Medical Education in the Digital Age - Benefits and Risks

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Abstract

The prophylactic and curative programs aim to use digital literacy as a tool to promote health education and to increase the accessibility and quality of health services. What is called "e-health" has become an important component of connecting health systems around the world. Variables such as cost, time, availability can be improved through the mechanism of digitization. Despite the benefits, there are a number of barriers, among which we mention the lack of digital literacy, reduced access to devices, user reluctance, and the danger of accessing scientifically unvalidated databases. Also an important risk factor is the vulnerability per se of these types of systems, which contain sensitive data about large categories of individuals. Apart from the risks and imperfections of actual digital health networks, the overall benefits of digital health networks cannot be minimized. Therefore, it is necessary to increase the literacy level of the population, in line with the current policies to be implemented by 2030. The aim of the study is to raise awareness among policy-makers and patients about the need for digital literacy. Through the current research we conducted an analysis of a total of 182 studies that we have identified in the PubMed database for the period 2005-2024. Data processing was performed using Microsoft Excel.The findings of the study point to the need for digital literacy of the population with the

amendment to correct issues such as misinterpretation of data, misuse of databases or misuse of devices.

Keywords: Internet, self-care, medical information, diagnosis

1. Introduction

Education is a concept that at the current moment of human evolution can no longer be limited only to the knowledge acquired during the period spent in educational institutions. Progress in science and the development of technology in all fields constitute the premise and at the same time a necessity for the continuous education of the population of all ages in various directions, because all discoveries have been made for and in the benefit of man. The present paper aims to address the subject of e-learning in relation to the health education of the population and medical information through digital platforms (Delungahawatta et al., 2022). The educational and medical systems, pillars of progress and social welfare, use the notion of continuous education. This phrase can also be taken up and used in the case of health counseling for the general population and patients (people already diagnosed with various conditions), in addition to the e-literacy process. In order to increase the efficiency of the medical act as well as the level of understanding, awareness and correct perception of the concepts of health and disease, measures are needed to instruct the patient in surfing the internet. Current medicine promotes prevention as a means of reducing morbidity and mortality (Perera & Agboola, 2019). Given that a responsible attitude towards one's own health should be a component of individual education, it is important to "provide" information on this topic. Digital education offers an effective way to offer health information. In general, digital information is accessed mainly by young people and adults with limited time resources, who prefer contact with the medical system, at least for general information, in an online manner. This population category, which has already gone through the digital literacy process, has the necessary skills to access medical platforms and health services online (Stukus, 2019). However, it is important to analyze the type and scientific validity of the

medical information accessed. It is equally important to prioritize understanding how medical information is perceived as useful for both the prophylactic and curative components. Therefore, in addition to digital education itself, it is necessary to implement ways to learn the process of selecting scientifically validated information. There are often situations in which false information represents "traps" of "self-care" via the Internet (Battineni et al., 2020). Although e-literacy is a continuous process and progress in facilitating access to the digital health network is undeniable, certain barriers can still be identified at present (Jia et al., 2021; Mee et al., 2024). One of these is represented by the distrust of certain categories of the population in the possibilities offered by online health networks, an aspect also determined by limited access to the Internet, the lack of digital knowledge or the devices necessary to access it and, last but not least, the perception of health and illness. This population sample may include the elderly, residents of isolated areas or those with limited financial resources. With social evolution, especially post-pandemic, the population's perception of health and access to medical services has changed considerably, in the sense of accepting online medical consultations and information to a growing extent (Haleem et al., 2021). In addition, the current lifestyle has led to limited time resources. This situation is also encountered in the medical system, where the greater the complexity of the medical act, the more time-consuming it is. The need to increase the degree of digital literacy of medical personnel and the general population has increased in parallel with the need for access to information. Consequently, these social goals can only be achieved by implementing programs that will contribute to increasing the percentage of individuals with a high level of awareness of the benefits of health education and digital education in a complementary way (Ruiz et al., 2006; Oluwadele et al., 2023b; Abbas et al., 2024b). Associated conditions of the process are represented by the access to this type of education and the establishment of the limits of safety and medical ethics conferred by the use of the online environment for medical purposes (Chaet et al., 2017b; Nason, 2023b). The reasoning would be that the search strategies and the quality of the websites visited are determining factors of the

patient's perception of a certain diagnosis or medical problems, in general. Individual education regarding medical information should start from the premise that there are no "minor" diseases and that any medical condition not diagnosed in time, neglected or incorrectly treated represents, firstly, an unnecessary suffering for the patient and, secondly, a burden for the health systems, in the short, medium and long term. From a medical point of view, the statement "there are no diseases, there are sick people" offers the possibility of a correct approach in the sense of personalized medicine. Studies show that the majority of internet users use the symptom exploration strategy, which is used as the origin for establishing a self-estimated symptom severity score (Kwakernaak et al., 2019b). Another aspect of the problem is the awareness of the risks related to data protection that patients are exposed to when using online platforms. E-digitalization can also contribute to solving the problems of digital vulnerability (Gao et al., 2022b) of patients by improving knowledge of legislation, correct use of devices or storage of medical data, to eliminate the risk of loss or dissemination of confidential medical data in the online environment where they can be accessed and used in the context of cybercrime (Ewoh & Vartiainen, 2024; Alodaynan & Alanazi, 2021b).

2. Literature Review

A review of the literature on the subject of online access to health information demonstrates slightly different conceptualizations in the pre-pandemic period compared to the pandemic and post-pandemic periods. Thus, while in the pre-pandemic stage the focus was on the credibility of information in relation to the quality of websites, (Daraz et al., 2019) in the pandemic period this aspect was pushed to the background as a practical necessity, the health crisis making it impossible for patients to access health systems (Suh et al., 2022; Chen, 2023) For this reason, the interest has focused on the aspect of monitoring patients who have gradually stepped into the digital world, regardless of age, adopting a digital behavior adapted to the period of health crisis. (Thapa et al., 2020) Of course access for seniors has been less easy due to lack of digital skills as

well as devices. This barrier has been gradually removed in urban and high economic potential environments and even though the pandemic has passed, the behaviors related to medical digitization have remained (Galavi et al., 2022b). There still remains a barrier in disadvantaged environments, in those where the Internet is unavailable or where the level of e-literacy is low not only due to age or level of education but also due to the limitations imposed by conditions that interfere with the ability to learn or to anchor in an objective reality (neurological or psychiatric conditions - dementia, cognitive impairment). (Kozelka et al., 2023b). In the pandemic period, the complexity of the issue has focused on aspects that are also related to medical ethics and the quality of medical care per se, namely, the influence that medical information obtained online can have on medical decision-making. (Heaton-Shrestha et al., 2023b). The post - pandemic period has preserved and improved the digital behavior of individuals who have discovered the benefits and advantages of online access to both medical information and the medical act *per se* in a particular form, different from the classical approach to the medical act (Starcevic, 2024c). Most studies emphasize the benefits of accessing health information online by linking it to increasing the health literacy of the population (Di Novi et al., 2024). The limitations, barriers and disadvantages of this practice are also mentioned, but the most important aspect is the need for further research to understand how access to online medical information affects medical decisions and therapeutic relationships (Coughlin et al., 2020; Bachofner et al., 2024b).

3. Purpose of the Study

The main purpose of the study is to provide a current dimension of the concept of digital literacy in relation to population health education, indirectly, by quantifying the interest in this topic in specialized literature, starting from the question: is digitalization and health education currently at the level required by the objective needs of social and health systems? Another purpose of the study is to increase awareness among decision-makers and the population regarding the need for

digital literacy, in an era when there is increasing talk about both the benefits and the risks of accessing the internet, in its various variants.

4. Research Design

The research question can be formulated as follows: are digitalizing and e-education currently at the level required by the objective needs of health systems?

The present study falls into the category of non-interventional systematic reviews. It is a mixed study, with a quantitative component - the identification of a number of 182 studies and a qualitative component - with reference to the phenomenology of the e-education process in relation to population health education. We searched the PubMed database for articles in English using the association of three terms as search keys: internet - self-care - medical information - diagnosis. The result was the identification of a total of 182 articles for the established period, namely, 2005-2024. The data obtained from the search process in the mentioned database were statistically analyzed using the Microsoft Excel application using the Data Analysis function. The data search was performed independently by the two authors. Between the first database search at the beginning of June 2024 and the date of finalization of the article, a total of 15 studies were indexed in the PubMed database. We included the work in the systematic review category, arguing that it met the criteria established for this type of analysis: academic synthesis of evidence (182 studies on the topic of digital education in correlation with health education) using critical methods of identification, definition and evaluation. In other words, the affected systematic review extracted and interpreted data from published studies on a mentioned topic, subsequently performing an analysis, description, critical appraisal and summary of the data in an evidence-based approach. Mention: in the meaning of the analysis carried out, the terms study and article are interchangeable because the identified articles represent the form in which scientific information resulting from research activity (studies) is disseminated.

Inclusion criteria
Articles published on the mentioned topic
Articles identified between 2005-2024
Articles published in the PubMed database
Articles in English
Exclusion criteria
Articles on related topics
Articles on the chosen topic but published in different periods
Articles published in other databases
Articles published in other languages

Table 1. Inclusion criteria

Study Limitations

The limitations of the research process were due to limited access to information (in this case by accessing a single freely accessible database), differences between studies, time constraints, methodological limitations, high heterogeneity due to multiple variables, linguistic fluency, methodological diversity of the studies analyzed, differences between outcome assessments, limitations of the review process, limitation to studies in English, objective difficulties in the selection process.

5. Results and Discussions

We performed statistical processing of the data from the point of view of the representativeness and validity of the analyzed sample. We calculated the mean, median, standard deviation and confidence interval (for α=0.05 (confidence interval 95%)). The values for these statistical indicators are listed in the table below.

Statistical variables
Mean 10.05555556
Median 10
SDEV 6.72
Confidence level 3.344500484 (α=0.05; 95%)

Table 2. Statistical variables

The Pearson correlation coefficient, whose value is 0.83, signifies a positive correlation but a weak strength between the two variables (number of published articles and the years of the chosen period). This finding confirms the inhomogeneous distribution of the data, more precisely the fact that there are years with a large number of published studies on the mentioned topic and years in which there are no published studies or there is a small number of published studies.

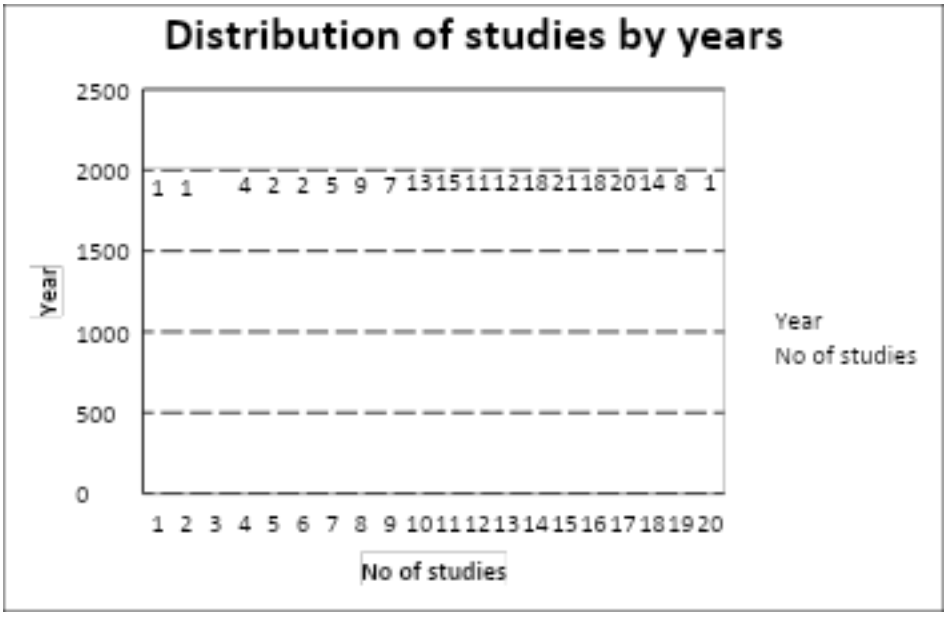

Figure 1. Distribution of studies by years

Regarding the importance of these statistical data in the educational process, analyzing the data in **Table 2** and **Figure 1**, we can state that with regard to the interest in medical education through digital platforms and implicitly, the interest in digital education, indirectly quantified by the number of studies carried out and their related articles identified in the PubMed database, there was an upward trend during the period 2005-2024. For a better comparison of the data, we divided the 20-year period into 4 periods, namely: 2005-2009, 2010-2014, 2015-2019, respectively, 2020-2024. (Shaver, 2022b; Alibudbud, 2025b)

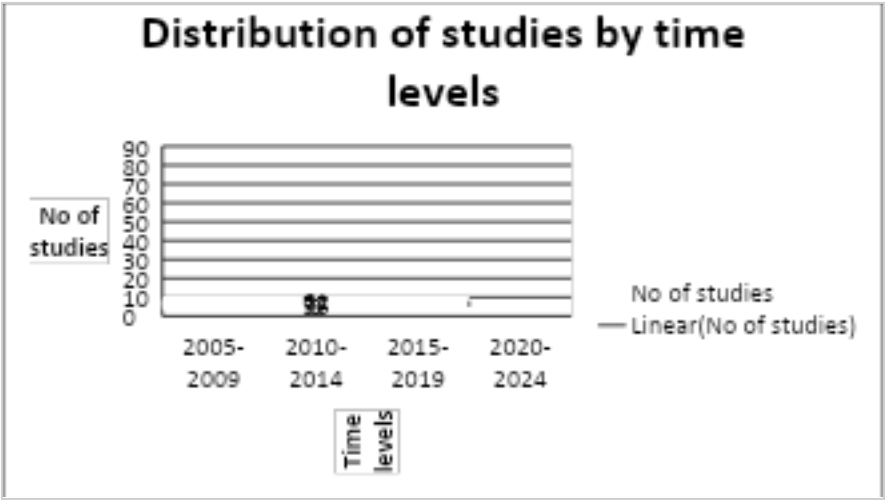

Figure 2. Distribution of studies by time levels

The analysis of the data distribution across the 4 time periods demonstrates a 4.5-fold (22.22%) increase in the number of studies in the period 2010-2014, compared to the period 2005-2010. The largest increase in the number of studies is observed in the period 2015-2019, 9.62 times compared to the period 2005-2010, respectively 2.13 times compared to the period 2010-2014. A slight decrease is observed in the period 2020-2024, with 1.26 times fewer articles being published than in the period 2015-2019. The analysis carried out through this study highlighted the fact that during the period 2015-2019, both digitalization itself and digital education were

carried out at an accelerated pace. Although the pandemic period represented an important leap in individuals' awareness of the importance and necessity of digitalization, especially of digital education, in terms of interest in general medical information it constituted a regression. The health crisis determined the focus of attention on the Covid 19 disease with its major implications both at the individual level and at the level of the entire health system. Using previously acquired knowledge, the population integrated it into its way of life, compensating for restrictions on social interaction (Khosrowjerdi et al., 2023b). This reduced the possibilities for research in the field of digital education per se. In the post-pandemic period, a hypothesis for the decrease in the number of studies on the subject can be represented by the natural integration of the use of digital systems and education of the population's needs into everyday existence (Htay et al., 2022b).

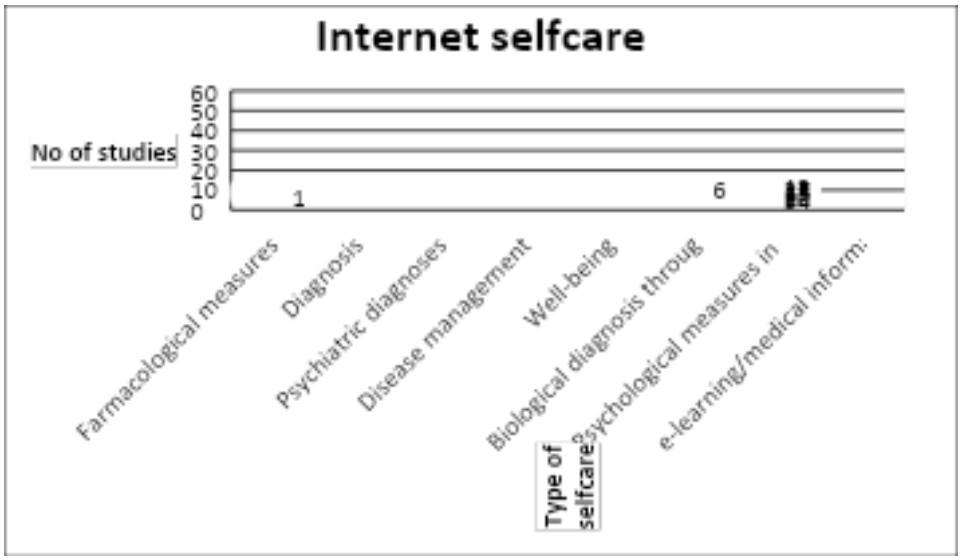

Figure 3. Internet and self-care

The research we conducted revealed that a total of 20 studies (10.98%) out of 182 studies revealed the use of the internet for diagnostic purposes. This is a relatively low percentage but by comparison with the n=12 studies, i.e. 6.59% studies showing the use of the Internet for

e-learning purposes in relation to medical problems, we can conclude that patients prefer to self-estimate risk by self-diagnosis, assuming that there are harmless diseases that can be ignored or self-treated without requiring a specialist consultation. The analysis we conducted revealed that n=57 (31.31%) of the 182 articles studied accessing medical web sites in search of information about the management of various conditions after diagnosis, and a total of n=34 (18.68%) studies highlighted the search for information about appropriate treatment. From a medical point of view it is encouraging that patients want to have more information about how to treat and manage their own disease, but at the same time it is worrying the other aspect, medical education that they consider unimportant in the equation of medical care. From the point of view of medical professionals, the basis of prophylaxis for the onset of disease lies precisely in patients' knowledge of information on how to maintain their health and the possibility of screening methods and access to validated websites that can guide patients on the decisions to be taken in the presence of certain symptoms. Based on the idea that prophylactic interventions (lifestyle optimization with reference to diet, smoking cessation, exercise, weight loss) reduce mortality by about 40%, the goal of medical education through digital applications is to provide information related to primary prophylaxis (prevention of disease). Studies show that the prevalence of metabolic diseases has increased over the last two decades (Chew et al., 2023). The importance of this lies not only in the prevalence of mortality and disability-adjusted life years, but especially due to the consequences occurring in the third stage of life. These lie in the impact of the risk factors listed above on lifespan and age-related decline through increased morbidity and impaired functionality (Zhang et al., 2023). Another important aspect is that of patients' addressability to the health system after the moment of information on certain aspects of medical interest starting with symptomatology and ending with treatment methods or management of various conditions. Previously I referred to the need to integrate the medical information accessed by the patient through the platforms in a clinical context (Farnood et al., 2020b). This can only be done by people with a medical background who, based on their clinical

knowledge and experience, can fill in the missing pieces of the clinical picture, formulate a correct diagnosis and finally correctly determine the risk score and prognosis of the disease and choose the most appropriate methods of therapy. In our analysis we found only one study promoting this aspect (0.54%). We found that the most numerous studies were those referring to the management of various diseases n=57 studies (31.31%) followed by studies on the psychological component in chronic diseases n=27 studies (14.83%) followed by studies on the medical education component N=12 (6.59%). From the perspective of disease management by health professionals, this is not a positive direction. It is encouraging that patients are willing to self-manage their conditions and this can be translated into an assumption of all that is involved in the individual relationship with the disease. On the other hand, these figures can also be interpreted as a lack of interest in prevention and a lack of interest in the curative component. Beyond the fact that only 6.59% of the identified articles address the subject of medical information in relation to e-digitalization, we found that a number n=34 (18.68%) articles address the interest in pharmacological measures and a number n=20 (10.98%) refer to diagnosis. Considering the high percentage of patients who resort to self-medication referred to in the specialized literature, often related to adverse reactions and information from scientifically unvalidated online sources, this is a worrying situation (Raja et al., 2024b; Agarwal et al., 2021b). On the other hand, and with regard to diagnosis, the literature frequently brings into discussion the fact that self-diagnosis, especially that associated with self-medication, (Bergmo et al., 2023b) leads to dangerous situations for patients, often reaching a life-threatening risk (Cotobal-Calvo et al., 2025b; Khoshbakht et al., 2023b; Efthymiou, 2025b).

After the lifting of restrictions, people realized that the existence of digital means during the pandemic constituted an opportunity that contributed greatly to the possibility of resolving the medical and social crisis we faced. People also realized that the use of digital means opened up new opportunities for distance communication and information that offer numerous advantages even after the lifting of restrictions and continued to adhere to this form of social behavior. As

for the education system in general and the medical education system in particular, they were reconfigured during the pandemic on the structure of digitalization, taking into account the risks of exposure to disease. The previous existence of digital education for children and young people represented an alternative that offered them the chance to access medical education and information even during the period of isolation. The analysis carried out through this study highlighted the fact that during the period 2015-2019, both digitalization itself and digital education were carried out at an accelerated pace. Although the pandemic period represented an important leap in individuals' awareness of the importance and necessity of digitalization, especially of digital education, in terms of interest in general medical information it constituted a regression. The health crisis determined the focus of attention on the Covid 19 disease with its major implications both at the individual level and at the level of the entire health system. Using previously acquired knowledge, the population integrated it into its way of life, compensating for restrictions on social interaction. This reduced the possibilities for research in the field of digital education per se. In the post-pandemic period, a hypothesis for the decrease in the number of studies on the subject can be represented by the natural integration of the use of digital systems and education of the population's needs into everyday existence. Regarding the connection between e-education and disease management through the perspective of medical information education of the general population, the problem that arises is represented by gaps in knowledge of internet navigation when there is no digital education, a situation in which the vulnerability of the internet user appears. This vulnerability refers both to the "public" exposure of confidential data and to accessing scientifically unvalidated data, the latter of which may constitute the premises of erroneous medical decisions on the part of the individual. This confirms the need for digital education that offers protection to those who surf the internet. There is also increasing talk in specialized literature about the vulnerability determined by excessive use of the internet network both from the perspective of the fact that frequent access represents an exposure to the dangers of cybercrimes, and from the perspective of the fact that excessive use of digital means

can itself cause medical and psychological problems. The correct management of diseases, which also involves informed consent in order to accept the diagnosis or to choose the type of therapy, are components of the medical act closely related to health education and, in the current context, to digital education. Consequently, a person who does not have the skills to access scientifically valid information will not be able to realize the lack of seriousness or, on the contrary, the seriousness of the disease, will not be able to make the best decisions for himself and will not collaborate with medical teams. Moreover, he will believe in the "myths" available on the internet, becoming a victim of his own distorted beliefs both in terms of prevention and the curative aspect of diseases, as a component of population health education. This also represents a form of manifestation of the digital vulnerability of individuals.

6. Conclusions

In conclusion, we can consider the Internet a valuable source of information conducive to educational activity. However, the present analysis demonstrates the existence of an insufficient level of interest in digital education and a discrepancy between it and accessing prophylactic or curative medical information. There are still a number of barriers to accessing information online, such as: lack of digital skills or digital devices, as well as the lack of access of internet network. Another problematic aspect would be related to the vulnerability of Internet users closely linked to the lack of digital skills, with reference to the protection of personal data or accessing scientifically unvalidated sources of information. All these variables can create an erroneous perception of the disease, representing risk factors for making rational decisions (non-acceptance of the diagnosis, abandonment of treatment or poor adherence to prescribed medication), belief in myths and unrealistic therapeutic possibilities or adherence to an inadequate lifestyle (e.g. restrictive, inadequate or pseudo-scientific diets). Negative affectivity determined by uncertainty and distrust in medical personnel in the event of accessing scientifically invalid information is another risk factor. For the patient himself, overwhelmed by

the burden of a bleak diagnosis and under the influence of contextual emotional imbalance, the information available online that does not respect the principles of evidence-based medicine can represent a trap with negative implications for the management of the disease. Self-management of the disease without the knowledge and expertise of a health professional can also pose a danger in the evolution and prognosis of the disease. At the end of the presentation, the answer to the initially formulated question is that digitalization and e-education are not currently at the level required by the objective needs of health systems. From this perspective, e-literacy, access to online medical platforms and raising the awareness of the population regarding e-health at all age groups, can constitute effective means of solving certain medical problems in the future and at the same time can contribute to improving the means of prophylaxis, decreasing the burden exerted on health systems. Consequently, continuous digital education correlated with health education based on scientifically validated information represents a necessity and an important social objective with addressability to all age groups and social categories.

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