions with healthcare professionals
Health Equity	Reduced disparities in health access
Preventive Care	Increased adoption of health promoting behaviour
Mental Well-Being	Better understanding of mental health resources
Trust & Awareness	Ability to identify misinformation and disinformation
Engagement with Technology	Increased use of digital health tools

Case study

Emma and David are both university students, but they come from different academic backgrounds.

- Emma (Health Student, High eHL):

Emma is a third-year nursing student who frequently uses evidence-based health websites, research journals, and medical apps to stay updated. She critically evaluates online health information before applying it to her diet, fitness, and mental well-being. She also educates her friends on fact-checking medical claims and avoiding health misinformation and disinformation.

- David (Business Student, Low eHL):

David, a Business Administration student, has limited exposure to health education. He primarily gets health information from Social Media, fitness influencers, and unverified blogs. As a result, he often falls for health myths, such as extreme dieting trends or misleading workout supplements. Unlike Emma, he struggles to assess the credibility of health information, leading to inconsistent lifestyle choices.

Key Observations:

1. Students in medical and allied-health disciplines tend to have stronger eHL skills, allowing them to find, assess, and apply credible health information more effectively.
2. Higher education and health-related coursework contribute to improved eHL, making students more inclined to seek and apply accurate digital health information.
3. Non-medical students may rely more on Social Media and unverified sources, increasing the risk of misinformation-driven health behaviors.
4. Higher education is not a guarantee for high HL.

Based on the findings of [19].

Case study

Sarah and Jake are both university students, but they differ in their approach to health management due to their varying levels of eHL.

- Sarah (High eHL, Proactive Approach):

Sarah, a Public Health student, actively uses trusted online resources, government health websites, and digital health tracking tools. She keeps up with vaccination schedules, books regular check-ups, and follows

evidence-based nutrition and fitness guidelines. When she experiences symptoms, she consults reputable medical sources before visiting a doctor and asks informed questions during consultations. She believes that preventive care reduces future health risks and takes an active role in managing her wellbeing.

- Jake (Low eHL, Reactive Approach):

Jake, an Engineering student, does not regularly engage with digital health tools or verified medical sources. He rarely schedules preventive health check-ups and typically seeks medical attention only when symptoms become severe. He often relies on Social Media and word-of-mouth health advice, sometimes following misinformation. As a result, he is less likely to monitor his health proactively, or ask questions during medical visits.

Key Observations:

1. Higher eHL is linked to proactive health behaviors, including early screenings, vaccinations, and lifestyle management.
2. Individuals with strong digital skills are more engaged in healthcare- they ask informed questions, take responsibility for their health, and actively participate in prevention, or treatment plans.
3. Low eHL can lead to delayed medical care, reliance on misinformation, falling into disinformation and a more passive approach to personal health management.

Based on the findings of [20].

Reflection Questions

- What strategies can help you as a future health professional to engage with low eHL patient (clients/ customers)? How can you promote critical thinking for low eHL of patients (consumers) when engaging with digital health information?
- How can healthcare professionals encourage patients to engage more actively in their health decisions?

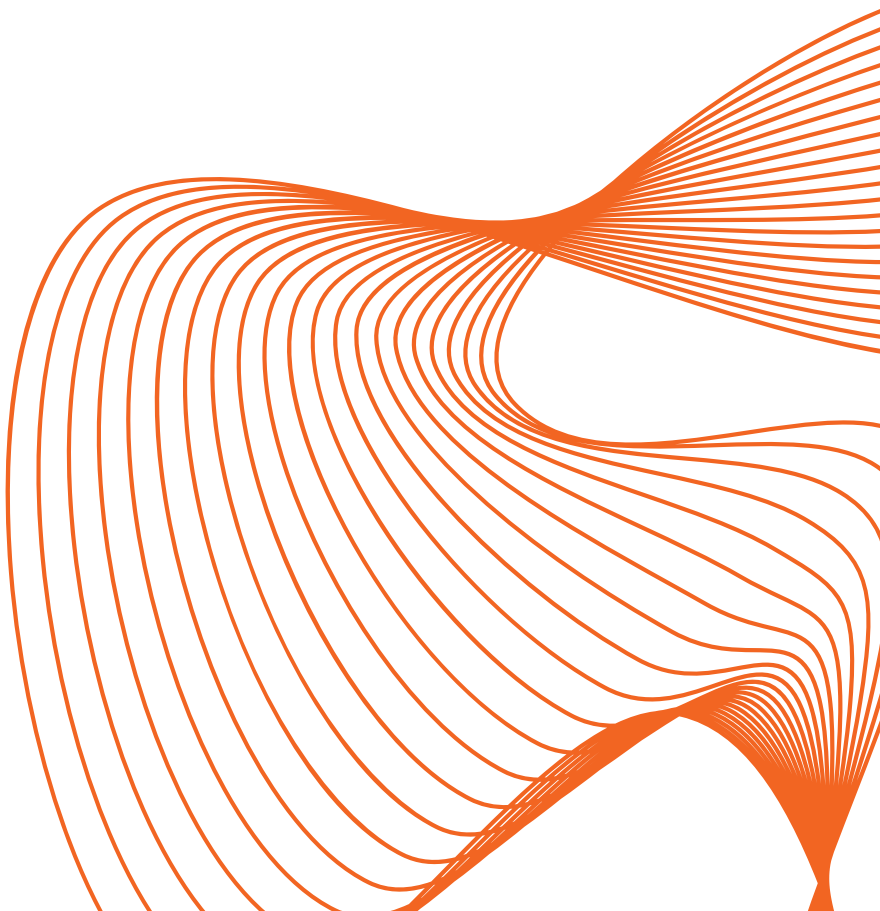
Key Takeaways

- eHL involves many skills – It's not just using the internet, but being able to read, understand, judge, and apply health info online.
- Being tech-savvy isn't enough – Even Gen Z students need to actively build health-specific digital skills.
- Use the Lily Model – This model helps you reflect on your reading, health, science, media, and tech literacy.
- Check out the DHLI model – It focuses on how you search, judge, and apply online health content.
- Practice self-assessment – Rating your own skills helps track where you need to improve.
- Protect your data – Learn to manage privacy, especially when using apps or digital platforms with health data.
- Why it matters – Good eHL means better health decisions, fewer mistakes, and more confidence in care.

References

1. Ban, S., Kim, Y., & Seomun, G. (2024). Digital health literacy: A concept analysis. Digital Health, 10, 1–10. https://doi.org/10.1177/20552076241287894
2. Norman, C. D., & Skinner, H. A. (2006). eHealth literacy: Essential skills for consumer health in a networked world. Journal of Medical Internet Research, 8(2), e9. https://doi.org/10.2196/jmir.8.2.e9
3. Jung, S. O., Son, Y. H., & Choi, E. (2022). E-health literacy in older adults: An evolutionary concept analysis. BMC Medical Informatics and Decision Making, 22(1), 28. https://doi.org/10.1186/s12911-022-01761-5
4. Kreps, G. L., & Neuhauser, L. (2010). New directions in eHealth communication: Opportunities and challenges. Patient Education and Counseling, 78(3), 329–336. https://doi.org/10.1016/j.pec.2010.01.013
5. Eurostat. (2024, February 22). Digital skills in 2023: Impact of education and age. Eurostat News Articles. https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20240222-1
6. Palumbo, R., Nicola, C., & Adinolfi, P. (2022). Addressing health literacy in the digital domain: Insights from a literature review. Kybernetes, 51(13), 82–97. https://doi.org/10.1108/K-07-2021-0547
7. van Kessel, R., Han Wong, B. L., Clemens, T., & Brand, H. (2022). Digital health literacy as a super determinant of health: More than simply the sum of its parts. Internet Interventions, 27, 100500. https://doi.org/10.1016/j.invent.2022.100500
8. Mensah, N. K., Adzakpah, G., Kissi, J., Taylor-Abdulai, H., Johnson, S. B., Agbeshie, P. A., Opoku, C., Abakah, J., Osei, E., Agyekum, A. Y., & Boadu, R. O. (2024). Health professionals' ethical, security, and patient safety concerns using digital health technologies: A mixed-method research study. Health Services Insights, 17, 11786329241303379. https://doi.org/10.1177/11786329241303379
9. Javaid, M., Haleem, A., & Singh, R. P. (2024). Health informatics to enhance the healthcare industry's culture: An extensive analysis of its features, contributions, applications and limitations. Informatics and Health, 1(2), 123–148. https://doi.org/10.1016/j.infoh.2024.05.001
10. Zhai, C., Wibowo, S., & Li, L. D. (2024). The effects of over-reliance on AI dialogue systems on students' cognitive abilities: A systematic review. Smart Learning Environments, 11(28). https://doi.org/10.1186/s40561-024-00316-7
11. Kuwabara, A., Su, S., & Krauss, J. (2019). Utilizing digital health technologies for patient education in lifestyle medicine. American Journal of Lifestyle Medicine, 14(2), 137–142. https://doi.org/10.1177/1559827619892547
12. Patil, U., Kostareva, U., Hadley, M., Manganello, J. A., Okan, O., Dadaczynski, K., Massey, P. M., Agner, J., & Sentell, T. (2021). Health literacy, digital health literacy, and COVID-19 pandemic attitudes and behaviors in U.S. college students: Implications for interventions. International Journal of Environmental Research and Public Health, 18(6), 3301. https://doi.org/10.3390/ijerph18063301
13. van der Vaart, R., & Drossaert, C. (2017). Development of the digital health literacy instrument: Measuring a broad spectrum of Health 1.0 and Health 2.0 skills. Journal of Medical Internet Research, 19(1), e27. https://doi.org/10.2196/jmir.6709
14. Tennant, B., Stellefson, M., Dodd, V., Chaney, B., Chaney, D., Paige, S., & Alber, J. (2015). eHealth literacy and Web 2.0 health information-seeking behaviors among baby boomers and older adults. Journal of Medical Internet Research, 17(3), e70. https://doi.org/10.2196/jmir.3992

15. Paige, S. R., Stellefson, M., Krieger, J. L., Anderson-Lewis, C., Cheong, J., & Stopka, C. (2018). Proposing a transactional model of eHealth literacy: Concept analysis. Journal of Medical Internet Research, 20(10), e10175. https://doi.org/10.2196/10175
16. Benny, M. E., Kabakian-Khasholian, T., El-Jardali, F., & Bardus, M. (2021). Application of the eHealth literacy model in digital health interventions: Scoping review. Journal of Medical Internet Research, 23(6), e23472. https://doi.org/10.2196/23473
17. Sakellari, E., Okan, O., Dadaczynski, K., et al. (2024). Digital health literacy and information-seeking on the internet in relation to COVID-19 among university students in Greece. Computer Methods and Programs in Biomedicine Update, 5(11), 1000139. https://doi.org/10.1016/j.cmpbup.2024.100139
18. Wang, C., Wu, X., & Qi, H. (2022). A comprehensive analysis of e-health literacy research focuses and trends. Healthcare, 10(66), 1–15. https://doi.org/10.3390/healthcare10010066
19. Tsukahara, S., Yamaguchi, S., Igarashi, F., Uruma, R., Ikuina, N., Iwakura, K., Koizumi, K., & Sato, Y. (2020). Association of eHealth literacy with lifestyle behaviors in university students: Questionnaire-based cross-sectional study. Journal of Medical Internet Research, 22(6). https://doi.org/10.2196/18155
20. Milanti, A., Chan, D. N. S., Parut, A. A., & So, W. K. W. (2023). Determinants and outcomes of eHealth literacy in healthy adults: A systematic review. PLOS ONE, 18(10), e0291229. https://doi.org/10.1371/journal.pone.0291229



Chapter 2. Potential influential factors of eHL

As medical and allied health professionals, it is essential to acknowledge the factors that impact the eHL of your patients (consumers) and peers, as well as the specific interventions to enhance eHL [1].

1.Sociodemographic and cultural factors

eHL is heavily influenced by various sociodemographic factors. Research indicates that sociodemographic variables such as age, education, gender, socioeconomic status, and geographic location play a pivotal role in shaping individuals' ability to effectively engage with digital health resources (Table 1) [2-4].

Determinant	**+/-**	**Impact**
Age	Negative (older age)	Younger individuals score higher
Gender	Mixed	Some studies show no difference, others favor males
Education Level	Positive	Higher education improves eHL
Income	Positive	Higher income linked to better eHL
Residence	Positive (urban)	Urban residents have higher eHL
Social Support	Positive	Strong networks enhance eHL
Internet Use	Positive	Frequent use improves eHL
Cultural Barriers	Negative	Hinders eHL, especially for older adults

Source: [1, 5]

➤ Age

Age is one of the key factors influencing eHL. Younger people, with greater interest in technology, typically achieve a higher level of digital skills than older individuals. As a result, their ability to use eHealth services and resources is generally greater [6].

Research indicates that older individuals often face difficulties with technology. They grew up in a time when digital technologies were not widely used, so they lack the necessary skills to navigate the internet, search for health information, or use eHealth services [7]. It is necessary to promote digital skills development among older adults so they can more actively engage in ehealth services [6].

There are several eHL definitions in older adults (Table 2) in various scientific fields, but they all emphasise the ability to use online obtained information to solve health problems.

Table 2. The evolution of definitions of eHealth literacy in older adults

Year	Definition	Field
2013	Ability to access information and use the information to support self-management of a health concern	Nutrition
2019	Ability to seek, understand, and evaluate health information desired on the Internet, and to apply online health information to health problems and solve them	Nursing
2019	The ability to find, understand, and appraise electronic information on the Internet by self-determining what information an individual needs	Nursing
2020	The ability to seek, find, understand, and appraise health information from electronic sources and apply the knowledge gained to address or solve a health problem	Gerontology
2020	The ability to seek, find, understand, and appraise health information on the Internet, as well as the ability to apply and transfer the knowledge gained to solve health problems	Nursing

Source: [8]

The attributes of eHL in older adults are: active information seeking, two-way interactive communication, and information utilization and sharing (Fig. 4).

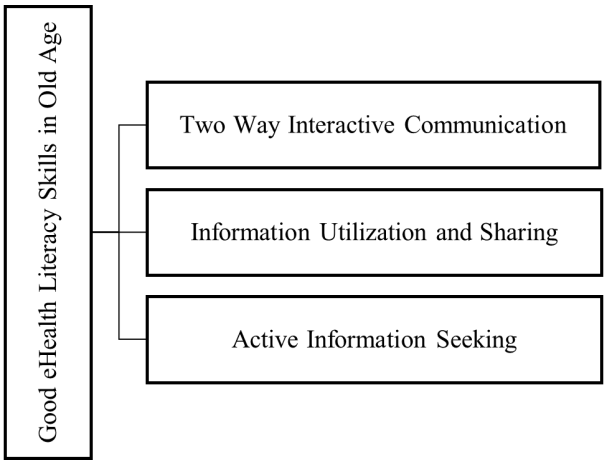


Fig. 4. eHL attributes in older adults
Source: adapted from [8]

Recommendations for Enhancing eHL Across Different Age Groups

- Youth (11-19 years):
  - Engagement and Empowerment: Actively involve in developing and disseminating eHealth resources to foster empowerment and independent involvement;
  - Educational Integration: Incorporate eHL into everyday activity, focusing on media health literacy and its relation to health literacy;
  - Stigma Reduction: Use eHealth strategies to enhance mental health literacy and reduce stigma associated with mental health issues.
- Early Adults (18-35 years):
  - Self-Esteem and Health Promotion: Develop or get involved in programs that enhance self-esteem and eHL, as these factors significantly influence health-promoting behaviors;
  - Targeted Interventions: Address specific needs and internet usage patterns to personalize eHL interventions;
- Middle-Aged Adults (40-64 years):
  - Digital Competence: Focus on improving digital skills, which is a significant predictor of eHL;
  - Chronic Disease Management: Integrate eHL into chronic disease management programs and specific information to enhance medication adherence and health outcomes.

- Older Adults (65+ years):
- Collaborative and Individual Learning: Both collaborative and individualistic learning methods can improve eHL, but individual learning may be more effective for those with little prior computer experience;
- Theory-Based Interventions: Utilize health behavior and learning theories to design effective eHL interventions;
- Continuous Training: Provide ongoing training and support to maintain eHL skills over time;
- Self-Efficacy and Self-Care: Enhance self-efficacy and self-care abilities as these mediate the relationship between eHL and health-promoting behaviors;
- Keep the interest.

Gender

Gender plays a significant role in eHL and technology use. Studies show that women are more likely to actively seek health information online, while men often rely on other sources, such as healthcare professionals [9].

Women's involvement in eHealth services tends to be higher because they actively seek health information and trust digital sources, while men are more inclined to rely on traditional methods, such as in-person consultations with healthcare professionals, resulting in lower engagement with eHealth services [10].

Some studies reveal significant gender differences in eHL, with females generally exhibiting higher functional [10] and critical eHL [11]. However, various other studies present high heterogeneity, with females presenting higher levels of eHL in some studies and lower levels in others [12]. Thus, gender does not appear to be a constant significant determinant factor of eHL.

Recommendations for Enhancing eHL Across Different Genders

- *Promoting Mental Health and Stress Management*
  - Engage in conducting webinars or interactive workshops focusing on stress management, mental health, and resilience using digital platforms;
  - Encourage using mental health apps for relaxation techniques, mindfulness practices, and de-stressing exercises;

- Engage in Social Media campaigns to reduce the stigma around seeking mental health support, emphasizing the benefits of using eHealth platforms.

- *Enhancing Health Information Evaluation and Critical Thinking*
  - Engage or develop online workshops that teach critical thinking and information evaluation skills- focusing on how to identify credible sources of health information and how to spot misleading or biased content online;
  - Think about where you can evaluate health claims, compare evidence-based practices, and make decisions based on trusted information;
  - Implement a "fact-checking challenge", that helps you in assessing health articles, identify potential biases, and rate trustworthiness based on evidence-based guidelines.

Education

Higher educational attainment is consistently associated with better eHL. For instance, students in higher education demonstrate good levels of eHL, which enables them to navigate and utilize online health information effectively [13]. It also shows significance among older adults - those with higher education levels report better eHL, which supports the development of interactive e-health interventions [14].

Education level is directly correlated with digital skills, meaning that higher education can increase an individual's ability to use digital technologies, including e-health services. Studies show that individuals with higher education are more likely to have better digital skills and trust online health information more [2]. This may be related to higher critical thinking skills and better knowledge of how to evaluate online information.

Recommendations for Enhancing eHL According to Different Education Levels

- *Low Education Levels:*
  - Simplified Content: Use simplified and easy-to-understand content to cater to individuals with lower education levels;
  - Training Programs: Engage in educational programs that focus on basic digital skills and eHL;

- Support Systems: Provide informational and instrumental support to help individuals navigate digital health resources.

- Higher Education Levels:
  - Engagement in Health Promotion: Encourage participation in health promotion activities and the use of digital health tools for self-management.

Socioeconomic status

Socioeconomic status seems to influence the level of eHL. As low socioeconomic status is associated with suboptimal use of health resources and health status, it is only expected that it is also reflected in the ability to acquire adequate health information from digital sources. Furthermore, access to the Internet and digital health tools may also be severely hindered by individuals' economic status, thus highlighting the importance of reinforcing digital health interventions among those who are the most underprivileged [1].

To reach people in low socioeconomic status, eHealth should fit into the person's daily life, ensure personal communication, be perceived as usable and useful, adapt its communication to literacy level and life situation, allow for meaningful self-monitoring and embody self-efficacy enhancing strategies. This will result in interventions that are more acceptable, satisfactory, and user-friendly [15].

Recommendations for Enhancing eHL According to the socioeconomic status

- *For Low Socioeconomic Status Groups*
  - Community-Based Programs: Contribute to community-based eHL interventions that provide broadband Internet access, training classes, and technical support to novice users;
  - Personal Contact and Support: Ensure personal contact between staff and participants and provide in-depth technical support to improve recruitment and retention;
  - Cultural Tailoring: Design eHealth tools that are culturally tailored and address language, accessibility, and literacy barriers.

Geographic location

Geographic location plays a crucial role in shaping eHL, with significant differences observed between urban and rural populations.

Studies have shown that individuals in urban areas typically have better access to advanced technology and faster, more reliable internet connections, which enables easier access to and use of ehealth services [16].

Rural residents often face greater challenges in eHL due to less exposure to online healthcare platforms and fewer opportunities to develop digital skills. This limited exposure can result in mistrust and reluctance to use ehealth services, further worsening health disparities in rural areas [17].

Recommendations for Enhancing eHL According to geographical location

Urban Areas

Programs should focus on improving specific dimensions of eHL, such as application, evaluation, and decision-making skills, which are crucial for medication adherence and overall health management.

Rural Areas

Rural residents face significant barriers to eHealth technology use, including product complexity, reliability issues, lack of trust, and cost. Interventions should prioritize simplifying technology, building trust through community engagement, and providing affordable solutions.

- Improving Access and Infrastructure: Ensuring high-speed internet access is crucial for effective eHL promotion in rural areas. This can help bridge the digital divide and enable rural residents to fully engage with eHealth technologies;
- Community-Based Approaches: Community-based interventions, provided broadband access, training, and technical support, have success in engaging rural populations. Personal contact and in-depth technical support are essential components of these interventions;
- Telehealth Utilisation: Telehealth has proven to be a useful tool for promoting health among rural older adults. However, technical supports are needed to improve ease of use and adherence. Telehealth can also be cost-effective, reducing travel costs and improving access to care.

Common Strategies for both urban and rural areas

- Support eHL content integration into educational curricula can address urban-rural differences effectively. For example, including family health content in educational programs can significantly improve eHealth literacy among nursing students.
- Involving users in the design and development of eHealth interventions ensures that the solutions are user-friendly and meet the specific needs of the target population. This approach is particularly important for socially disadvantaged groups.
- Utilizing health behavior and learning theories in the design of eHL interventions can enhance their effectiveness. These theories help in understanding and addressing the psychological and behavioral aspects of eHL.

Cultural

Cultural backgrounds and beliefs significantly influence individuals' perceptions of health, illness, and medical practices, which in turn shapes how they access and interpret health information [18].

Language barriers can significantly impact health literacy, especially in multicultural societies. When patients interact with healthcare providers who speak their preferred language, there is a noticeable improvement in patient satisfaction and management of chronic conditions, such as diabetes [19]. However, language differences often lead to misunderstandings, with studies indicating that a large proportion of patients struggle to understand medication instructions and appointment details [20].

Table 3. Personalized eHealth resources to different populations

Cultural Factors	Recommendations
Cultural Beliefs and Values	• When creating eHealth resources, cultural differences should be considered to ensure relevance and acceptance;

	• Healthcare providers should undergo cultural competency training to better address the diverse cultural backgrounds of their patients; • Design resources according to users' cultural and technological habits and engage community members to ensure effectiveness.
Language Barriers	• Provide multilingual support and ensure that healthcare providers speak the patient's preferred language; • Personalized educational programs that address language barriers and provide clear, concise health information can improve eHL.

Recommendations for Enhancing eHL according to cultural differences

- Cultural personalization:
  - Design eHealth materials that reflect the cultural values, beliefs, and practices of the target population;
  - Use culturally relevant examples and scenarios in educational content.
- Language Accessibility:
  - Provide eHealth resources in multiple languages and ensure translations are accurate and culturally appropriate;
  - Use simple language and visual aids to enhance understanding for individuals with limited literacy.
- Community Engagement:
  - Partner with local community organizations to disseminate eHL resources and gather feedback;
  - Engage in developing workshops and training sessions within the community to build trust and encourage participation.

2. Cognitive, situational and technical factors

A. Cognitive factors

Cognitive factors play a critical role in how individuals interact with digital health resources and information [21, 22]. These factors, including attitudes, outcome expectations and self-efficacy, have a direct impact on a person's ability to navigate and use eHealth resources effectively (Fig. 5).

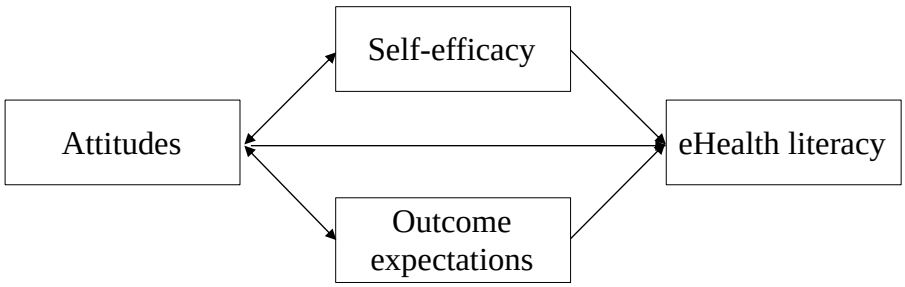


Fig. 5. Cognitive factors influencing eHL

- Attitudes

Psychological literature, particularly theories of social-cognitive learning, emphasize the important role of attitudes, as key determinants of behavior.

When considering attitudes, it is important to think about the different ways in which they influence actions and decisions. For example, it is valuable to examine individual attitudes toward the following:

- the internet;
- online learning;
- medicines;
- eHealth;
- the digitalization of healthcare;
- use of the internet for health decisions.

These attitudes are essential in shaping our behaviors, especially in contexts such as eHL. They largely determine initiative and autonomy in the use of technology for health information management. Usefully, research studies show that attitudes towards technology and the digitalization of healthcare are generally positive, not only among students but also among healthcare professionals.

Expectations of outcomes

Another important variable in this context is expectation. According to Bandura's social-cognitive theory, expectations of outcomes influence motivation and behavior. In the case of eHL, those who expect positive outcomes, such as better health outcomes or better decision making, are more likely to engage with digital health resources and use them effectively [23].

In terms of eHL outcomes, research has shown that it has several positive effects. eHL can positively influence preventive behaviors, improve knowledge and attitudes towards disease, and increase psychological wellbeing. General health-promoting behaviors such as healthy eating, exercise and adequate sleep are also outcomes associated with eHL. In addition, eHL can have a positive impact on social and community networks and improve living and working conditions.

eHealth engagement

eHealth engagement refers to the involvement and active participation of users with eHealth technologies, which include digital tools and platforms designed to improve health outcomes. Engagement is essential because it can significantly influence the effectiveness of eHealth interventions, determining whether they are beneficial to users [24].

The concept of *Engagement eHL* can be divided into several components (Fig. 6):

- Behavioral Engagement involves the actual use of eHealth tools, such as logging into an app or participating in online health platforms;
- Cognitive Engagement includes the mental investment in understanding and using the eHealth tools effectively;
- Emotional Engagement pertains to the emotional connection and satisfaction users feel when interacting with eHealth technologies.

Recommendations for enhancing eHL according to cognitive factors

- Foster Positive Attitudes Towards eHealth
    - Increase Awareness and Familiarity: Encourage peers to develop positive attitudes towards eHealth by integrating it into their daily practices. This could include using eHealth platforms for academic and personal health management;

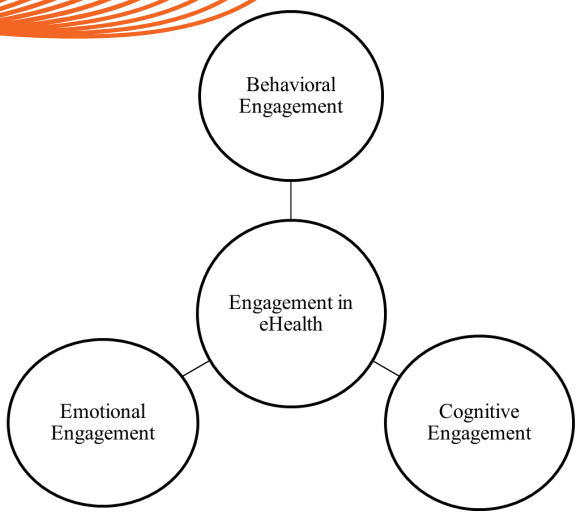


Fig. 6. Components of an engagement in eHealth
Source: [24]

- Create Supportive Learning Environments: Use case studies and examples to demonstrate how eHealth can benefit peers in managing their health, particularly focusing on success stories of improved health outcomes due to digital tools;
- Support the integration of technology into education: Encourage other peers to use technology in health activities. This may include practical sessions using telemedicine or eHealth applications, as well as promoting the integration of digital tools in medical treatment.

- Set Clear Expectations of Positive Outcomes
  - Emphasize the Benefits of eHealth Engagement: Ensure that your peers understand the potential positive outcomes of engaging with eHealth resources, such as better health management, improved decision-making, and increased prevention of diseases;
  - Promote Evidence-Based Results: Share data and research findings that demonstrate how eHealth has improved health outcomes for individuals. Highlight improvements in areas such as mental health, chronic disease management, and preventive behaviors;
  - Link eHealth to Academic Success: Emphasize how eHL can enhance academic and clinical decision-making, by encouraging your peers to use digital tools for research and practice. Show how proper eHealth use can lead to better patient care and informed health decisions.

- Enhance Engagement with eHealth Technologies
  - Behavioral Engagement: Encourage peers to actively use eHealth platforms, such as health apps, telemedicine consultations, or online health forums;
  - Cognitive Engagement: Facilitate deeper cognitive engagement by promoting or engaging in courses or workshops that focus on critical thinking and data interpretation through digital platforms.

B. Situational factors

Current health concerns and increased attention to one's health may prompt individuals to pay more attention to their wellbeing and be more proactive in seeking healthy behaviors.

Research shows that students who are more concerned about their health tend to have better functional health literacy (which includes evaluating basic reading and writing skills and basic knowledge of health conditions and health care systems) and critical health literacy (which includes the ability to analyse health information and use it to make informed decisions that help individuals exert more control over situations related to their personal and societal goals) [25]. These students are more likely to engage in positive health behaviors because they are better able to apply their knowledge to real-world situations.

Recommendations for enhancing eHL according to situational factors

- Foster Health Awareness Campaigns: Encourage peers to stay informed about current health issues, such as emerging diseases or mental health concerns, by using eHealth resources such as health news platforms, digital health reports, or reputable health websites.

C. Technical factors

- Language/linguistic variables: In the context of technical factors, language and linguistic variables are often discussed, particularly in relation to significant barriers to effective communication and understanding in the area of (e)health literacy. Studies suggest that overuse of medical jargon, cultural illiteracy among healthcare providers and language barriers can affect individuals' ability to understand health information.

These language barriers impact both the functional and critical aspects of eHL as individuals struggle to understand and analyze basic health information to make informed decisions about their wellbeing.

- Access and usability issues: From the user's perspective, various factors hinder the development of eHealth expertise. While the logistic challenges of digital platforms are often discussed, in some contexts- particularly in socio-economically weaker areas or in areas with insufficient internet connectivity- the obstacles are more organizational in nature. These include issues such as affordability of devices, limited access to technology or a lack of reliable internet services. In addition, many users have difficulties navigating digital interfaces, such as small text or complex design, which can hinder the effective use of online health resources. These accessibility and usability issues can prevent individuals from fully utilizing eHealth tools.
- Training and knowledge gaps: A major barrier related to technological factors is the insufficient training and lack of familiarity with current technologies. This issue affects not only the use of digital health resources but also personal factors such as self-efficacy or access. Becoming familiar with technology is essential for building user trust and promoting the adoption of eHealth solutions.
- Privacy and security concerns: Privacy is a key issue in the world of digital health. Digital privacy literacy refers to how well people understand online privacy, privacy policies and strategies to protect personal data. In the eHealth sector, privacy is particularly important as health data is some of the most sensitive personal information. As soon as it is shared online, there is a risk of unauthorized access and misuse. Studies show that people who know how to manage their privacy settings on Social Media feel more confident using digital platforms and are more likely to engage with online health information. Therefore, developing *privacy literacy* is an important part of eHL as it helps to build trust and encourage people to use digital health tools with more confidence.
- Data accuracy: An important reason why youth may not utilize eHealth sources is due to health misperceptions and misinformation. This can lead to greater mistrust of the internet and digital health tools, which may be further influenced by concerns about data security and privacy.

Interestingly, online misinformation and disinformation can cultivate misperceptions regardless of one's level of eHL. However, individuals with higher eHL are less likely to act on their misperceptions, as they are more capable of verifying and correcting inaccurate information over time. This highlights the importance of both providing accurate, reliable information and ensuring that individuals have the skills to critically evaluate and verify health-related content.

Recommendations for Enhancing eHL According to technical factors

- Data Accuracy
  - Verify health information: When disseminating information, people should ensure that it is accurate, evidence-based from reputable sources such as government health agencies, academic institutions, or recognized healthcare organizations;
  - Fight misinformation and disinformation: Fighting against misinformation and disinformation is achieved by implementing fact-checking tools or features that alert peers when they are reading potentially inaccurate or misleading health information. It is key to encourage the use of peer-reviewed sources and expert opinions in health-related digital content.
  - Promote Critical Thinking: Teaching peers how to critically assess the information they find online. Provide guidance on how to identify credible health websites, how to cross-check facts across multiple sources, and how to recognize biases or conflicts of interest in online health content.
- Privacy and Security Concerns
  - Educate on Digital Privacy: Get informed and inform peers about privacy risks and how to manage their data online. This includes how to understand and use privacy settings in eHealth apps, websites, and health-related Social Media platforms.
  - Enhance Privacy Literacy: Provide information that focuses on digital privacy literacy, helping your peers to understand how to protect their personal health information, how to recognize secure sites, and how to manage cookies and permissions.
- **Language and Linguistic Variables**
  - Simplify Health Information: To reduce the impact of language barriers, health information should be written in clear, simple language that is easily understandable by a broad audience.

Medical jargon should be avoided or simple explanations for complex terms should be provided.

- Offer Multilingual Resources: Provide health materials and eHealth resources in multiple languages to support peers and patients. This can improve accessibility for individuals who do not speak the primary language in which most eHealth tools are presented.
- Cultural Sensitivity: Ensure that health information is culturally appropriate and sensitive to different social and cultural norms. This includes using language that respects diverse beliefs and practices related to health.
- Use Visual Aids: Incorporating images, videos, or infographics can help individuals with limited language skills better understand health information. Visual representations are particularly useful for explaining medical concepts and procedures.

Key Takeaways

- Background matters – Age, education, income, and where you live can shape your electronic health skills.
- Culture can be a barrier – Language and cultural beliefs may limit how people use or trust electronic health tools.
- Cognitive overload is real – Your brain can only process so much; learn how to focus on reliable information.
- Your situation affects you – Stress, illness, or urgency can influence how you seek and use digital health help.
- Technology access isn't equal – Not everyone has good devices or internet; that impacts their learning and health decisions.
- There's a digital divide – Students from disadvantaged backgrounds might need extra support with eHL.
- But you can learn – These are challenges, not roadblocks—everyone can improve with the right tools and support.

References

1. Estrela, M., Semedo, G., Roque, F., Ferreira, P. L., & Herdeiro, M. T. (2023). Sociodemographic determinants of digital health literacy: A systematic review and meta-analysis. International Journal of Medical Informatics, 177, 105124. https://doi.org/10.1016/j.ijmedinf.2023.105124
2. Zhao, S., Wang, F., & Zhang, Y. (2020). The influence of education and socioeconomic factors on digital health literacy. Journal of Public Health, 42(4), 764-772. https://doi.org/10.1007/s10389-019-01263-w
3. van Kessel, R., Wong, B. L. H., Clemens, T., & Brand, H. (2022). Digital health literacy as a super determinant of health: More than simply the sum of its parts. Internet Interventions, 27, 100500. https://doi.org/10.1016/j.invent.2022.100500
4. Prentice, C., & Järvelä, K. (2020). E-health literacy and its socio-demographic correlates. The European Journal of Public Health, 30(1), 131-137. https://doi.org/10.1093/eurpub/ckz158
5. Bíró, É., Vincze, F., Mátyás, G., & Kósa, K. (2021). Recursive path model for health literacy: The effect of social support and geographical residence. Frontiers in Public Health, 9, 724995. https://doi.org/10.3389/fpubh.2021.724995
6. Jankowski, P., Harris, S., & Liu, M. (2021). Age and digital skills: Examining the factors influencing the use of e-health services among older adults. The Journal of Aging & Social Policy, 33(1), 15-29. https://doi.org/10.1080/08959420.2020.1730198
7. Smith, T., Lee, H., & Wong, F. (2020). The role of education in e-health literacy: A review of the evidence. Health Education Research, 35(2), 136-147. https://doi.org/10.1093/her/cyz059
8. Jung, S. O., Son, Y. H., & Choi, E. (2022). E-health literacy in older adults: An evolutionary concept analysis. BMC Medical Informatics and Decision Making, 22, 28. https://doi.org/10.1186/s12911-022-01761-5
9. Thomas, L., & Miller, P. (2020). Gender differences in health information-seeking behavior: Implications for e-health literacy. Journal of Medical Internet Research, 22(3), e17335. https://doi.org/10.2196/17335
10. Liu, Y., Wang, Z., & Chen, J. (2022). Gender differences in e-health literacy and engagement with digital health platforms. Journal of Digital Health, 3(1), 50-59. https://doi.org/10.1007/s41199-021-00298-7
11. Chakraverty, D., Baumeister, A., Aldin, A., Seven, Ü. S., Monsef, I., Skoetz, N., Woopen, C., & Kalbe, E. (2022). Gender differences of health literacy in persons with a migration background: A systematic review and meta-analysis. BMJ Open, 12(7), e056090. https://doi.org/10.1136/bmjopen-2021-056090
12. Patel, S., & Johnson, M. (2021). Exploring gendered health information-seeking behaviors and their implications for digital health services. Health Communication, 36(4), 493-503. https://doi.org/10.1080/10410236.2021.1882872
13. Oliveira, L., Zandonadi, R. P., Nakano, E. Y., Almutairi, S., Alzghaibi, H., Lima, M. J., Teixeira-Lemos, E., Saraiva, A., & Raposo, A. (2024). From validation to assessment of e-health literacy: A study among higher education students in Portugal. Healthcare, 12(16), 1626. https://doi.org/10.3390/healthcare12161626
14. Cherid, C., Baghdadli, A., Wall, M., Mayo, N. E., Berry, G., Harvey, E. J., Albers, A., Bergeron, S. G., & Morin, S. N. (2020). Current level of technology use, health and eHealth literacy in older Canadians with a recent fracture-a survey in orthopedic clinics. Osteoporosis International, 31(7), 1333-1340. https://doi.org/10.1007/s00198-020-05359-3

15. Jasper, S., Al-Dhahir, I., Reijnders, T., Chavannes, N. H., Evers, A. W. M., Kraal, J. J., van den Berg-Emons, H. J. G., & Visch, V. T. (2021). Attitudes toward health, healthcare, and eHealth of people with a low socioeconomic status: A community-based participatory approach. Frontiers in Digital Health, 3. https://doi.org/10.3389/fdgth.2021.690182
16. Wang, W., Zhang, Y., Lin, B., Mei, Y., Ping, Z., & Zhang, Z. (2020). The urban-rural disparity in the status and risk factors of health literacy: A cross-sectional survey in central China. International Journal of Environmental Research and Public Health, 17(11), 3848. https://doi.org/10.3390/ijerph17113848
17. Roberts, S., Johnson, D., & Turner, L. (2018). The role of socioeconomic status in the digital divide in health information. Journal of Health Disparities Research and Practice, 11(2), 1-14. https://doi.org/10.18060/21681
18. Shah, D., Slater, M., & Hsu, H. (2021). The role of cultural beliefs in the adoption of e-health literacy. Journal of Communication, 71(2), 304-320. https://doi.org/10.1093/joc/jqz019
19. Batal, H., Morita, K., & Kaji, Y. (2019). Language barriers in healthcare and their impact on health literacy. Journal of Health Communication, 24(1), 23-35. https://doi.org/10.1080/10810730.2019.1612263
20. Schillinger, D., Bindman, A. B., Wang, F., & Stewart, A. L. (2016). Functional health literacy and the quality of diabetes care: The Diabetes Study of Northern California (DISTANCE). Journal of the American Medical Association, 296(10), 1255-1261. https://doi.org/10.1001/jama.296.10.1255
21. Huang, C. L., Yang, S.-C., & Chiang, C.-H. (2020). The associations between individual factors, eHealth literacy, and health behaviors among college students. International Journal of Environmental Research and Public Health, 17(6), 2108. https://doi.org/10.3390/ijerph17062108
22. Liu, L., Fu, M., Wu, J., Wang, H., Zhao, J., Chen, P., Cao, J., Zhang, W., & Lin, Q. (2024). Digital health literacy among undergraduate nursing students in China: Associations with health lifestyles and psychological resilience. BMC Medical Education, 24. https://doi.org/10.1186/s12909-024-06075-w
23. Bandura, A. (2012). Social cognitive theory. In P. A. M. Van Lange, A. W. Kruglanski, & E. T. Higgins (Eds.), Handbook of theories of social psychology (pp. 349–373). Sage Publications. https://doi.org/10.4135/9781446249215.n18
24. Kelders, S. M., Kip, H., & Greeff, J. (2020). Psychometric evaluation of the TWente Engagement with Ehealth Technologies Scale (TWEETS): Evaluation study. Journal of Medical Internet Research, 22(10), e17757. https://doi.org/10.2196/17757
25. Dopelt, K., Avni, N., Haimov-Sadikov, Y., Golan, I., & Davidovitch, N. (2021). Telemedicine and eHealth literacy in the era of COVID-19: A cross-sectional study in a peripheral clinic in Israel. International Journal of Environmental Research and Public Health, 18(18), 9556. https://doi.org/10.3390/ijerph18189556

Chapter 3. Specific influential factors of eHL

1.Individual-specific factors: Impostor syndrome and self-efficacy

Students and professionals who develop strong eHL skills can enhance patient care, engage in evidence-based practice, and remain adaptable to evolving healthcare technologies. However, several psychological and cognitive factors can impact eHL development.

A. Understanding Impostor Syndrome in medical and allied health students

Impostor Syndrome (IS) is a psychological phenomenon wherein individuals doubt their competencies and fear being exposed as frauds despite evident success. It can also be described as persistent self-doubt and fear of being exposed as a "fraud," despite evident competence and achievements [1].

Among medical and allied health students, the high-pressure learning environment fosters IS, exacerbating stress and self-doubt. The competitive nature of medical education, rigorous coursework, and the expectation to retain vast amounts of knowledge contribute to feelings of inadequacy. Many students feel inadequate despite high academic performance, which affects their confidence in navigating digital health tools and engaging with e-health resources effectively. This lack of confidence may discourage students from exploring new digital tools, participating in collaborative online learning, or seeking digital mentorship opportunities.

Additionally, IS can lead to avoidance behaviors, where students hesitate to seek help or clarify uncertainties regarding digital resources, fearing that doing so may expose them as incompetent. This phenomenon can lead to increased stress, anxiety, and a reluctance to engage fully with learning resources, including digital platforms. In the long term, this reluctance may limit students' ability to stay updated with the latest advancements in digital health, ultimately impacting their professional preparedness and patient care efficiency. Addressing IS early in medical education is crucial to fostering digital confidence and ensuring that students develop the necessary eHL skills to thrive in an increasingly digitalized healthcare environment.

Implications for eHL

Students experiencing IS often hesitate to engage with digital health platforms due to a lack of confidence in their ability to interpret and apply e-health information correctly. This can lead to avoidance behaviors, where they refrain from utilizing online health databases, telemedicine applications, and digital patient education tools, limiting their exposure to critical technological advancements in healthcare. Over time, this avoidance can create a widening gap in digital competency, making it more challenging to integrate new digital tools into their future clinical practice [2].

Additionally, IS can have direct consequences on professional work. A medical student or early-career professional who doubts their ability to use modern digital tools may struggle to access the latest medical research, interpret patient data, or confidently use electronic health records (EHRs). This hesitation can result in outdated decision-making, reliance on traditional methods, and an increased risk of clinical errors due to an inability to effectively evaluate decision-support systems. In environments where telemedicine and digital patient monitoring are becoming standard, professionals with low eHL may find themselves unable to meet the expectations of digitalized healthcare delivery. This, in turn, may lead to inefficiencies in patient care, increased cognitive workload, and difficulty in keeping pace with emerging technologies. Addressing IS is, therefore, not just about improving confidence but ensuring that students and professionals are equipped with the necessary digital skills to provide high-quality, and evidence-based care.

C Case study

A group of third-year medical students participated in a clinical rotation where they were expected to use digital health tools, such as electronic health records (EHRs), mobile health apps, and clinical decision support systems (CDSS), to assist in diagnosing and treating patients. The students were introduced to the tools at the beginning of the rotation, with the goal of helping them make informed decisions based on the data provided by these digital systems.

One student, Sarah, stood out in the study for her experience with impostor syndrome. Despite having the academic qualifications to be in the program, Sarah frequently felt like she was not "good enough" to make decisions, especially when using the digital tools provided.

Although she had access to accurate data and treatment recommendations, Sarah often second-guessed herself, fearing that the technology might be wrong or that her interpretation of the data might be flawed. This lack of confidence caused her to hesitate in making decisions and to rely more on her supervisors for guidance, despite having the capability to act independently.

Key Findings:

- Doubts in Judgment: Students like Sarah who exhibit signs of impostor syndrome are less likely to trust their own judgment when using digital health tools. Despite the systems being based on evidence-based guidelines and offering real-time patient data, these students often feel their clinical knowledge is insufficient to understand or act on the information provided by the tools.
- Delayed Decision-Making: Due to their doubts, students with impostor syndrome are more likely to delay making decisions, either by overanalysing the data or seeking constant reassurance from their supervisors. This results in delays in patient care and a diminished sense of autonomy in their clinical roles.
- Negative Impact on Professional Identity: The lack of confidence caused by impostor syndrome affects students' professional identity development. They struggle to see themselves as competent, autonomous healthcare providers in the digital age. Their inability to trust digital tools further isolate them from integrating into the modern healthcare environment, where digital health solutions are becoming increasingly vital.
- Academic Performance: The study indicates that students with high levels of impostor syndrome have lower academic performance in assessments that involved the use of digital health tools. These students tend to underperform in tasks that require them to analyze data and make independent clinical decisions based on the information provided by the tools.

Based on the findings of [1]

Reflection Questions

- Reflect on a time when you felt unsure about using a digital health tool. What factors contributed to that uncertainty, and how did you overcome or fail to overcome it?
- How do you think a lack of trust in digital health tools might impact patient care? How would you handle a situation where you doubt the recommendations provided by these tools?
- What resources or strategies could help build confidence in students and encourage them to trust their abilities when using digital tools?
- How does the feeling of being an "impostor" shape your view of yourself as a future healthcare professional? What steps can be taken to overcome this feeling and develop a stronger professional identity?
- Reflect on the digital health tools you have used so far in your education. What strategies can you implement to feel more comfortable using these tools, and how can they contribute to your academic and clinical success?
- Consider the potential benefits and drawbacks of integrating digital tools into patient care. How do you ensure that these tools complement rather than replace the human element of healthcare?

Recommendations to overcome Impostor Syndrome in eHL

- Encouraging self-awareness: Recognizing IS patterns and understanding that these feelings can help reduce self-doubt. Educational institutions should incorporate self-reflective practices into their curriculum, such as journaling exercises, anonymous self-assessment surveys, and structured group discussions about personal experiences with self-doubt. These activities can help students identify their own tendencies toward IS and develop strategies for overcoming them. Institutions should also provide real-world examples of accomplished professionals who have struggled with IS, reinforcing the idea that these feelings are common and do not reflect actual competence. By fostering a culture of self-awareness and resilience, institutions can equip students with the mindset needed to confidently engage with digital health resources and technological advancements in healthcare.

- Mentorship and peer support: Providing structured mentorship opportunities and peer discussions fosters confidence, reduces isolation, and creates a support network for students experiencing Impostor Syndrome (IS). Regular mentorship programs should be established where senior students, faculty members, or healthcare professionals can guide students in overcoming self-doubt and building digital health competencies. Peer mentorship groups can facilitate shared experiences, allowing students to discuss their challenges in a non-judgmental space. Additionally, institutions should encourage group learning activities and networking events to reinforce confidence, enhance collaboration, and normalize struggles with IS. Establishing an accessible and inclusive mentorship culture within medical and allied health education can ·significantly improve students' ability to navigate digital health technologies with greater assurance and ease.
- Skill-building workshops: Conducting practical training sessions on digital health platforms helps boost competence and confidence. Students should be given early exposure to digital tools with guided instruction, allowing them to develop familiarity with key e-health applications such as electronic health records (EHRs), clinical decision support systems, and telemedicine platforms. These workshops should include hands-on simulations where students practice using digital resources to analyse patient data, research medical literature, and interact with virtual patient cases. Additionally, incorporating problem-based learning exercises and case studies into these sessions can help students understand real-world applications of digital health tools. By fostering an interactive learning environment, skill-building workshops can empower students to integrate digital health solutions into their professional practice with ease and confidence.
- Promoting a growth mindset: Encouraging students to view challenges as learning experiences rather than reflections of incompetence is essential in fostering resilience and adaptability in medical and allied health education. A growth mindset helps students see setbacks as opportunities to improve rather than indicators of failure. To cultivate this mindset, specialists can incorporate reflective practices, such as journaling and case-based discussions, where students analyze how overcoming difficulties leads to professional and personal growth.

Additionally, institutions should provide continuous feedback and emphasize progress over perfection, reinforcing the idea that competency in eHL is developed through persistence and learning from mistakes. Workshops on cognitive reframing and self-compassion can also be beneficial in helping students shift their perspectives on challenges, ensuring they approach new digital health tools with confidence rather than hesitation.

- Open discussions and reflective practices: Normalizing IS through dialogue and self-reflection fosters resilience. Institutions should create a safe space for students to share their experiences and learn from peers by implementing structured discussion forums, group reflection sessions, and workshops led by experienced educators or mental health professionals. These platforms can encourage students to express their struggles without fear of judgment, helping them recognize that their experiences are shared by many others in the field. Especially, integrating IS discussions into medical and professional ethics or professional development courses can further validate the topic and equip students with coping strategies. Role-playing exercises and storytelling techniques can also be employed to help students reframe their experiences in a constructive way, fostering confidence and resilience in handling digital health challenges.

B. The Role of Self-Efficacy in eHL

Understanding Self-Efficacy in Medical and Allied Health Students

Self-efficacy, the belief in one's ability to succeed in specific tasks, plays a crucial role in learning and professional development. For medical and allied health students, high self-efficacy translates into greater confidence in utilising digital health technologies, engaging in evidence-based online research, and integrating these tools into their academic practice. Students with strong self-efficacy are more likely to actively seek digital solutions for patient care, use data-driven decision-making approaches, and adopt innovative technologies with ease [3]. In the context of medical education, high self-efficacy is associated with proactive learning, adaptability to new technologies, and a willingness to experiment with digital tools, such as artificial intelligence-assisted diagnostics and remote patient monitoring systems.

Moreover, self-efficacy influences how students approach problem-solving in digital health settings, as those with greater confidence are more likely to troubleshoot technical difficulties, critically evaluate online health information, and collaborate with interdisciplinary teams in telehealth environments. Therefore, fostering self-efficacy among students is essential for ensuring their preparedness for an increasingly digitalized healthcare system.

How Self-Efficacy Affects eHL

Students with high self-efficacy are more likely to explore digital health resources, critically assess health information, and apply it effectively in clinical settings. They tend to engage with digital tools such as electronic health records (EHRs), telemedicine applications, and clinical decision support systems with confidence. This allows them to make data-driven decisions, improve patient care, and stay up to date with medical advancements.

Conversely, low self-efficacy leads to hesitation in using digital tools, difficulty in discerning credible information, and increased reliance on traditional learning methods. Students with low confidence in their digital abilities may avoid online medical databases, hesitate to interpret digital patient data, or rely on outdated sources for decision-making [4]. This lack of engagement can result in missed opportunities for professional growth and reduced efficiency in clinical environments where digital health tools are increasingly central to patient care. Addressing self-efficacy barriers is crucial in ensuring students are equipped with the necessary digital skills to thrive in modern healthcare settings.

C Case Study

A group of second-year medical students participated in a structured digital health training program as part of their curriculum. The program was designed to improve students' eHL skills, including learning how to access and evaluate medical information online, utilize digital health records, and integrate e-health resources into their clinical decision-making processes.

The training involved a series of workshops, practical exercises, and assessments that allowed students to practice using online medical databases such as PubMed.

In addition, they learned how to critically evaluate the quality of medical research, identify credible sources, and integrate relevant research findings into their clinical practice. The program also focused on improving students' ability to use electronic health records (EHRs) to make informed clinical decisions.

Key Findings:

- Increased Self-Efficacy: After completing the eHL program, students reported a higher level of confidence in using digital health resources. They felt more capable of navigating online medical databases, accessing relevant research, and utilizing digital health tools to inform their clinical decisions.
- Improved Clinical Decision-Making: Students who participated in the program demonstrated a greater ability to integrate e-health resources into their clinical decision-making process. They were better equipped to apply evidence-based guidelines and research findings.
- Enhanced Research Evaluation: The program helped students become more critical in evaluating the quality of medical research. They gained skills in distinguishing between high-quality and low-quality studies, which allowed them to make more informed decisions when applying research to their clinical practice.
- Early Exposure to Digital Health Education: The study highlighted the importance of early exposure to digital health education. Students who participated in the program were able to develop the necessary competencies and confidence to effectively use digital tools in their professional practice, which would be essential as they advanced in their medical careers.

Based on the findings of [4].

Reflection Questions

- Reflect on your current ability to use digital health tools. How would structured training improve your confidence and efficacy in using these tools?
- Consider a situation where you might need to use a digital health tool or online medical database. How would enhanced confidence in using these tools impact your decisions and patient outcomes?

- Reflect on your current skills in evaluating research. How could learning to critically assess research help you make better-informed decisions in your medical practice?
- Consider the potential benefits of integrating digital health training into early medical education. How does early exposure to these tools prepare you for future clinical practice?
- Think about how you can use digital health resources to enhance patient care. Can you identify specific tools or strategies that could be useful in your future practice?
- Reflect on potential obstacles you might encounter when using digital tools in clinical settings. How can you overcome these challenges to improve your practice?
- Consider ways to promote the importance of eHL among your peers. How can you create a culture of confidence and competence in using digital health resources within your medical school or future practice environment?

Recommendations to improve self-efficacy in eHL

- *Integrate eHL into the curriculum*: Embedding digital health competencies in education ensures that students develop essential digital skills in a structured and progressive manner. This can be achieved by incorporating dedicated courses on digital health tools, online medical databases, and telemedicine applications. Additionally, integrating eHL into clinical training allows students to gain hands-on experience using electronic health records (EHRs) and decision-support systems, enhancing their confidence and competency. Institutions should also establish partnerships with health technology companies to provide access to the latest innovations, ensuring that students are prepared for real-world digital health challenges.
- *Hands-on training*: Practical exposure to e-health tools builds familiarity and confidence by allowing students to engage directly with digital health technologies in a controlled learning environment. Training sessions should include interactive modules where students practice using electronic health records (EHRs), medical databases, telehealth platforms, and artificial intelligence-assisted diagnostic tools.

- *Hands-on workshops* can incorporate case studies and real-world scenarios that require students to retrieve patient data, interpret lab results, and use decision-support systems effectively. Furthermore, institutions should provide opportunities for students to shadow healthcare professionals using these technologies in clinical settings, ensuring that they understand how digital health tools integrate into everyday medical practice. By applying knowledge in simulated and real-world conditions, students can build the technical proficiency and confidence necessary for digital healthcare environments.
- *Simulation-based training*: Utilizing simulations provides hands-on experience with digital tools in a low-risk environment. These simulations can be designed as interactive case scenarios where students analyze virtual patient data, make diagnostic decisions, and receive real-time feedback on their choices. Virtual reality (VR) and augmented reality (AR) technologies further enhance simulation training by providing immersive experiences that mimic real patient interactions. Additionally, gamified learning modules and AI-driven simulations can help reinforce eHL by allowing students to test their knowledge in dynamic, engaging settings. Incorporating structured debriefing sessions after simulations helps students reflect on their performance, identify areas for improvement, and develop confidence in their digital health competencies.
- *Peer-led learning sessions*: Encouraging peer-to-peer learning creates a supportive environment for skill development by fostering collaboration, shared experiences, and interactive learning opportunities. In medical and allied health education, peer-led learning allows students to teach and learn from one another, reinforcing their understanding of digital health tools and increasing their confidence in using technology in clinical practice. Structured peer-led workshops, where students take turns presenting on various digital health topics, can be an effective approach to reinforcing eHL. Additionally, forming peer study groups to practice navigating online medical databases, conducting digital patient assessments, and engaging in critical discussions on e-health information credibility can enhance learning outcomes. Institutions can also implement mentorship pairings where more experienced students guide newer students through the use of telemedicine platforms, electronic health records (EHRs), and medical apps.

- *Positive reinforcement*: Recognising achievements in digital competency fosters motivation by reinforcing students' confidence in their ability to use digital health tools effectively. Providing timely and constructive feedback on eHL, such as proficiency in navigating online medical databases or using electronic health records (EHRs), encourages continuous learning. Institutions can implement a system of digital badges or certifications to acknowledge students' progress in eHL. Additionally, public recognition through academic awards, peer acknowledgments, or faculty recommendations can create a positive learning environment where students feel motivated to further develop their digital health skills. Creating a culture of encouragement, where mistakes are seen as learning opportunities, helps reinforce growth and persistence in mastering digital health technologies.
- *Goal setting*: Helping students set and achieve small, incremental goals builds confidence over time. By setting clear, attainable objectives, students can progressively improve their eHL skills without feeling overwhelmed. For example, students can start by mastering basic tasks such as searching for peer-reviewed articles on medical databases, then advance to analyzing complex datasets from electronic health records (EHRs) or using telemedicine platforms for simulated patient interactions. Educators can guide students in creating personalized learning plans with specific milestones and deadlines, reinforcing accountability and self-motivation. Additionally, incorporating SMART (Specific, Measurable, Achievable, Relevant, Time-bound) goal-setting frameworks into digital health training ensures students have structured, realistic objectives to work towards, ultimately enhancing their confidence and proficiency in using eHL.

2. Context-specific factors: Source credibility

Defining Source Credibility in E-Health Context

Source credibility refers to the perceived trustworthiness and expertise of information providers. In e-health, assessing the credibility of online health information is crucial to ensure accuracy and reliability, as misinformation can have significant consequences on patient care and public health. Both professional healthcare providers and students must be able to evaluate the reliability of medical websites, online journals, and health forums to avoid

misinformation and ensure they base their clinical decisions on accurate and up-to-date knowledge [5].

When assessing source credibility, students should consider multiple factors, including the author's credentials, their institutional affiliations, and whether they are recognized experts in the field. The publication date is also critical, as medical knowledge evolves rapidly, and outdated information can lead to incorrect conclusions. Additionally, credible sources should provide clear references to peer-reviewed studies and reputable institutions, ensuring transparency and accountability in the presented information.

Another key aspect of source evaluation is recognizing potential biases, such as industry sponsorships or conflicts of interest that may influence the reliability of the information. Students should also be aware of algorithmic biases in search engines, which may prioritize popular or commercially driven content over rigorously scientific research [6]. By developing strong source evaluation skills, medical and allied health students can confidently navigate the digital health landscape and ensure their clinical decision-making is informed by the highest standards of evidence-based practice.

The influence of search algorithms on perceived credibility

Search algorithms play a significant role in shaping the information that students and healthcare professionals encounter online. Many search engines prioritize content based on popularity, user engagement, and advertising revenue rather than the credibility and accuracy of the information. As a result, less reliable sources may appear at the top of search results, leading users to trust and rely on information that may not be evidence-based. This issue is particularly specific to healthcare, where misinformation and frequently disinformation can lead to incorrect self-diagnosis, unnecessary panic, or poor medical decisions.

Additionally, social media platforms and news aggregation websites use algorithms that create filter bubbles and echo chambers, reinforcing pre-existing biases and limiting exposure to diverse perspectives. When users interact primarily with content that aligns with their existing beliefs, they may develop a skewed perception of medical information, reducing their ability to critically assess alternative viewpoints. Furthermore, search algorithms can be influenced by targeted advertising and paid content, leading to increased visibility of commercialized or agenda- driven health information over peer-reviewed, and evidence-based content.

To address these concerns, students and healthcare professionals must develop critical search skills, including using academic databases such as PubMed, Google Scholar, University's digital libraries and Cochrane Library, rather than relying solely on general search engines. They should also be encouraged to use fact-checking services and scrutinize the sources behind health claims. Understanding how search algorithms work and recognizing the influence of digital marketing on health information can help ensure that professionals base their clinical decisions on the most accurate and scientifically validated sources available.

For medical and allied health students, understanding how these algorithms function is critical to improving their ability to assess the credibility of online health information. Search engine algorithms are designed to rank content based on various factors such as user engagement, relevance, and paid advertisements, rather than the scientific accuracy or credibility of the information. As a result, high-ranking health information may not always be the most reliable or evidence-based.

To navigate this challenge, students should develop strategies to critically evaluate search results, such as cross-referencing multiple reputable sources, using academic databases like PubMed, Cochrane Library, Universities' digital libraries and Google Scholar, and being mindful of potential commercial influences that may skew information. They should also consider the domain authority of sources (e.g., government agencies, peer-reviewed journals, and medical institutions) over less reliable websites. Another essential strategy is recognizing and mitigating confirmation bias by actively seeking diverse perspectives and assessing information from different viewpoints, that are supported by scientific evidence.

Additionally, understanding how personalized search algorithms function- where search results are influenced by a user's browsing history and preferences- can help students avoid falling into digital echo chambers. To counteract this, they should practice searching in incognito mode, using neutral search terms, and manually navigating to verified health information sources. By enhancing their awareness of algorithmic biases and adopting a more systematic approach to information verification, students can navigate the digital health landscape more effectively, avoid misinformation, and make informed clinical decisions.

Case Studies

Case study 1

Smith et al. (2021) conducted a study on how users of online health communities assess the credibility of medical information shared on forums and Social Media [6]. The study revealed that while many individuals rely on peer recommendations and anecdotal experiences, there is a significant risk of misinformation and occasionally, disinformation, due to the lack of verification mechanisms in such platforms.

Key Findings:

- *Reliance on Peer Recommendations*: Many users of online health forums and Social Media groups rely on peer recommendations and anecdotal experiences when evaluating health information. This practice increases the risk of misinformation.
- *Higher eHL and Cross-Referencing*: Users with higher eHL are more likely to verify the health information they come across by consulting authoritative sources like PubMed, WHO, and government health agencies. This behavior helps ensure that the information they trust is evidence-based and reliable.
- *Susceptibility to Misinformation*: Users with lower eHL are more likely to accept health information based on social validation, such as the number of likes or shares a post receives. This reliance on social cues rather than evidence increases their vulnerability to misinformation.
- *Need for eHL Education*: The study emphasizes the importance of educating users on eHL to improve their ability to assess the credibility of online health content. It also calls for platforms to incorporate mechanisms like fact-checking tools and credibility scores to help users make informed decisions.

Reflection Questions

- Reflect on your current approach to evaluating health information found online. What steps would you take to verify its accuracy?
- Consider how your level of eHL influences your ability to discern reliable sources from misleading ones. How can improving your eHL benefit your health decision-making?

- Think about the role of social validation in shaping public opinion. How does relying on these factors without fact-based verification increase the risk of misinformation?
- Reflect on the potential benefits of eHL education. How can it equip individuals with the skills necessary to critically evaluate online health content?
- Consider practical strategies for incorporating fact-checking into your online health information-seeking habits. How can you ensure that the resources you use are trustworthy?
- Think about the current limitations of online health forums and Social Media platforms. What changes would you recommend to make it easier for users to distinguish between reliable and unreliable information?
- Reflect on how you can contribute to raising awareness about eHL among peers. How can you encourage others to verify health information from reputable sources?
- Reflect on the challenges posed by misinformation in online health communities. What actions can be taken to reduce its spread and ensure more accurate health information?

C Case study 2

Lee & Chang (2020) conducted a study on how algorithmic biases influence the spread of misinformation on digital health platforms [5]. Their research found that search engines and Social Media algorithms often prioritize content based on engagement metrics rather than accuracy, leading to the increase of misleading health information.

Key Findings:

- *Algorithmic Biases*: Search engine and Social Media algorithms often promote health content based on engagement metrics (likes, shares, comments), not the credibility or accuracy of the information. This prioritization leads to the increase of misleading health content.
- *Echo Chamber Effect*: Users who interact with low-quality health sources are more likely to receive similar recommendations, which reinforces pre-existing biases and limits exposure to trustworthy, and evidence-based health information.

- *Sensationalism Over Scientific Credibility*: Articles with emotionally charged language or sensationalized titles receive more engagement, leading algorithms to prioritize these low-quality pieces over more scientifically rigorous content.
- *Recommendations for Medical Education*: The study emphasizes the importance of teaching students how to critically evaluate electronic health information, especially from search engines and Social Media. Students should be trained to cross-reference information with peer-reviewed studies and credible health organizations like WHO.

Reflection Questions

- Reflect on your personal experience with electronic health resources. Do you notice patterns in the type of content promoted to you? How might these influence your health-related decisions or beliefs?
- Think about a time when you encountered health information online that seemed too good (or too alarming) to be true. How did you verify its accuracy, and what resources did you use to cross-check the information?
- Reflect on the types of health content that appear in your Social Media feed or search results. How might algorithmic biases be affecting the information you receive, and how could this impact your decision-making regarding health?
- Consider strategies for evaluating the credibility of online health information. What steps can you take to cross-reference claims with reputable sources, such as peer-reviewed journals, government health websites, or expert medical organizations?
- Reflect on the features you would want to see in health-related digital platforms to help users better evaluate the reliability of content. How could transparency in algorithmic decision-making contribute to this goal?
- Reflect on the role of education in improving eHL. How can medical and allied health professors teach students to critically evaluate online health information and navigate digital health tools effectively?
- Consider the broader implications of algorithmic biases and the echo chamber effect. How might this influence public health outcomes, especially if individuals are repeatedly exposed to misinformation?

Recommendations for enhancing source evaluation skills

- Media Literacy Training: Introducing media literacy concepts can help students recognize misleading headlines, clickbait, and emotional language that may indicate bias in health information. Students should be trained in identifying logical fallacies, assessing sources for sensationalism, and understanding the techniques used in misinformation campaigns.
- Reverse Image and Citation Searches: Teaching students how to perform reverse image searches and trace citations back to their original sources can help verify the authenticity of claims. Tools such as Google Reverse Image Search and citation tracking in Google Scholar or Scopus can help confirm whether images or quotes have been taken out of context or manipulated.
- Collaboration with Librarians and Information Specialists: Academic institutions can provide workshops or consultations with information specialists who can guide students in effective research techniques and reliable sources. Librarians can play an important role in teaching students how to use advanced search functions in medical databases and distinguish between primary and secondary sources.
- Cross-Disciplinary Collaboration: Encouraging students to engage with experts from other fields, such as data science, ethics, and journalism, can provide a broader understanding of information credibility and bias. Interdisciplinary workshops can help students recognize how misinformation spreads across different domains and how to counteract it effectively.
- Utilising Professional Guidelines and Position Statements: Students should be encouraged to refer to guidelines from reputable professional organizations (e.g., WHO, CDC, ECDC) to validate health information. Knowing where to find and how to interpret position statements from medical associations can help students discern expert consensus from misleading or non-peer-reviewed sources.
- Critical Appraisal Techniques: Teaching frameworks such as CRAAP (Currency, Relevance, Authority, Accuracy, Purpose) for source evaluation is crucial in assessing the reliability of health information.

This method encourages students to systematically analyze online health resources by considering when the information was published, whether it is relevant to their needs, who authored it and their credentials, whether the information is supported by evidence, and the intent behind the publication.

Additionally, students should be introduced to alternative frameworks such as the PROMPT (Presentation, Relevance, Objectivity, Method, Provenance, Timeliness) and DISCERN criteria, which provide more nuanced ways to critically assess medical content. To enhance their evaluation skills, students should engage in hands-on exercises where they compare multiple sources, identify red flags in unreliable health information, and practice using research databases to cross-verify claims. These techniques empower future healthcare professionals to navigate the digital health landscape with confidence and ensure that they base their clinical decisions on the most credible and accurate data available.

- Fact-Checking Tools: Encouraging the use of verification tools and automated AI-driven fact-checking services can help students verify the credibility of digital health information. Encouraging students to integrate these tools into their research process helps them develop a habit of verifying claims, reducing the risk of propagating inaccurate or misleading health information.
- Understanding Biases: Educating students on algorithmic biases that may affect search rankings is essential for ensuring critical evaluation of online health information. Search engines and Social Media platforms use algorithms that prioritize content based on factors like user engagement, popularity, and paid promotions, rather than accuracy or scientific credibility. As a result, students may be exposed to biased or misleading health information that appears more credible due to its high ranking in search results. Additionally, personalized search algorithms create filter bubbles, limiting users to content that aligns with their previous interactions, which can reinforce misinformation and hinder exposure to diverse perspectives.

Key Takeaways

- Impostor syndrome holds you back – Doubting your abilities may stop you from using electronic health tools.
- You can overcome it – With peer support, reflection, and encouragement, confidence grows.
- Believe in yourself – Self-efficacy (believing you can do it) leads to stronger electronic health skills.
- You can build confidence – Practice, small wins, and mentorship help boost self-belief.
- Trustworthy sources are key – Learning how to spot credible websites saves time and protects your health.
- Watch out for bias – Search engines and Social Media may show what's popular, not what's true.
- Keep checking sources – Make it a habit to question, compare, and confirm any online health information.

References

1. McGarry, P., & Stevens, K. (2022). The clandestine cost of feeling like a fake: Impostor syndrome and digital health literacy. Medical Education, 56(4), 312-320. https://doi.org/10.1093/eurpub/ckab165.145
2. Patel, V., Johnson, H., & Lee, S. (2023). The reluctance to adopt AI-driven diagnostic tools among medical trainees: The role of impostor syndrome. Artificial Intelligence in Medicine, 78, 200-214. https://doi.org/10.1016/j.tele.2024.102228
3. Jeon, H., & Kim, S. (2022). The mediating effects of digital literacy and self-efficacy on e-health literacy among nursing students. Nursing Education Today, 102, 105378. https://doi.org/10.1016/j.nedt.2022.105378
4. Brown, J., Smith, R., & Taylor, K. (2023). The impact of targeted digital literacy programs on self-efficacy among medical students. Journal of Medical Education Research, 45(2), 110-125. https://doi.org/10.1016/j.medres.2023.100130
5. Lee, C., & Chang, D. (2020). Algorithmic bias and misinformation in digital health platforms: Implications for medical education. Journal of Digital Health Literacy, 12(3), 155-168. https://doi.org/10.1016/j.digiheal.2020.104037
6. Smith, R., Kim, Y., & Hernandez, M. (2021). Verifying information in online health communities: The role of digital health literacy. Journal of Online Health Communication, 18(5), 88-102. https://doi.org/10.2196/47595

Chapter 4. Assessment Instruments

To assess eHL skills, various measurement tools have been developed. These instruments evaluate an individual's ability to locate, understand, and use digital health information effectively. Regular assessments using these tools can help students and other interested entities to identify knowledge gaps and implement targeted interventions to improve eHL skills.

1. Assessment instruments for eHL

Several validated instruments are widely used to assess eHL, including:

- **eHEALS (eHealth Literacy Scale)** measures the perceived eHL ability, focusing on an individual's confidence in using online health information. The eHealth Literacy Scale (eHEALS), developed by Norman and Skinner, is one of the most commonly used tools for assessing eHL [1]. It consists of eight self-reported items that measure an individual's confidence in using the internet to find and evaluate health information. eHEALS assesses key dimensions of eHL, including information-seeking skills, ability to differentiate between reliable and unreliable sources, and capacity to apply online health information to personal health decisions. Since its development, eHEALS has been translated into multiple languages and validated across diverse populations. However, a limitation of eHEALS is that it primarily focuses on perceived eHL rather than objectively measuring a person's actual abilities in navigating digital health environments.
- **E-HLS (Electronic Health Literacy Scale)** is a broad assessment tool that measures eHL across different health contexts [2].
- **eHLA (eHealth Literacy Assessment Toolkit)** is a comprehensive assessment tool designed to measure various dimensions of eHL skills [2].
- **DHLAT (Digital Health Literacy Assessment Tool)** focuses on assessing digital literacy skills in relation to health information access and use [2].
- **eHealth Literacy Questionnaire (eHLQ)** evaluates various dimensions of health literacy, including digital aspects [2].

- **DHLI (Digital Health Literacy Instrument)** evaluates digital competence in healthcare settings, particularly in evaluating online health information [2]. DHLI is a more comprehensive tool that assesses multiple aspects of eHL. Unlike eHEALS, DHLI includes performance-based tasks that evaluate individuals' actual ability to find, interpret, and apply digital health information. It covers several dimensions, such as information navigation, online communication with healthcare providers, privacy awareness, and critical evaluation of digital content. DHLI is particularly useful in identifying specific digital health literacy gaps within different demographic groups, such as older adults, low-income populations, or individuals with chronic illnesses. Because it includes both self-reported and task-based assessments, DHLI provides a more objective measure of eHL than eHEALS.
- **TeHLI (Transactional eHealth Literacy Instrument)** measures the ability to critically engage with and apply digital health information [2].
- **eHealth Literacy Framework (eHLF)**, introduced by Kayser et al., expands on previous models by integrating seven core dimensions of eHL. These include knowledge and skills in digital health, trust in digital health information, motivation to engage with eHealth, and the ability to actively participate in online health communities. eHLF emphasizes the importance of both individual and systemic factors in shaping eHL. Unlike eHEALS and DHLI, which focus primarily on user skills, eHLF considers how healthcare systems, digital platforms, and public policies contribute to eHL levels. This makes it particularly valuable for organizations and policymakers looking to design interventions that enhance eHL on a broader scale [2].

The eHL assessment instruments

E-HLS
- Communication
- Trust
- Action

eHEALS- eHealth Literacy Scale
- Traditional literacy
- Media literacy
- Information literacy
- Computer literacy
- Science literacy
- Health literacy

eHLA- eHealth Literacy Assessment Toolkit
- Information need identification and question formulation
- Information search
- Information assessment
- Information management

DHLI- Digital Health Literacy Instrument
- Operational skills
- Navigation skills
- Information searching
- Evaluating reliability
- Determining relevance
- Adding content
- Privacy

DHLAT- Digital Health Literacy Assessment Tool
- Functional health literacy
- Health literacy self-assessment
- Familiarity with health and health care
- Knowledge of health and disease
- Technology familiarity
- Technology confidence
- Incentives for engaging with technology

TeHLI- Transactional eHealth Literacy Instrument
- Functional eHL
- Communicative eHL
- Critical eHL
- Translational eHL

eHLQ- eHealth Literacy Questionnaire
- Using technology to process health information
- Understanding health concepts and language
- Ability to actively engage with digital services
- Feel safe and in control
- Motivated to engage with digital services
- Access to digital services that work
- Digital services that suit individual needs

Source: [2]

Applying eHL instruments involves:

- Conducting self-assessments among students and healthcare professionals to identify their own strengths and weaknesses in eHL;
- Integrating assessment tools into medical curricula to ensure that future healthcare professionals develop strong eHL skills;
- Utilising results to design targeted eHL improvement programs, helping individuals enhance their ability to find and use digital health information effectively;
- Applying digital tools to track progress and provide personalised learning recommendations based on assessment outcomes;
- Implementing institutional policies to enhance digital health education and ensure that students are equipped with essential eHL skills before entering the workforce.

2. Assessment instruments for individual-specific factors

In the context of eHL, **impostor syndrome** undermines individuals' confidence in their ability to evaluate, interpret, and apply digital health information, potentially impairing decision-making and self-management behaviours in healthcare contexts [3].

Source: Generated with AI from Canva

The impostor syndrome assessment instruments

In addition to identification tools, cognitive-behavioural interventions have demonstrated success in mitigating impostor syndrome symptoms. These interventions emphasize reframing maladaptive thought patterns, promoting self-reflection, and strengthening self-efficacy.

Mindfulness-based approaches have also shown promise in reducing impostor-related anxiety, as they foster present-moment awareness and help individuals detach from self-critical thoughts. Encouraging peer support through group-based interventions can further validate personal experiences, reducing feelings of isolation and promoting a more confident engagement with digital health resources [8].

In eHL, **self-efficacy** determines how confidently users search for, evaluate, and apply health information obtained online.

The self-efficacy assessment instruments

Bandura's Self-Efficacy Scales [9]

Academic Self-Efficacy Scale
It consists of items that assess beliefs about completing academic tasks such as reading, writing, problem-solving, and time management

Self-Efficacy for Health Behaviors
This scale includes items about managing behaviors like stress, physical activity, and health maintenance

General Self-Efficacy Scale (GSE) [10]
It consists of 10 items rated on a 4-point Likert scale, assessing an individual's perceived ability to overcome difficulties.

3. Assessment instruments for context-specific factors

With the growing reliance on digital platforms for health information, evaluating the credibility of sources has become a fundamental skill in eHL.

Evaluating digital health sources requires assessing multiple criteria:

- Author Credentials: Are the contributors qualified professionals in the relevant healthcare field?
- Peer Review and Editorial Oversight: Is the content supported by peer-reviewed evidence or published by a reputable institution?
- Publication Date and Updates: Is the information current, particularly for fast-evolving medical fields like infectious diseases or mental health treatments?
- Evidence-Based Claims: Does the source cite credible research, clinical guidelines, or medical experts?

Source credibility assessment instruments

Several other validated tools are designed to guide users in assessing the reliability of digital health information.

The **DISCERN tool**, developed by Charnock et al. [15], is a widely recognized instrument for evaluating the quality of consumer health information. It assesses criteria such as clarity in treatment options, impartial presentation of benefits and risks, and evidence supporting medical claims. DISCERN is particularly useful for evaluating websites, health brochures, and educational materials intended for public consumption.

The CRAAP test [16] offers another effective framework. Originally designed for academic research, CRAAP evaluates five key factors:

- Currency: Is the information recent and regularly updated?
- Relevance: Does the content address the user's specific healthcare needs?
- Authority: Are the authors qualified in the relevant medical field?
- Accuracy: Are the claims evidence-based and cross-referenced with credible sources?
- Purpose: Is the content intended to inform rather than persuade or promote?

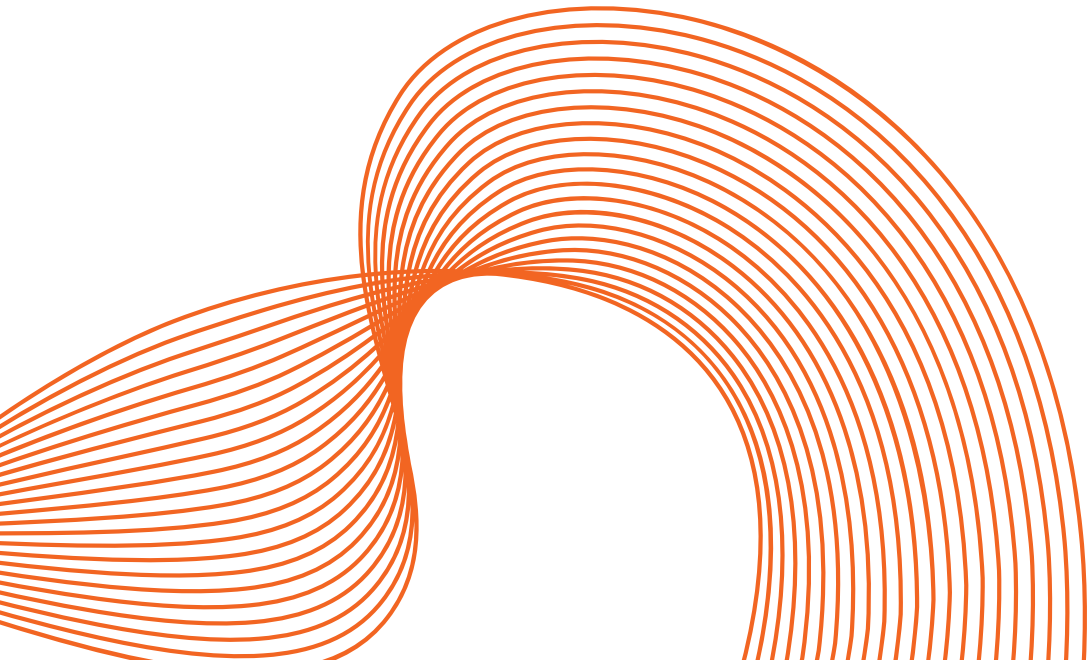
Another key resource is the **Health On the Net (HONcode)** certification, which verifies websites that adhere to strict publishing standards. Platforms displaying the HONcode seal meet criteria for transparency, accuracy, and adherence to ethical health communication practices. Studies indicate that individuals, who rely on HONcode-certified websites demonstrate improved trust in digital health resources [17].

Reflection Questions

- How confident are you in self-assessing your own eHL level? What instruments or methods would you use?
- When interpreting results from an eHL assessment tool, how would you ensure that individual-specific factors such as self-efficacy or impostor syndrome are adequately considered?
- How would you explain the purpose and value of an eHL assessment tool to a patient or a peer with limited digital skills?

Key Takeaways

- There are tools to measure your eHL – Try tools like eHEALS or DHLI to get a snapshot of your eHL skills.
- Measure your confidence – Assess your impostor syndrome and self-efficacy to understand your mindset.
- Check how you judge information – Some tools measure your ability to evaluate health websites and sources.
- Know where you stand – Self-assessment shows you what you're doing well and where to improve.
- Use different methods – Combine surveys with real-life case practice for a full picture.
- Compare with peers – Knowing how others perform can give you insight and motivation.
- Track your progress – Reflect regularly on how your skills grow over time.



References

1. Norman, C. D., & Skinner, H. A. (2006). eHEALS: The eHealth Literacy Scale. Journal of Medical Internet Research, 8(4), e27. https://doi.org/10.2196/jmir.8.4.e27
2. Lee, J., Lee, E. H., & Chae, D. (2021). eHealth literacy instruments: Systematic review of measurement properties. Journal of Medical Internet Research, 23(11), e30644. https://doi.org/10.2196/30644
3. Clance, P. R., & Imes, S. A. (1978). The impostor phenomenon in high-achieving women: Dynamics and therapeutic intervention. Psychotherapy: Theory, Research, & Practice, 15(3), 241–247. https://doi.org/10.1037/h0086006
4. Clance, P. R. (1985). The impostor phenomenon: Overcoming the fear that haunts your success. https://openlibrary.org/books/OL2554807M/The_impostor_phenomenon
5. Harvey, J. C. (1981). The impostor phenomenon and achievement: A failure to internalize success (Unpublished doctoral dissertation). Temple University.
6. Wrench, A., Padilla, M., O'Malley, C., & Levy, A. (2024). Impostor phenomenon: Prevalence among first-year medical students and strategies for mitigation. Heliyon, 10(8), e29478. https://doi.org/10.1016/j.heliyon.2024.e29478
7. Leary, M. R., Patton, K. M., Orlando, A. E., & Funk, W. W. (2000). The impostor phenomenon: Self-perceptions, reflected appraisals, and interpersonal strategies. Journal of Personality, 68(4), 725–756. https://doi.org/10.1111/1467-6494.00114
8. Schunk, D. H. (2003). Self-efficacy for reading and writing: Influence of modeling, goal setting, and self-evaluation. Reading & Writing Quarterly, 19(2), 159–172. https://doi.org/10.1080/10573560308219
9. Nurhikmah H., N., & Nurhikmah, H. (2019). Analysis on students' computer self-efficacy instrument. https://doi.org/10.2991/icet-19.2019.158
10. Luszczynska, A., Scholz, U., & Schwarzer, R. (2005). The General Self-Efficacy Scale: Multicultural validation studies. The Journal of Psychology, 139(5), 439–457. https://doi.org/10.3200/JRLP.139.5.439-457
11. McCroskey, J. C., & Teven, J. J. (1999). Goodwill: A reexamination of the construct and its measurement. Communication Monographs, 66(1), 90–103. https://doi.org/10.1080/03637759909376464
12. Berlo, D. K., Lemert, J. B., & Mertz, R. J. (1969). Dimensions for evaluating the acceptability of message sources. Public Opinion Quarterly, 33(4), 563–576. https://doi.org/10.1086/267745
13. Ohanian, R. (1990). Construction and validation of a scale to measure celebrity endorsers' perceived expertise, trustworthiness, and attractiveness. Journal of Advertising, 19(3),39–52. https://doi.org/10.1080/00913367.1990.10673191
14. Pornpitakpan, C. (2004). The persuasiveness of source credibility: A critical review of five decades' evidence. Journal of Applied Social Psychology, 34(2), 243–281. https://doi.org/10.1111/j.1559-1816.2004.tb02547.x
15. Charnock, D., Shepperd, S., Needham, G., & Gann, R. (1999). DISCERN: An instrument for judging the quality of written consumer health information on treatment choices. Journal of Epidemiology & Community Health, 53(2), 105–111. https://doi.org/10.1136/jech.53.2.105
16. University of Chicago Library. (n.d.). CRAAP test – Evaluating resources and misinformation. Library Guides at UChicago. https://guides.lib.uchicago.edu
17. Lewandowsky, S., Ecker, U. K. H., & Cook, J. (2017). Beyond misinformation: Understanding and coping with the "post-truth" era. Journal of Applied Research in Memory and Cognition, 6(4), 353–369. https://doi.org/10.1016/j.jarmac.2017.07.008

Chapter 5. Strategies for eHL enhancement

1. Strategies to improve eHL at an individual level

Improving eHL at the individual level requires a combination of education, critical thinking, and access to reliable health information. One of the most effective strategies is participation in training programs and eHL courses, which help individuals develop the skills needed to navigate and use digital health resources effectively.

The key factors that influence eHL at an individual level of medical and allied health students focus on Impostor Syndrome, self-efficacy, and source credibility. Each of these factors plays an essential role in shaping students' ability to navigate, critically assess, and apply digital health resources effectively in both their education and future professional practice.

- **Impostor Syndrome** contributes to self-doubt, limiting students' willingness to engage with digital heath tools and reducing their confidence in interpreting and utilizing eHealth information. This psychological barrier can result in the avoidance of essential learning experiences, hindering the development of digital competencies required in modern healthcare.
- **Self-efficacy** significantly influences whether students take an active role in exploring digital resources. Higher self-efficacy is linked to proactive engagement with eHealth tools, critical evaluation of medical information, and the ability to adapt to evolving digital healthcare landscapes. Conversely, students with low self-efficacy may hesitate to engage with digital health technologies, reinforcing skill gaps that affect their future professional practice.
- **Source credibility assessment** is a vital component of eHL, ensuring that students and professionals rely on accurate, evidence-based medical information. However, challenges arise from algorithmic biases in search engines and social media platforms, which often prioritize content based on engagement rather than scientific credibility. This makes it essential for students to develop critical appraisal skills to distinguish between reliable and misleading sources.

The following **strategies** may be applied by **any student** to enhance their eHL level:

- Use credible medical sources such as PubMed, Cochrane Library, Medline Plus, and WHO for research;
- Apply the CRAAP test (Currency, Relevance, Authority, Accuracy, Purpose) to assess online health content (see the Appendix);
- Learn advanced search strategies using Boolean operators for efficient database navigation;
- Stay Updated on Emerging Digital Health Technologies
  - Follow updates on AI in healthcare, telemedicine, wearable health devices, and mobile health apps;
  - Enroll in online courses on digital health (e.g., Coursera);
  - Participate in workshops on digital diagnostics and AI-driven clinical decision support systems.
- Practice Using Telemedicine Platforms
  - Learn how to conduct virtual patient consultations through telehealth platforms;
  - Focus on digital communication skills, including telehealth principles and remote patient engagement;
- Critically Evaluate Online Health Information
  - Identify bias and misinformation in online medical content, especially on Social Media;
  - Follow trusted health organizations (CDC, WHO, NIH, ECDC) for accurate public health updates;
  - Learn to recognize predatory journals and unreliable health blogs;
- Engage with Digital Health Tools and Apps
  - Use clinical decision-support tools in daily study routines;
  - Test patient education apps to better understand digital health management;
  - Explore AI-driven diagnostics to understand the role of AI in clinical decision-making.
- Participate in eHL Training Programs
  - Attend university-led eHL workshops;
  - Join student-led peer mentoring programs focused on eHL;
  - Participate in MOOCs (Massive Open Online Courses) on digital health;

- Improve Cybersecurity Awareness & Ethical Considerations
  - Learn about GDPR regulations to ensure patient data privacy;
  - Understand cybersecurity best practices to prevent breaches when handling electronic health records (EHRs);
  - Engage in discussions about ethics in AI-driven healthcare.
- Engage in eHealth Research & Community Projects
  - Collaborate on research projects about digital health adoption and its impact on patient care;
  - Work on community outreach programs to teach patients and patient families how to evaluate online medical information;
- Contribute to Digital Communication and Patient Education Skills
  - Learn how to explain complex medical terms in simple, patient-friendly language;
  - Use infographics, videos, and mobile apps to educate patients on digital health topics;
  - Role-play digital patient interactions to build confidence in online medical consultations;
- Advocate for eHL Among Peers
  - Form student discussion groups on eHL challenges and solutions;
  - Collaborate with faculty to enhance digital health curriculum integration;
  - Promote awareness about the importance of eHL in clinical practice.

2. The eHL Learning Organization

As many eHL strategies at individual level cannot be assessed, unless supported by an organization or an institution, it was concluded that there is a necessity for integrating digital health skills into universities' curriculum [1]. This integration not only prepares students for future professional roles, but also empowers them to surpass the complexities of accessing accurate online health information [2].

By integrating eHL strategies into medical and allied health education, institutions can contribute and encourage students to confidently recognize biases in the digital content, and take accurate and reliable decisions, transforming the education institution into **eHL Learning Organization**.

The eHL Learning University aims to build students' confidence, and equip them with the necessary skills to critically determine and apply health information in their daily lives, as well as in their future professional careers. Training medical and allied health students in eHL is essential for ensuring they can effectively support patients and peers in using digital health tools. They should be equipped with the knowledge to guide patients in using telemedicine platforms, accessing digital health records, and distinguishing credible online health information. By developing patient-centred digital health applications that are intuitive, multilingual, and accessible to diverse populations can enhance the usability of eHealth services and ensure more equitable healthcare access.

To strengthen eHL among medical and allied health students, educational institutions, be they universities or other types of entities, should implement comprehensive strategies that integrate digital health education, psychological support, and practical skills development.

The key strategies that aim to improve eHL at the educational organization's level are:

- **Integrate digital health education into curricula:**

Develop structural courses covering eHL, including the use of electronic health records (EHRs), telemedicine platforms, and evidence-based online research tools. This approach can be explored by using different education methods, as follows:

- *Task-based:* guided exercises about digital health platforms allow students to develop step-by-step competencies;
- *Interactive case studies:* presenting students with real-world scenarios, where they should evaluate online health information;
- *Role-play exercises:* simulating healthcare situations in which students have to apply eHL skills [3]. By simulating patient interactions, where students must use eHealth technologies to collect and deliver health information, learners will experience enhanced compentencies in both technical and interpersonal skills. In addition, integrating *simulated learning experiences* [4], allows students to gain hands-on experience in searching for health information online and evaluating its relevance and reliability. This active learning embodies the critical components of eHL, thereby enhancing students' skills to make informed health decisions in real life.

- *Gamification:* By incorporating game-like elements, such as rewards, achievements, and levels, into health-related digital platforms, users are motivated to engage more deeply with the content. For instance, interactive quizzes, challenges, and simulations can help users practice health decision-making in a fun and engaging way. Gamification not only improves knowledge retention but also encourages behavioural change, as users are more likely to continue learning and applying new health information when it is presented in an enjoyable format. This strategy is particularly effective among younger audiences, but can be adapted to all age groups by focusing on topics of interest and ensuring accessibility and inclusivity.
- *Digital storytelling for eHL education*: Another innovative strategy for improving eHL is digital storytelling, which involves using narrative techniques to share health-related information in an engaging, emotional, and relatable way. By integrating multimedia elements- such as videos, animations, and personal testimonials- digital storytelling can make complex health topics more understandable and memorable. For example, stories of patients managing chronic diseases or healthcare providers explaining medical procedures in an accessible way can demystify medical concepts and help individuals relate to the information on a personal level. Visual aids, diagrams, and interactive elements further support learning by catering to different learning styles, making the experience both informative and enjoyable.

- Implement blended learning methods, combining online modules with hands-on digital tool training
  - *Incorporating digital tools such as mobile health applications and e-learning platforms into learning processes* can significantly enhance students' eHL. Research by Jiang et al. recommends the integration of eHL in health education programs to support holistic learning and better overall health outcomes [5]. By training students to use these tools effectively, healthcare providers can feel more confident in their abilities to manage patient care digitally.

- *Facilitating workshops* which focus on the utility of online health resources can help students develop the ability to discern credible health information. Aydınlar et al. found that first-year nursing students exhibited high levels of eHL in specific areas, suggesting that workshops aimed at teaching effective navigation and critical assessment of digital health resources would benefit students across disciplines [6]. Interactive sessions that utilize case studies and real-world scenarios will enhance engagement and retention of skills.

Encourage the inclusion of digital health case studies and interactive assignments to ensure that students gain practical experience.

- *Peer-led eHL Workshops:* Universities can implement workshops led by trained peers to foster a supportive learning environment among students. The interventions from Hsu et al. indicate that peer-led education can effectively enhance eHL by helping students navigate online health resources and apply their knowledge in real-world contexts, ultimately promoting healthier behaviors [7]. These workshops address common challenges students face when searching for reliable health information online and provide them with practical skills to evaluate the credibility of health resources.
- *Collaborating with library services* to create modules that teach students about health information sources can enhance their eHL. Libraries can offer workshops on finding and evaluating scholarly health information online. As noted by Coleman et al., educational competencies regarding health literacy should be included in training for students [8]. This integration helps students to better navigate the vast array of information available, ensuring that they select valid and reliable resources.
- Establishing digital resource centers through university departments can provide students ongoing access to filtered high-quality health information. According to Rosário et al., health literacy activities should target university resources to develop health literacy courses for students [9]. Resource centers can house digital tools, internet access, and trained staff to assist students in finding and interpreting health-related information.

- *Regular Curriculum Review and Updates:* Continuous evaluation and adaptation of the eHL curriculum based on evolving health technologies and student needs are vital. As noted by Frings et al., changes in the landscape of eHL necessitate adaptive curriculum strategies that address emerging trends [10]. By setting expectations for regular curriculum reviews informed by current research and technological advancements, institutions can foster a more responsive learning environment.

Address psychological barriers to digital learning:

- Establish mentorship programs where experienced faculty members or senior students can guide peers in overcoming Impostor Syndrome.
- Provide workshops on self-confidence, cognitive reframing, and strategies for dealing with self-doubt in digital learning.
- Create peer support networks and safe spaces where students can openly discuss challenges related to digital health competency.

Enhance self-efficacy through hands-on learning:

- Implement problem-based learning scenarios that require students to navigate digital health platforms in real or simulated environments.
- Use simulation training, including virtual reality (VR) and artificial intelligence-driven case studies, to reinforce practical experience.
- Encourage students to engage in self-directed digital learning projects to build autonomy and digital fluency.

Strengthen source evaluation skills:

- Introduce structured training on evaluating online health information using frameworks such as CRAAP (Currency, Relevance, Authority, Accuracy, Purpose) and DISCERN.

Raise awareness of algorithmic biases and misinformation risks:

- Educate students about the impact of search algorithms on information credibility and teach them how to adjust search settings to access more reliable content.
- Encourage the use of academic search engines such as PubMed, Google Scholar, and Cochrane Library over general search engines for medical research.
- Provide eHL training on recognizing echo chambers, filter bubbles, and targeted misinformation in Social Media and digital health platforms.

- Practical Assessments and Feedback Mechanisms: It is crucial to implement assessment strategies that evaluate students' eHL skills throughout their educational journey. As articulated in the work by Machleid et al., ongoing assessments can reveal gaps in students' eHealth knowledge and guide curriculum improvements [11]. For example, formative assessments, such as quizzes or practical presentations utilizing digital resources, can provide insights into students' proficiency levels and help educators tailor future instruction accordingly.

Foster interdisciplinary collaboration:

- Encourage partnerships with experts in fields such as data science, journalism, and ethics to offer a comprehensive understanding of eHL.
- Organize interdisciplinary workshops that involve professionals from different fields to discuss the intersection of healthcare, technology, and digital information ethics.
- Develop collaborative projects that integrate digital health solutions across multiple disciplines, preparing students for teamwork in real-world healthcare settings.

Parent and Community eHL Education:

Incorporating extracurricular activities that target local communities can provide students with opportunities to apply their eHL skills in real-world contexts. Turan et al. mention that nursing students' eHL positively affects various aspects of their health-promoting lifestyles, suggesting that teaching others can reinforce their learning [12]. Engaging students as community health educators can broaden their understanding of public health and enhance their practical skills.

By implementing these strategies, medical and allied health education programs can better prepare students to navigate the rapidly evolving digital health landscape. These interventions will ensure that students develop the necessary eHL skills to make informed, evidence-based decisions in their future practice, ultimately improving patient care and advancing healthcare innovation.

3. eHL Support Systems

At a broader societal level, increasing awareness of eHL is essential for improving public health outcomes. Public health initiatives, such as nationwide eHL campaigns and community-based workshops, can help raise awareness about the importance of eHL and equip people with the skills to use digital health resources responsibly. Universities, workplaces, and community centres can serve as important venues for teaching eHealth skills and promoting digital health awareness.

Government policies also play an essential role in ensuring equitable access to credible digital health resources. Policymakers should focus on reducing the digital divide by providing affordable internet access, funding eHL programs, and ensuring the availability of reliable online health information. Ethical considerations, such as data privacy, digital health accessibility for vulnerable populations, and the prevention of misinformation and disinformation, must also be integrated into eHL initiatives. By addressing these factors at the societal level, countries can build a more informed and health-literate population, leading to better healthcare engagement and improved public health outcomes.

The Standing Committee of European Doctors (CPME) advocated for successful implementation of the European Health Data Space (EHDS), that will require coordinated efforts from all stakeholders, considering the varying levels of digitalization across Member States, the diverse digital skills of healthcare professionals, and differing public attitudes toward health data sharing [13]. While harnessing health data can drive innovation and improve healthcare delivery, it must not lead to inequitable access to care. Safeguarding medical confidentiality, privacy, and individual consent must remain central to the secondary use of electronic health data. Additionally, ensuring that new digital processes do not impose excessive administrative burdens or costs on healthcare professionals is crucial. EHDS should stimulate practical solutions that will enhance patient care while maintaining ethical and professional standards.

A health literacy system capacity framework (Fig. 7) encompasses several components: workforce, organizational structures, research and knowledge development, financial resources, partnerships, leadership and good governance, technology and innovation as well as people-centredness based on user engagement and enabling environments [14].

- *Health literate workforce* is important because improving the sensitivity and responsiveness of clinicians and health service management to the impact of low health literacy helps to minimize disadvantages and health outcomes;
- *Health literacy leadership* can be characterized by management-buy-in, pioneer spirit, endurance, persistence and confidence that health literacy is a public good. It is encouraged to include health literacy management skills as part of education and professional development.

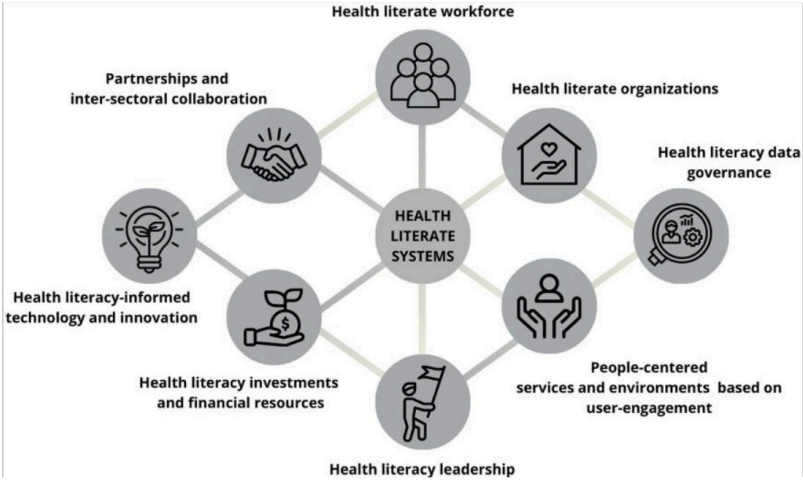


Fig. 7. Building health literacy system capacity: a framework for health literate systems
Source: [14]

- *Health literate organizations* can be based on the next attributes: leadership, integration of health literacy in planning and evaluation, a health literate workforce, user engagement in design and implementation, avoiding stigma, health literate communication skills and strategies, easy access to information and services, easy understandable and enabling designs, meeting the needs of users in high-risk situations, and transparency about costs and coverages;
- *Health literacy data governance* is a necessary part of the operation of health systems today. Health literacy analytics is important to inform the development of health literacy policy and practice. The development and integration of health literacy as a key performance indicator and health literacy data governance includes data availability, usability, consistency, integrity and security as part of health literacy systems' capacity and it is an important challenge to accomplish as part of health literacy systems' capacity;
- *Health literacy-informed technology and innovations* become a way to influence digital and technical developments for the public good. In the digital era, it is critical not just to provide the information but also support tools to help receivers seek, evaluate and analyse the quality of information that are important to improve health literacy and health;

- *People-centred services* based on user engagement and enabling environments are more effective, cost less, improve health literacy system capacity health literacy and patient engagement, and are better prepared to respond to health crises. Thus, integrated people-centred health services place people and communities, not diseases, at the centre of health systems, and empower people to take charge of their own health rather than being passive recipients of services. Health literacy informs patients and providers to co-produce health and engage in shared decision-making by focusing on the communication and deliberation process during a healthcare;
- *Partnerships and inter-sectoral collaboration* can be used to increase through the creation of formal and informal partnerships; joint ventures and public-private partnerships. A wide range of health literacy partnerships and collaborations are already present in the form of interest groups, networks and platforms within the health literacy field. Health literacy partnerships involving public and private stakeholders, communities and the civic society can enhance the impact of health literacy to ensure that the most disadvantaged population groups are reached;
- *Health literacy investments and financial resources* refers to the generation of financial resources and resource allocation, through tax and treasury, insurance and donations. Health systems vary within and between countries which means that financial resources are distributed differently. The cost effectiveness of health literacy and its social and economic return on investment is a growing area of interest based on the added value of interventions, campaigns and programmes.

The key strategies to improve eHL at a supporting systems' level are:

- *Caregiver and Peer Support Systems*: Social support systems such as caregivers, peers, or educators can significantly enhance eHL, particularly among vulnerable populations, including those with disabilities. Personalized interventions aimed at enhancing social support significantly improve health-related decision-making for individuals with low cognitive abilities [15]. Training caregivers and peers to offer accurate health information can foster a supportive environment that actively enhances individuals' ability to navigate health resources.

- *Clinical Practice Protocols for eHL*: Integrating eHL assessments and training into healthcare protocols can enhance healthcare professionals' ability to support patients effectively [16]. This necessitates embedding eHL perspectives into institutional policies, guidelines, and training modules.
- *Workplace eHL Programs:* Implementing eHL initiatives within organizational environments can mediate the relationship between individual eHL and wellbeing [17]. Such programs can educate employees about the use of digital health resources, enhance communication skills, and foster supportive work cultures that prioritize health literacy. Strategic leadership plays a vital role in promoting these initiatives successfully.
- *Patient-Centric Health Information Systems:* Systems that prioritize patient engagement through clear communication and user-friendly interfaces can enhance eHL. Models focusing on comprehensive eHL interventions empower patients to effectively manage their care [18]. By building platforms that facilitate easy access to information, patients become more empowered to make informed decisions about their health.
- *Community Health Literacy Initiatives:* Programs that engage community members in learning about eHL can bridge the gap between health services and the population. The effectiveness of community-based interventions cultivates eHL through peer education and collaboration with healthcare providers [19]. Initiatives that target specific community needs can have significant positive effects on overall public eHL.
- *Educational Campaigns for Digital Health Tools:* Regular educational campaigns focused on the use of digital health tools can foster greater awareness and understanding of eHealth resources. Improving eHL, particularly in online contexts, became especially crucial during the pandemic [20]. Such campaigns can target specific populations, ensuring that individuals understand how to access and utilize digital health services effectively.

Reflection Questions

- Which individual-level eHL enhancement strategy do you find most impactful, and how would you apply it in your future professional practice?

- In your opinion, what role should universities play in fostering organizational-level eHL?
- What barriers do you foresee when implementing electronic health education programs in your institution? How might they be addressed?
- How can digital tools be integrated into patient education in a way that promotes empowerment rather than dependency?
- What are some ways to measure the success of an eHL support system in a healthcare organization?
- Have you observed or experienced a 'learning organization' in action in a healthcare context? What elements made it effective (or ineffective)?
- How would you tailor eHL improvement strategies for underserved or vulnerable populations in your community?
- Which ethical concerns might arise when promoting eHL through digital platforms, and how would you address them?

Key Takeaways

- Start with yourself – Learn to use tools, evaluate sources, and communicate digitally about health.
- Work on your mindset – Address impostor feelings and build belief in your digital skills.
- Boost your confidence – Set small goals, practice regularly, and celebrate progress.
- Get support from your institution– Push for eHL training and resources in your curriculum.
- Help each other – Peer-led workshops and study groups build everyone's skills.
- Create a supportive space – Educational institutions and communities should offer user-friendly technology and guidance.
- Keep learning – eHL isn't a one-time thing—it grows with you throughout your life and career.

References

1. Mather, C., Cheng, C., Douglas, T., Elsworth, G., & Osborne, R. (2022). eHealth literacy of Australian undergraduate health profession students: A descriptive study. International Journal of Environmental Research and Public Health, 19(17), 10751. https://doi.org/10.3390/ijerph191710751
2. Kim, S., & Jeon, J. (2020). Factors influencing eHealth literacy among Korean nursing students: A cross-sectional study. Nursing and Health Sciences, 22(3), 667-674. https://doi.org/10.1111/nhs.12711
3. Allenbaugh, J., Spagnoletti, C. L., Rack, L., Rubio, D., & Corbelli, J. (2019). Health literacy and clear bedside communication: A curricular intervention for internal medicine physicians and medicine nurses. MedEdPORTAL, 15, 10795. https://doi.org/10.15766/mep_2374-8265.10795
4. Wang, K., Gao, X., Sun, F., & Bishop, N. J. (2021). eHealth literacy and caregiver burden among Chinese caregivers of older adults with cognitive impairment: Does education matter? Journal of Applied Gerontology, 40(12), 1837–1845. https://doi.org/10.1177/0733464820957151
5. Jiang, S., Ng, J., Choi, S., & Ha, A. (2024). Relationships among eHealth literacy, physical literacy, and physical activity in Chinese university students: Cross-sectional study. Journal of Medical Internet Research, 26, e56386. https://doi.org/10.2196/56386
6. Aydınlar, A., Mavi, A., Kütükçü, E., Kırımlı, E., Alış, D., Akın, A., ... & Altıntaş, L. (2024). Awareness and level of digital literacy among students receiving health-based education. BMC Medical Education, 24(1). https://doi.org/10.1186/s12909-024-05025-w
7. Hsu, W., Chiang, C., & Yang, S. (2014). The effect of individual factors on health behaviors among college students: The mediating effects of eHealth literacy. Journal of Medical Internet Research, 16(12), e287. https://doi.org/10.2196/jmir.3542
8. Coleman, C., Hudson, S., & Maine, L. (2013). Health literacy practices and educational competencies for health professionals: A consensus study. Journal of Health Communication, 18(sup1), 82-102. https://doi.org/10.1080/10810730.2013.829538
9. Rosário, J., Raposo, B., Santos, E., Dias, S., & Pedro, A. (2024). Efficacy of health literacy interventions aimed to improve health gains of higher education students —A systematic review. BMC Public Health, 24(1). https://doi.org/10.1186/s12889-024-18358-4
10. Frings, D., Sykes, S., Ojo, A., Rowlands, G., Trasolini, A., Dadaczynski, K., Orkan, O., & Wills, J. (2022). Differences in digital health literacy and future anxiety between health care and other university students in England during the COVID-19 pandemic. BMC Public Health, 22(1). https://doi.org/10.1186/s12889-022-13087-y
11. Machleid, F., Kaczmarczyk, R., Johann, D., Balčiūnas, J., Atienza- Carbonell, B., Maltzahn, F., & Mosch, L. (2020). Perceptions of digital health education among European medical students: Mixed methods survey. Journal of Medical Internet Research, 22(8), e19827. https://doi.org/10.2196/19827
12. Turan, N., Özdemir, N., Çulha, Y., Aydın, G., Kaya, H., & Aştı, T. (2020). The effect of undergraduate nursing students' eHealth literacy on healthy lifestyle behaviour. Global Health Promotion, 28(3), 6-13. https://doi.org/10.1177/175797592096044

13. Standing Committee of European Doctors (CPME). (n.d.). European doctors' reaction to European health data space agreement. https://www.cpme.eu/news/european-doctors-reaction-to-european-health-data-space-agreement
14. Sørensen, K., Levin-Zamir, D., Duong, T. V., Okan, O., Brasil, V. V., & Nutbeam, D. (2021). Building health literacy system capacity: A framework for health literate systems. Health Promotion International, 36(Suppl_1), i13–i23. https://doi.org/10.1093/heapro/daab153
15. Nam, H., Lee, S., Park, H., Kim, B., & Yoon, J. (2023). A mixed-method systematic literature review of health literacy interventions for people with disabilities. Journal of Advanced Nursing, 79(12), 4542-4559. https://doi.org/10.1111/jan.15805
16. Simkins, J., Breakwell, R., & Kumar, K. (2023). Physiotherapists' views and experiences of health literacy in clinical practice. Musculoskeletal Care, 21(4), 1204-1212. https://doi.org/10.1002/msc.1800
17. Lindert, L., Choi, K., Pfaff, H., & Zeike, S. (2023). Health literacy at work – Individual work and organizational health literacy, health- supporting leadership, and employee wellbeing. BMC Health Services Research, 23(1). https://doi.org/10.1186/s12913-023-09766-0
18. Geboers, B., Reijneveld, S., Koot, J., & Winter, A. (2018). Moving towards a comprehensive approach for health literacy interventions: The development of a health literacy intervention model. International Journal of Environmental Research and Public Health, 15(6), 1268. https://doi.org/10.3390/ijerph15061268
19. Kaper, M., Winter, A., Bevilacqua, R., Giammarchi, C., McCusker, A., Sixsmith, J., Koot, J.A.R., & Reijneveld, S. (2019). Positive outcomes of a comprehensive health literacy communication training for health professionals in three European countries: A multi-centre pre-post intervention study. International Journal of Environmental Research and Public Health, 16(20), 3923. https://doi.org/10.3390/ijerph16203923
20. Arigorat, E., Begonia, K., Franklin, M., & Honsky, J. (2024). Assessment of electronic health literacy among Filipino Americans. CIN: Computers, Informatics, Nursing, 42(7), 530-536. https://doi.org/10.1097/cin.0000000000001140

Conclusion. The future of eHL in healthcare

The future of eHL is closely intertwined with the ongoing evolution of emerging technologies, such as artificial intelligence (AI), machine learning, and personalized health interventions. As healthcare continues to embrace digital tools, it is crucial for individuals to develop advanced eHL to engage effectively with these innovations. A robust eHL allows people to navigate online health resources confidently, make informed health decisions, and improve patient self-care. To address challenges like the digital divide and misinformation, it is essential to embed eHL education at all levels, ensuring equitable access to digital health information and empowering individuals to take charge of their health. Collaboration between healthcare providers, technology developers, and educators is key to adapting eHL programs to the changing digital health landscape.

📌 **AI and machine learning**

Artificial intelligence (AI) and machine learning have the potential to revolutionize the way health information is presented to individuals, making it more personalized and accessible. AI-driven systems can analyse vast amounts of health data and provide tailored recommendations to patients, helping them make more informed health decisions. As AI becomes more prevalent, it will likely play an important role in empowering patients to understand their health conditions and take proactive steps towards better health management. However, it will be important to ensure that users have the necessary eHL skills to engage effectively with these systems.

📌 **Personalised eHL interventions**

As digital health tools continue to evolve, there is a growing focus on personalized interventions that cater to the individual needs of users. These interventions, powered by technologies like AI and data analytics, will offer tailored health advice, recommendations, and resources based on an individual's health history, preferences, and behavioural patterns. For example, personalized apps can send reminders for medication or provide advice based on a user's health data, such as exercise or diet. This level of customization requires a high level of eHL, as individuals will need to understand and navigate these digital platforms effectively.

Ethical standards for AI health systems

The rise of AI-driven health information systems raises important ethical considerations. As AI systems become more embedded in healthcare, there will be increased concerns about issues such as privacy, bias, and transparency. AI systems can process and interpret vast amounts of personal health data, but it is highly important that these systems are developed with ethical guidelines that protect users' privacy and ensure the accuracy of information. Moreover, bias in AI algorithms can lead to disparities in healthcare delivery, particularly among marginalized or vulnerable populations. As such, it is essential that digital health tools are designed in a way that is transparent and accessible to all, ensuring that eHL programs emphasize the ethical implications of AI use in healthcare.

The new trends regarding eHL development should focus on:

- *Technological evolution:* eHL must adapt to emerging tools like wearables, mobile health apps, and telemedicine;
- *New digital competencies:* Users need to develop skills to navigate digital platforms, evaluate tool reliability, and interact with AI-based health systems;
- *Beyond providing access to information:* eHL should include navigating complex digital environments and critically assess digital health content;
- *Public education:* Ongoing efforts are required to teach individuals how to effectively use digital health technologies;
- *Obtain better outcomes through eHL:* Enhancing eHL can lead to a more informed population and improved health results;
- *Overcoming barriers* includes differing levels of literacy and ethical concerns surrounding AI in healthcare and eHL;
- *Increasing the role of institutions:* Policymakers and healthcare providers must prioritize ethical use, infrastructure, and inclusive health education, in connection to eHL;
- *Equity focus:* Personalized strategies of eHL education can bridge gaps and ensure equitable access to digital healthcare benefits.

Glossary

- **Algorithm bias** refers to systematic and unfair discrimination that can arise from the design or training of algorithms, often leading to unequal treatment or outcomes for certain groups—especially based on race, gender, age, or socioeconomic status.
- **Clickbait** is a type of content (usually a headline or thumbnail) designed specifically to grab attention and entice people to click on it—often using sensational, misleading, or exaggerated language. The goal is to drive traffic to a webpage, video, or ad, not necessarily to deliver quality or truthful information.
- **Computer Literacy** means proficiency in using digital tools (e.g., EHRs, health apps) for information management and communication.
- **CRAAP Test** is a method to evaluate information sources based on: Currency, Relevance, Authority, Accuracy, and Purpose.
- **Critical thinking** is the ability to analyze, evaluate, and interpret information carefully and logically before accepting it or making decisions. It involves questioning assumptions, identifying biases, and considering evidence rather than just taking things at face value.
- **Cross-check information** means verifying the accuracy, reliability, and credibility of a piece of information by comparing it with multiple independent and trustworthy sources. It's a critical step in avoiding misinformation and making informed decisions.
- **Digital Divide** is the gap between demographics and regions that have access to modern digital technology and those that don't, impacting eHL.
- **Digital Health Literacy (DHL)** is a more recent term than eHL, encompassing the use of electronic tools and platforms to access, assess, and use health information in the digital age.
- **Digital Health Literacy Instrument (DHLI)** is a multidimensional assessment tool evaluating real-life eHL skills such as searching for, evaluating, and applying digital health information.
- **Disinformation** is false information that is deliberately created and spread with the intent to deceive or mislead people. Unlike misinformation, which can be shared unknowingly, disinformation is purposeful and often part of a strategy to manipulate public opinion, hide the truth, or cause harm.

- **Echo chamber effect** is a social and psychological phenomenon where people are exposed only to information, opinions, and beliefs that reinforce their existing views, while excluding or dismissing differing perspectives.
- **eHealth Literacy (eHL)** is the ability to seek, find, understand, appraise, and apply health information from electronic sources to address or solve a health problem.
- **eHealth services** refer to the use of digital technologies and electronic communication to provide, support, or improve healthcare and health-related services. They aim to make healthcare more accessible, efficient, and patient-centered by leveraging the internet, mobile apps, telemedicine, and other digital tools.
- **eHL Support Systems** are networks and environments—such as peers, caregivers, or institutions—that enhance individuals' capacity to develop eHL.
- **Electronic Health Records** are digital versions of patients' paper medical charts. They contain comprehensive health information about an individual and are designed to be shared securely among authorized healthcare providers to improve the quality and coordination of care.
- **Functional Literacy** means basic reading and writing skills needed to function effectively in everyday situations, including health contexts.
- **Health Literacy** is the capacity to obtain, process, and understand basic health information and services to make informed health decisions.
- **Health On the Net Code (HONcode)** is a certification that confirms websites follow ethical standards in health information dissemination.
- **Imposter Syndrome** is a psychological pattern in which individuals doubt their competencies and feel like frauds, relevant in self-assessing eHL confidence.
- **Information Literacy** is the ability to locate, evaluate, and use information effectively, especially from digital sources.
- **Lily Model** is a foundational model of eHL including six literacies: traditional, health, information, scientific, media, and computer literacy.
- **Media Literacy** is the ability to access, analyze, evaluate, and create media in various forms, crucial in discerning reliable from misleading health content.

- **Misinformation** is false or inaccurate information that is spread, regardless of whether there is intent to deceive. Unlike disinformation, which is deliberately misleading, misinformation can be shared by people who believe it's true but are actually mistaken.
- **Privacy Literacy** is the understanding of digital privacy rights and strategies to protect personal health data online.
- **Scientific Literacy** is the understanding of scientific concepts and processes necessary to interpret clinical studies and make informed health decisions.
- **Search engine** is an online tool or software designed to help users find information on the internet by typing keywords or phrases. It scans billions of web pages, indexes them, and ranks the most relevant results to show you.
- **Self-Efficacy** is an individual's belief in their ability to successfully perform tasks and manage situations, crucial for effective eHL engagement.
- **Source Credibility** suggests the assessment of the trustworthiness, expertise, and intent of digital health information providers.
- **Transactional Model of eHL** is a model outlining four levels of digital health competency: functional, communicative, critical, and translational literacy.

Disclaimer:
The Glossary was generated with AI based on the content of this eHL Handbook

Appendix
Source Credibility Checklist for Electronic Health Information

Use this checklist to assess whether an online health source is trustworthy and reliable:

1. Authority

- Is the author (sender of information) or organization clearly identified?
- Are credentials or expertise in health/Medicine obvious?
- Is the channel of information affiliated with a reputable institution (e.g., university, hospital, health agency, NGOs, other institutions)?

2. Currency

- Is the information up to date?
- Can you find a publication or last review date?
- Are statistics or data sources from recent years?

3. Accuracy

- Is the content backed by scientific research or peer-reviewed sources?
- Are sources or references clearly cited?
- Are claims consistent with what you've seen in academic or official materials?

4. Purpose

- Is the content educational or informational (not purely commercial)?
- Are there any obvious biases or persuasive language promoting products, services, ***ideas***?
- Is the goal to inform, sell or manipulate?

5. Objectivity

- Does the content present multiple viewpoints or acknowledge uncertainty?
- Are there disclaimers about medical advice or limitations?

6. Transparency & Privacy

- Is there a clear privacy policy, especially for interactive tools?

7. Verification

- Can you cross-check the information with other credible health sites (e.g., WHO, CDC)?
- Has the content been recommended by a healthcare provider or university?

Be cautious if:

- The content lacks identifiable authorship or institutional endorsement;
- There are no references or supporting evidence;
- It is used fear-based or exaggerated language.