Digital Health Literacy in Patients With Heart Failure in Times of Pandemic

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This study sought to determine the effect of a digital health literacy program regarding knowledge and skills in the use of digital resources related to self-care and health empowerment for patients with heart failure. A cross-sectional pilot study was conducted before and after the program in patients (n = 28) with heart failure at a tertiary care center. Both a knowledge test and the Health Empowerment Scale were used with a Cronbach's α of 0.89. The information was processed using the statistical software Restudio, which allowed us to make a descriptive and inferential analysis. Seventy-five percent of the participants were men with an average age of 68 years, 60.7% had elementary schooling, 71.4% had preserved ejection fraction, and 57.6% had a family member as a caregiver. A statistically significant change ($P < .005$) was found in the level of empowerment and the knowledge and skills in the use of digital resources applied in health. The results showed that the digital health literacy program is a cost-effective intervention that nursing professionals must integrate into continuity of care, not only in pandemic times but also in a permanent and standardized manner. An empowered patient with knowledge and skills in the use of digital resources is a patient with the ability to decide, satisfy needs, and solve problems, with critical thinking and control over their health.

KEY WORDS: Digital resources, Health literacy, Heart failure, Pandemic, Patient

Heart failure (HF) has become a public health issue, since it is one of the main causes of morbidity and mortality in the population worldwide.[1] This population becomes one of the most vulnerable—in this day and age considering the COVID-19 pandemic—as they have an increased risk of contagion and complications associated with their base pathology.[2] Therefore, it is necessary to make every effort to keep face-to-face medical appointments to a minimum, when not essential.

For this reason, nursing professionals must promote educational processes and integrate instruments to teach, reinforce, improve, and evaluate—on a constant basis—the skills for self-care, seeking to achieve a high level of empowerment in the management of the disease in the patient.[3]

The acquisition of the educational information must be framed in health literacy, which is defined as the capacity of an individual to obtain, process, and grasp data and basic services of health so that they can make appropriate health decisions.[4]

To obtain data, adapt them, and make decisions, digital health literacy becomes an educational instrument with a high potential to increase empowerment in patients with HF. Digital health literacy is an extension of health literacy, but in the context of technology. It also uses the same operative definition, but again—as mentioned—in the context of technology. Technological solutions have the potential to either promote health literacy or become an obstacle.[5]

This literacy is understood as the set of skills, knowledge, and attitudes that a person needs to perform functionally in their daily activities with regard to the information and communication technologies (ICT).[6] Nonetheless, this definition should not be reduced to technical competencies only, since its possibilities range from sharing opinions to creating high-level knowledge. All this is possible thanks to the great availability of instruments of a social and collaborative nature that have greatly impacted health education.[2,6]

Digital solutions offer the opportunity for the individual to be an active participant in their health. Digital solutions will provide a more centered approach in the person. In this approach, the individual will have more control on their health and a greater access to their data, while staying connected to their medical attention team.[7]

Digital health literacy has an enormous educational potential for patients with HF. In times of pandemic, it helps to promote the development of skills to achieve problem-solving, solution proposals, and decision-making processes regarding self-care through the ability to understand, evaluate, use, and transform digital objects, processes, and systems. In addition, it promotes the deployment of three interdependent dimensions: knowledge, ways of thinking, and capacity to act.[8]

The implementation of digital health literacy as an educational instrument for patients generates a series of benefits

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reflected in the reduction of the number of hospitalizations and emergency calls.[9] Despite these benefits, at an international level, there is evidence that older adults reject the adoption of ICT for health management and some others believe that it is a temporary phenomenon that will soon be over.[10]

According to Seifert et al,[11] there are eight characteristics that can allow and restrict the use of technology: the ability to learn how to use technology, the patient's skills, the patient's knowledge, security measures, perceived autonomy, the nature of the patient's responsibilities, the adaptation to home environment, and the maintenance of a person's professional and social life. Additionally, aging and the presence of other diseases and physical disabilities complicate the adoption of digital health resources.

In Colombia, this panorama is very similar. Carrillo-González et al[12] evidenced that there is a low level of knowledge and access to ICT in patients with chronic diseases: only 35.9% of men and 27.6% of women present optimal levels of knowledge and mastery of digital resources.

Moreover, the decline in physical and mental abilities that inevitably arrive over the years[13] is another obstacle to overcome; hence, that is the importance of using a simple, dynamic, and participatory method during the application of digital instruments. It is worth mentioning that family support is a key factor in this whole process, since it constitutes an important source of psychological stability for the patient. Furthermore, it enables relatives to guide the patient to participate in self-care activities and effectively cope with any complication derived from their disease.[14]

Numerous studies revealed that patients do not retain the information provided by nurses about self-care procedures necessary to avoid decompensation, and many of them walk away feeling confused about the information provided. Only 1 in 10 patients with HF can be expected to master their self-care, which creates the necessity to re-educate patients in a constant way and to do a follow-up.[15,16]

There is an urgent need to recognize that ICT can favor re-education processes.[17] For this reason, it is necessary for nursing professionals to consider the use of ICT as an effective educational support system, seeking to empower patients to fully participate in their health decisions, adequately informed via online health resources led by professionals.[18,19]

Thus, the objective of this research study was to determine the effect of a digital health literacy program on knowledge and skills in the use of digital resources regarding self-care and health empowerment in patients with HF.

METHODS
Design
A cross-sectional pilot study was performed—before and after the program—in patients diagnosed with HF, who attended an outpatient consultation in a tertiary institution.

Procedure
First, the fourth-level health institution was contacted to request authorization to access the research population. Then, the participants were selected, and it was made sure that they met the established inclusion criteria. The inclusion criteria were male or female patients over 18 years of age, diagnosed with HF, who were linked to an outpatient care program, who had a portable device with Internet connectivity, and who had a caregiver.

Sample/Participants
The sample size corresponded to the entire population with the restriction criteria (n = 28 subjects). A digital health literacy program was implemented.

Description of the Program
The program was developed by a nurse trained in the use of ICT. During eight sessions, patients were provided with a theoretical component on ICT applied to health—the use of technological resources such as e-mail, chats, blogs, forums, and applications—and a practical component, where each of the technological resources seen in self-care were integrated. The frequency of the sessions was weekly, with an intensity of 2 hours. The methodology used in the program had a motivational, participatory, and playful approach (see Figure 1), where the family and/or caregivers were included to support the patient in the incorporation of technological resources.

The motivational component was developed thanks to health coaching, where the aim was to empower patients in their ability to recognize that they could use and integrate technological resources in their self-care through the establishment of goals, fully developing self-confidence and breaking down fears or barriers—often self-imposed—that prevented the use of these resources. An individual and personalized process was developed, in which the patient was the focus of the learning process, whereas the professional was the facilitator, who accompanied the patient in the achievement of goals, never imposing his or her methods or beliefs.

Gamification instruments were used in the development and evaluation of the sessions, which is characterized by the integration of game dynamics that help to enhance the motivation of patients. Gamification was based on applying game mechanics to non-game contexts—in this case, in the development of the theoretical component to generate a bit of fun in the participants during the activities developed in each session. In addition to generating motivational and cognitive benefits, these games managed to transform the idea of the use of technological resources into an attractive challenge that was worth continuing.[20]

On the other hand, teaching back was a way of confirming whether patients had understood the information delivered. In each session, understanding was evaluated by asking
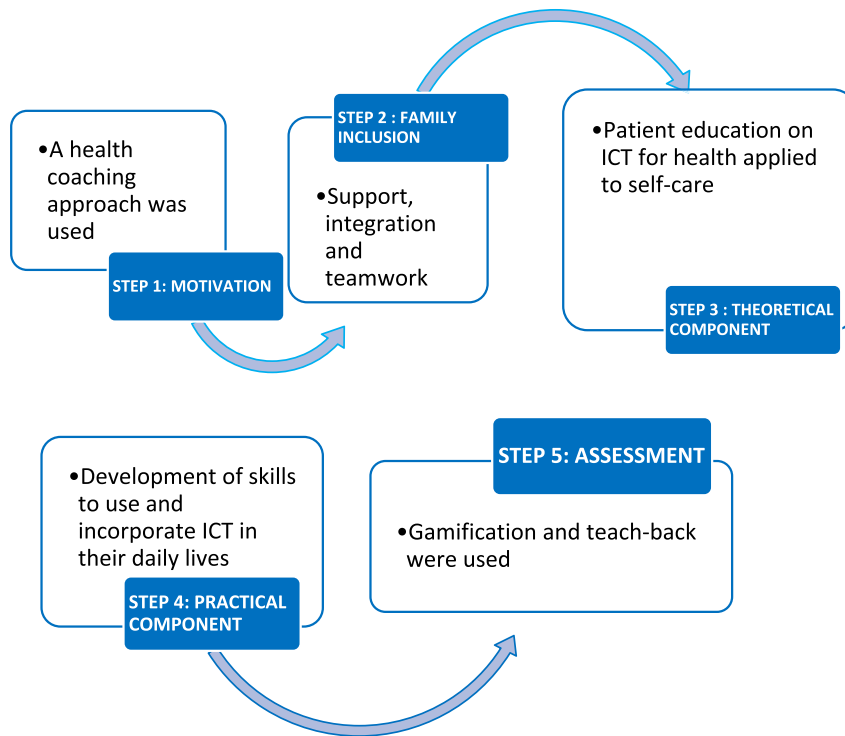
FIGURE 1. Model for the implementation of digital health literacy regarding self-care in patients diagnosed with HF.

about the use of the technological resources. In case there were doubts, the explanation would be given one more time using a simple language, emphasizing on one to three key points so that patients could apply this knowledge to their own healthcare (see Figure 1).[19]

Data Collection Technique

To collect the information, a test on knowledge about the digital resources applied to their health and the Health Empowerment Scale were used. These were administered before and after the end of the program.

The test on knowledge about digital resources was designed by the researchers, based on different theoretical references that link the use, employment, and utilization of ICT to the quality of life dimension.[21,22] It consisted of nine questions with a Likert-type scale of 1 (always) to 4 (never). It was reviewed by two experts in digital literacy and two health professionals who are leaders in HF programs. A pilot test was conducted to determine the clarity and understanding of the questions. It has a Cronbach's α of 0.85.

Regarding the Health Empowerment Scale, it consists of eight dimensions that enable the assessment of self-control, self-efficacy, problem solving, psychosocial coping, stress management, social support, self-motivation, and decision-making. It has a 5-point Likert-type scale (1, strongly dis-

agree; 5, strongly agree). The higher the score, the better the empowerment. It has been validated in the Colombian population and has a Cronbach's α of 0.89.[23]

Ethical Considerations

The study was based on international ethical considerations, such as the Declaration of Helsinki, which establishes the scientific, technical, and administrative standards for health research. This study was approved by the Institutional Ethics and Research Committee.

Data Analysis

To analyze the information, a descriptive analysis of data was carried out, in which measures of central tendency and standard deviation were calculated for the quantitative variables. The questions of the test on knowledge about digital resources corresponded to ordinal qualitative variables. For these variables, percentage distribution measures and frequency tables were calculated. Subsequently, an inferential analysis was carried out so as to compare the scores of the scales applied before and after the program through the non-parametric Mann-Whitney U test for paired data, where all the assumptions for the performance of the test were previously verified. Statistical significance was taken into account with a P value < .05 and a confidence level of

95%. The information was processed using the statistical software Restudio.

RESULTS

It was observed that most of the patients were men, with an average age of 67 years, with a standard deviation of ±12.9 years, with elementary schooling, whose occupation was homemaking. All of them had a relative as a caregiver, either a son or a daughter.

Regarding the clinical data, it was found that the most predominant etiology was the ischemic one, with a preserved left ventricular ejection fraction and a functional class I according to the New York Heart Association (Table 1).

It was noticed that after the intervention, the proportion of the use of smartphones increased, as well as the use of social networks, which generated a decrease in the use of

Table 1. Description of Sociodemographic and Clinical Variables

Variables		N = 28	
		n	%
Age, mean ± SD, y	67.3 ± 12.9		
Sex	Male	21	75
	Female	7	25
	Total	28	100
Schooling	Elementary	17	60.7
	High school	6	21.4
	Other	5	17.8
	Total	28	100
Occupation	Homemaking	14	50
	Freelance	9	32
	Pensioner	4	14
	Employee	1	3.5
	Total	28	100
Caregiver	Children	16	57.6
	Spouse	7	25
	Other	5	17.8
	Total	28	100
Diagnosis	Ischemic	15	53.5
	Valvular	8	28.6
	Hypertension	3	10.7
	Other	2	7.1
	Total	28	100
Ejection fraction	Greater than 40%	20	71.4%
	Less than 40%	8	28.5
	Total	28	100
Functional class	I	12	42.8
	II	10	35.7
	III	6	21.4
	IV	0	0
	V	0	0
	Total	28	100

classic/basic cell phones and landlines. According to the dimensions "technological resource" and "time per day"—despite noticing changes in frequencies—no statistically significant differences were found in the vast majority, except for the variable "does not spend time" in "time per day" (see Table 2).

Questions related to the level of knowledge and skills for digital resources ($P = .003$), to resolving doubts when using the Internet ($P = .001$), and to motivation by family and friends in the use of digital resources ($P = .001$) showed a statistically significant change after the digital health literacy program (see Table 2).

As shown in Table 3, it was found that the level of empowerment improved significantly ($P = .01$) after the digital health literacy program. A positive change was observed in the dimensions that emphasized the level of self-control to change certain aspects that generated dissatisfaction regarding their self-care, as well as in troubleshooting, decision-making, and motivation to make changes in behavior.

DISCUSSION

Regarding the socio-demographic profile, the data of the present study showed that the majority of the participants were men, with an average age of 67 years, with a standard deviation of ±12.9 years, with elementary education, whose occupation was homemaking. All of them had a caregiver, which was a son or a daughter. Jones[22] and Serrani-Azcurra[23] have considered that age and schooling can influence knowledge and skills in the use of ICT, given that patients with lower literacy levels do not seek to have smartphones or use the Internet, especially for health reasons. On the other hand, both the cognitive deficit and the low self-efficacy associated with an advanced age significantly reduce adults' ability to use technology. Nevertheless, as long as teaching-learning methodologies that increase their motivation are integrated, greater access and participation will be achieved. Various authors—such as Smith and Magnani[24] and Vaportzis et al[25]—highlight that there are three motivations to use technology: connecting with others, learning new information, and integrating the caregiver into learning.

The results showed that the effect of the digital health literacy program generated a statistically significant change in the level of knowledge and skills of patients regarding ICT and in the level of empowerment of the patient concerning the disease.

It was observed that after the intervention, the proportion of the use of smartphones increased, as well as the use of social networks, which generated a decrease in the use of classic/basic cell phones and landlines. According to Sims et al,[26] educating patients in digital resources applied to health expands the target audience, which allows the inclusion of patients to this modality, adapts the instruments depending on the

patient, delivers information in a more timely manner, standardizes the message, and allows patients to deepen their care and knowledge using smartphones and social networks

Table 2. Results of Questionnaire on the Use of Information Technologies Before and After the Program, Most Used Resource and Time Spent

Item	Before		After		P
	n	%	n	%	
1. Is there any support you can rely on from a relative or caregiver when using technological resources?					
Always	22	78.6	17	60.7	.39
Often	3	10.7	10	35.7	
Sometimes	1	3.6	1	3.6	
Never	2	7.1	0	0	
Total	28	100	28	100	
2. Do you feel comfortable when asking your caregiver or relative for help with the use of technological resources?					
Always	15	53.6	11	39.3	.62
Often	8	28.6	15	53.6	
Sometimes	4	14.3	1	3.6	
Never	1	3.6	1	3.6	
Total	28	100	28	100	
3. Do you have sufficient knowledge and skills for the use of Internet, chat, forums, and health applications?					
Always	4	14.3	3	10.7	.003
Often	3	10.7	6	21.4	
Sometimes	4	14.3	17	60.7	
Never	17	60.7	2	7.1	
Total	28	100	28	100	
4. How often do you try to resolve doubts about your illness using the Internet?					
Always	2	7.1	2	7.1	.001
Often	2	7.1	16	57.1	
Sometimes	6	21.4	9	32.1	
Never	18	64.3	1	3.6	
Total	28	100	28	100	
5. Do your family and friends encourage you to use the Internet, applications, forums, and blogs to improve your self-care?					
Always	2	7.1	8	28.6	.001
Often	5	17.9	14	50	
Sometimes	10	35.7	6	21.4	
Never	11	39.3	0	0	
Total	28	100	28	100	
6. Are you motivated to receive training to improve self-care through the Internet, chat, apps, forums, and blogs?					
Always	22	78.6	24	85.7	.11
Often	3	10.7	1	3.6	
Sometimes	0	0	3	10.7	
Never	3	10.7	0	0	
Total	28	100	28	100	

(continues)

Item	Before		After		P
	n	%	n	%	
7. Do you feel safe and confident when accessing to the Internet, chats, applications, forums, and health blogs?					
Always	10	35.7	4	14.3	.4
Often	9	32.1	14	50	
Sometimes	6	21.4	10	35.7	
Never	3	10.7	0	0	
Technological resource					
Smartphone	10	34.5	12	44.8	.5
Social networks	0	0	1	3.4	.7
Classic/basic cell phone	13	48.3	12	41.4	.03
Landline	5	17.2	3	10.3	.07
Total	28	100	28	100	
Time per day					
Does not spend time	10	35.7	3	10.7	.01
1 h	10	35.7	14	50	.5
Between 2 and 3 h	4	14.3	4	14.3	1.0
More than 3 h	4	14.3	7	25	.5
Total	28	100	28	100	

through digital health literacy. Resources can be delivered more efficiently and instruments can be more sustainable, as patients increase their skill in using these technologies.

With regard to the amount of time spent per day on technologies, there was a noticeable increase. This result coincides with Halvorsen et al[27] who found that the association of digital resources with a chronic disease facilitates its adoption by patients, which increases the amount of time they invest in these.

An improvement was also identified in the level of knowledge and skill in the use of specific resources such as e-mail, applications, and chats. This aspect agrees with that mentioned by Gordon and Crouch,[28] who state that for technologies to be used, they must satisfy the patients' needs, adapting to the activities that are most likely to be performed in their day-to-day life. They must also be useful and easy to use to be accepted.

According to Kuerbis et al,[29] active use of e-mail, Internet, and social networks by patients can improve access to care, improve patient education, facilitate detection programs, and increase adherence to treatment plans.

Another aspect that improved was related to the resolution of health questions using the Internet. Authors such as Fausset et al[30] and Zhang et al[31] highlight that digital health literacy allows to find, understand, evaluate, and access information through electronic sources or online—to address

Table 3. General Results and by Dimensions in the Level of Empowerment

General Level of Empowerment	n	Average	P^a
Before	28	27.6	.001
After	28	38.2	

Empowerment Dimensions	Before	After	P
Self-control	3	4	.002
Self-efficacy	3	4	.001
Troubleshooting	3	5	.001
Coping	5	4	.09
Stress management	5	4	.09
Social support	3	5	.001
Self-motivation	4	5	.001
Decision-making	3.5	4	.001

[a]Mann-Whitney U test.

health-related concerns—but it is also important to educate the patient about the limitations of health information on the Internet, to ensure that patients can critically evaluate and collaborate effectively with healthcare professionals in the context of decision-making related to their health.

Likewise, an increase in the patient's motivation was found by family and friends regarding the use of digital resources. This result agrees with Silver[32] and Featherall et al[33] who mention that a more explicit and determined participation of relatives as caregivers in digital information resources about health could improve clinical quality and patient safety by increasing the transparency, precision, and exhaustiveness of the information about the patient's health in all care settings, increasing the motivation of patients to use these types of resources.

Some aspects of the program that could have favored these results were the motivational approach—centered on coaching as a starting point—in which it was possible to identify the limitations and the degree of confidence that patients had in the use of technological resources, through questions and active listening. From this exploration throughout the sessions, patients were shown how they could transform these limitations and change their behaviors, establishing weekly goals to apply what had been learned during the sessions, and identifying obstacles and looking for solutions. In this way, self-confidence was encouraged.

The treatment of patients with HF is complex, since changes in their lifestyle are required. Improving these patients' self-care is a process that requires, mainly, a change of behavior and a change in the motivation of each person. Health interventions become necessary to help the patient in this transition and maintenance of healthy lifestyle habits.[34,35]

From this perspective, the behavioral approach—through coaching—that was used as the methodology in the development of the program's sessions made it possible to help the individual in the process of changing their behavior, encouraging commitment through a convincing and encouraging approach.

Another component integrated into the literacy program that contributed to the results was the teach-back technique and gamification. Teach-back would be applied in all educational sessions. Guiding questions were elaborated on the topics developed to determine what patients had understood. Some of the examples of the questions asked were "Can you tell me what we discussed today?" or "What can you tell your wife/husband about using the apps?" If the person responded with an incorrect explanation or seemed to have a gap in understanding, the nurse could identify what information was necessary to be repeated or clarified. The cycle continued until the patient responded correctly. In this way, comprehension is assessed and healthcare professionals can identify an educational strategy that almost all people commonly understand. This tool allowed those patients with low literacy levels to actively participate and information to be reiterated.

Tran et al[36] show that the teach-back method is an intervention that has shown to be effective in improving retention and understanding of information, since it allows healthcare providers to ask patients to explain, in their own words, the information that has been discussed. If the patient cannot remember or has difficulty understanding the information, the provider can identify specific misunderstandings or deficiencies and re-explain the concept, allowing to encompass the cognitive and social skills that influence an individual's ability to promote and maintain good health through the effective understanding and application of health information.

The gamification approach to the literacy program included games that had challenges and rewards (eg, points, achievement badges, and leaderboards), which contributed to knowledge acquisition, increased motivation, and a competitive spirit in favor of their learning. This approach made the theoretical component more enjoyable, promoted the development of positive social relationships, and fostered a feeling of integration with their peers.

Sardi et al[37] affirm that empirical evidence is just emerging to support gamification in health. Through games, the information provided is reaffirmed and motivation is increased.

With respect to empowerment, an increase was identified after the intervention, which was evidenced in a change in the level of self-control to modify certain aspects of their self-care, related to hydrosaline restriction, weight control, and management of alarm signs and symptoms. This increase was also evident in both the resolution of problems and the decision-making skill to make changes in conduct.

The literacy program was a tool to increase patients' empowerment, since it allowed the acquisition of motivations and skills that patients can use to improve their participation

in decision-making and, thus, improve their control in their relationship with professionals. This goes beyond the fact of simply informing the patient and requires a process of motivation so that actions can be understood.

There is growing evidence about the fact that effective patient empowerment is considered a key factor for patients to assume co-responsibility in their care and for them to increase their self-management and self-efficacy regarding their health, which helps them achieve better health conditions. Not only does it improve patients' quality of life, it also alleviates the impact of morbidity on people's lives and limits the demands on health and social care services.[38] It is important to note that a low level of literacy may limit information retention and, therefore, be reflected in a lower awareness of the disease. High levels of empowerment derived from literacy favor patients with HF to have a better quality of life, as evidenced in the improvement of their functional capacity, adequate mental health, symptom control, and easiness in the process of social, labor, and family reincorporation.

On the other hand, as there is an increase in the patient's self-control, positive coping is developed. The same occurs with the problem-resolution capacity and achieved decision-making processes. Self-control is considered a key factor to improve adhesion to treatment regimens and to guarantee the efficient use of primary health resources.[8]

The results obtained in this study showed that digital health literacy has a strong impact on empowerment and patient self-care regarding their pathology. It also encourages exploring new training possibilities through digital resources. Nursing professionals must integrate and standardize digital health literacy in educational processes in a transversal manner, not limited to times of pandemic. It should be considered as a fundamental instrument to promote more active, informed, and educated patients. Nonetheless, it is a challenge since innovative methodologies must be permanently incorporated to increase access and acceptance in the use of ICT.

The incorporation of digital health literacy settings in clinical practice will lead to an increase of the coverage of patients who benefit from these digital resources and will minimize the physical, psychosocial, and economic impact derived from the lack of adherence to treatment and the lack of involvement in their care.

Certain limitation that was identified was the use of nonparametric statistics due to the weakness of statistical power, as well as the use of a small sample for convenience. As authors, we will continue advancing with the conduct of more studies under this research phenomenon, to generalize results. Finally, it is suggested to continue with this type of study with a larger sample size and with a control group to minimize selection biases.

CONCLUSIONS

Technological literacy is a complementary instrument in the educational processes that should be integrated by nursing professionals in the continuity of care, in a permanent and standardized manner. Digital health literacy provides the patient with capacities for their empowerment and self-management of their disease. Digital health literacy also allows patients to feel supported through technologies and socialize the achievements with people who go through the same situation. An empowered patient with knowledge and skills in the use of digital resources is a patient with the ability to decide, satisfy needs, and solve problems, with critical thinking and control over their health.

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