

App for The Detection of Risk Factors for Cervical Cancer in University Students

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KEYWORDS

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ABSTRACT

Expert systems (SE) is an area of Artificial Intelligence that is responsible for studying knowledge-based systems, are applied to many fields such as medicine, military strategies, financial economics, engineering, law and others, you can also say They try to imitate the reasoning of an expert to solve a problem of a defined topic. Their behavior is based on previously defined knowledge and through this knowledge, the SE are able to calculate solutions (Sánchez, 2015). On the other hand; In the world, the first three causes of death in women due to cancer correspond in descending order to breast cancer, lung cancer and cervical cancer with standardized means by age between 11.41 and 6.89 per 100,000 women. The National Statistical Office of the United States of America indicates an approximate number of 10,000 deaths from this disease (Beramendi, 2017). That is why, the objective of this research was to detect the risk factors in cervical cancer in the students of the Universidad Nacional del Santa; not trying to replace the specialist doctor, but supporting him in giving a reliable diagnosis, fast and using information technologies. The results showed the reliability of the information that allows an early diagnosis of cervical cancer. Therefore, it is recommended to expand the field of research of expert systems to cover a greater number of diseases.

Introduction

The term cancer encompasses a large group of diseases that are characterized by the development of abnormal cells, which divide, grow and spread uncontrollably in any part of the body.

Normal cells divide and die over a scheduled period of time. However, the cancer or tumor cell "loses" the ability to die and divides almost without limit (Figure 01). Such multiplication in the number of cells can form masses, called "tumors" or "neoplasms", which in their expansion can destroy and replace normal tissues (Seom, 2017).

Cervical cancer is the second most common type of cancer in women, and this in all parts of the world; all cases are related to a genital sexually transmitted infection with the human papillomavirus (HPV). More than 90% of deaths are concentrated in low- and middle-income countries, where access to timely testing and treatment services is very limited (Who, 2013).

According to the latest national studies, cervical cancer represented the leading cause of death in Peru, registering more than 16 thousand new cases, becoming the first cause of cancer morbidity in Peruvian women and the second in Lima. This disease develops in young women from the age of 30 and originates due to infection by the Human Papillomavirus (HPV), which has more than 110 subtypes and only some of them such as 16 and 18 are responsible for approximately 70% of cases of cervical cancer. 2016).

In Peru, 85% of cancer cases are detected in advanced stages, which results in lower chances of cure, lower quality of life, higher cost of treatments, and high mortality (Trome, 2017).

The general objective of this research is to detect the risk factors in cervical cancer in undergraduate students of the Universidad Nacional del Santa through the development of a mobile application, which allows appropriating in a computer application the expertise and understanding of an expert professional in the field. To meet this objective, the risk factors that cause cervical cancer will have to be identified and the knowledge will have to be adequately represented; identifying all the necessary elements to be able to solve the problem, also represent the knowledge base through an expert system, as well as perform verification tests, evaluate the reliability of the information and finally reduce the response time of the diagnosis.

According to the problems described in the previous paragraphs, the following question arises: How will the development of a mobile application be able to assertively detect risk factors for cervical cancer in university students?

This research is justified because it aims to reduce expenses in diagnostic tests. In addition, it promotes the appropriation of new information technologies. It also helps students to have an early evaluation of probable cervical cancer. Finally, the excess in the time of diagnosis, as well as in the time of care.

Therefore, the importance of developing a mobile application for the detection of risk factors in cervical cancer in university students, for reasons that cervical cancer is the most frequent in women and an annual check-up is recommended to the female population that has initiated sexual activity. In

addition, the early diagnosis of diseases using information technologies will make it easier for the specialist to have a more effective treatment, allowing to slow down the progression of the disease and risk to the lives of the students

METHOD

Type of study to be investigated

a. According to applicability or purpose

Applied: Because it seeks the generation of knowledge with direct application to the problems of society; in this case the problem of cervical cancer in women. It is fundamentally based on technological findings detected through the APP.

b. According to nature or depth

Experimental: To carry out this type of research, it is necessary for the researcher to become familiar with reality, which allows him to know the problem of neoplastic diseases for the formulation and formulation of the hypothesis.

Population and Sample

a. Universe

Undergraduate Students of the Universities of Peru.

b. Sample

The sample will be randomized aimed at EPISI undergraduate students. In 2023, a total of 27 female students were enrolled between cycles III and X.

Techniques

a. Document analysis

It will be developed based on primary sources: bibliography, hemerography, interviews and the internet.

b. Survey

It will be used to find out if they have information about cervical cancer risk factors.

c. Interview

It will be developed to get information from specialists about risk factors for cervical cancer.

Instruments

Questionnaire

Data Processing and Analysis Techniques

Descriptive statistics will be used: Statistical tables, bar graphs, and others appropriate to the research

- Data Collection Procedure
 - a. Data collection: books, journals, and websites will be used to put together the theoretical framework necessary to support the research.
 - b. Fieldwork: surveys will be carried out on students from the III to X cycle of the EPISI and data processing corresponding to the year 2023, so that we will obtain direct information on what we want to research.
 - c. Office work: What was collected in the fieldwork will be systematized for analysis and discussion

RESULTS AND DISCUSSION

1. Application Reliability

For the evaluation of the independent variable that is the mobile application, we resort to the exponential function that will allow us to determine the level of reliability of the expert system considering the following scale.

Table 01: Application Reliability Scale

| Scale | Percentage |
|------------|----------------------|
| 100% - 80% | Very satisfactory |
| 79% - 50% | Satisfactory |
| 49% - 10% | Unsatisfactory |
| 9% - 0% | Nothing satisfactory |

Next, we perform the exponential function.

Be:

$$f(t) = e^{-\lambda t}, \text{ con } t \geq 0$$

where:

λ = represents the number of correct diagnoses.

t = is the time that the mobile application works.

If the application starts working at the time $t_0=0$ and we observe until it fails. The probability of the mobile app crashing is the time t is:

$$P [T \leq t] = f(t)$$

Therefore, the probability of work without system failure at time t is:

$$R(t) = P[T < t] = 1 - f(t) = 1 - e^{-\lambda t}$$

From the analysis of the 27 tests processed by the mobile application, 25 coincided with the diagnosis of the specialist doctor.

For a 2-month working time of the mobile application, the reliability of the mobile application will be:

$$R(t) = 1 - (e^{-(25/27)2}) = 0.84$$

Which indicates that the mobile app will be 84% reliable on the scale mentioned above. 84% of the value obtained is within the Very Satisfactory range. Therefore, it is concluded that the mobile app is reliable.

2. Response Time

N° Students = 27

Average Mobile App Time = 11.33 minutes

Average Current System Time = 33.26 minutes

Average Time Gained= 21.93

Degree of Improvement = 65.94 % = 66%

It can be concluded that the response time is acceptable since it is 66% higher than the current system.

3. Degree of Satisfaction

The surveys were applied to the students of the EPISI from the III to the X cycle, then the analysis and tabulation of the data of the surveys that were carried out were carried out. After that, the frequency tables and graphs of the results will be made, after which the discussion of the results will be made.

1. Are you satisfied with the use of mobile technology to detect factors in cervical cancer in women?

Table 02: Frequency Question 1

| Scale | Frequency |
|----------------------|-----------|
| Very satisfied | 19 |
| Satisfied | 6 |
| Indifferent | 2 |
| Not very satisfied | 0 |
| Not at all satisfied | 0 |
| TOTAL | 27 |

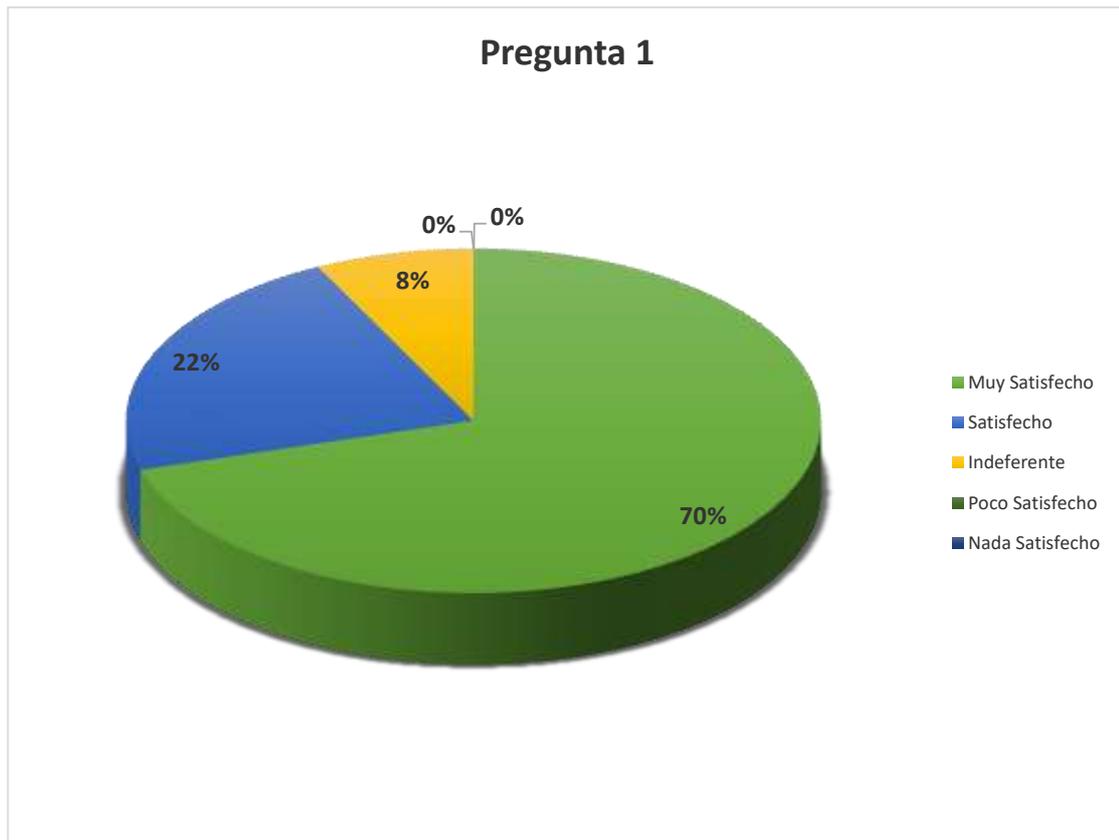


Figure 01: Use of mobile technology

Discussion

Of all the students of the National University of Santa Cruz, 70% of them stated that they are very satisfied with the use of mobile technology for the detection of cervical cancer factors, 22% responded that they are only satisfied with the use of mobile technology for the detection of cancer factors, while 8% of students feel indifferent to the use of this technology.

Information technologies have become an important element for society, because their contributions have motivated society to benefit from their use. Every day we notice the advance in information technology, especially in mobile technology, which allows great benefits not only in communication for people but also in providing information, data processing and strengthening processes.

That is why the use of mobile technology to detect cervical cancer factors in women is very beneficial since it helps to prevent and be able to be aware of any risk that may arise because if detected in time it can be possible to combat this disease.

2. Do you think that the "App for the Detection of Factors in Cervical Cancer" helps you to have a broader knowledge about the disease?

Table 03: Frequency Question 2

| Scale | Frequency |
|----------------------|-----------|
| Very satisfied | 21 |
| Satisfied | 3 |
| Indifferent | 3 |
| Not very satisfied | 0 |
| Not at all satisfied | 0 |
| TOTAL | 27 |

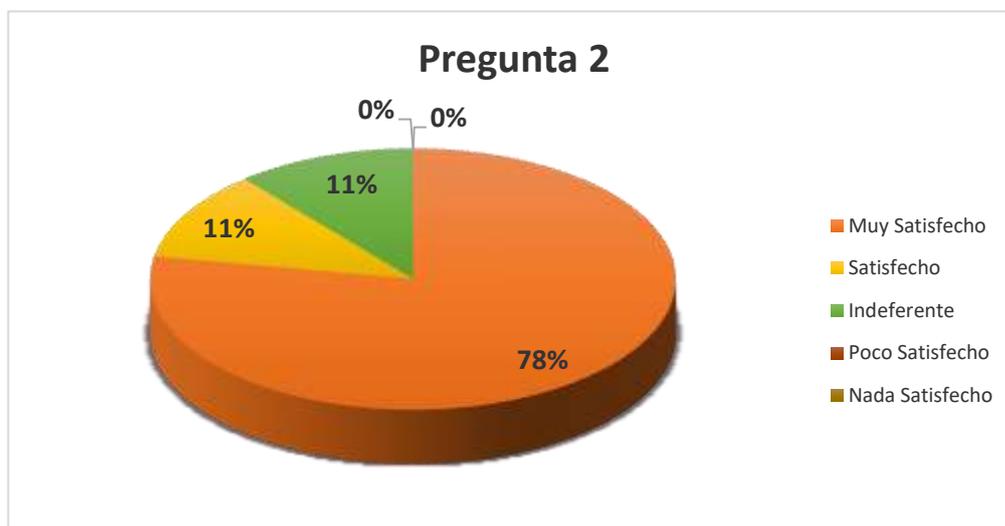


Figure 02: Knowledge of the Disease

Discussion

Of all the students surveyed, 78% responded that they feel very satisfied with the uterine cancer factor detection application with which they obtain a broader knowledge about the disease, while 11% only feel satisfied with the information obtained, the other 11% are indifferent to the use of the App for the detection of uterine cancer factors.

Providing necessary information on the detection of cancer factors in women is very beneficial, it provides us with truthful information helping us to know exactly what are the symptoms, causes and risk factors that lead to contracting cervical cancer. It helps us to have an early diagnosis and with this it will be easier for them to prevent and treat.

3. Are you satisfied with the ease of use of the "App for the detection of cervical cancer factors"?

Table 04: Frequency Question 3

| Scale | Frequency |
|----------------------|-----------|
| Very satisfied | 25 |
| Satisfied | 2 |
| Indifferent | 0 |
| Not very satisfied | 0 |
| Not at all satisfied | 0 |
| TOTAL | 27 |

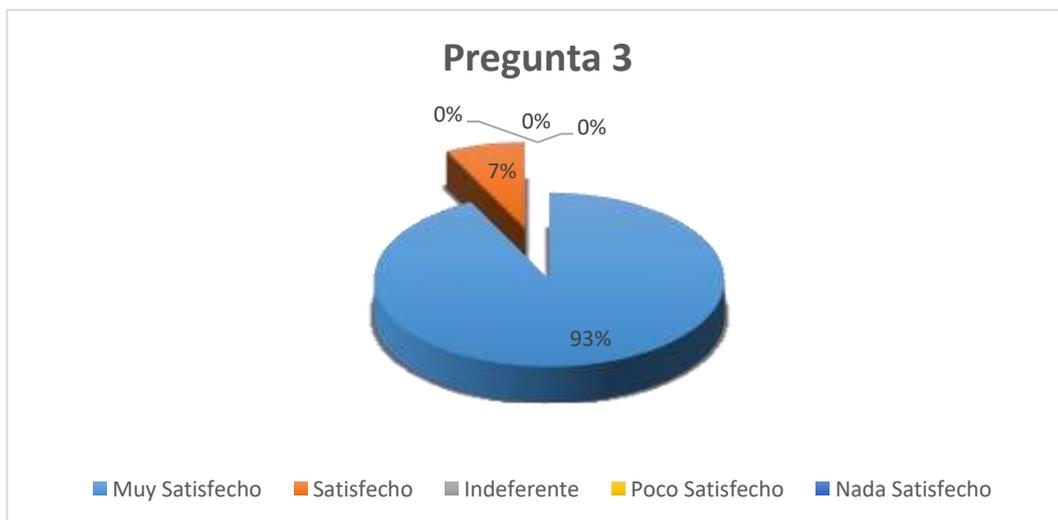


Figure 03: Ease of Use

Discussion

Of all the students surveyed, 93% responded that they are very satisfied with the ease of use of mobile technology for the detection of cervical cancer factors, while 7% responded that they are simply satisfied with the ease provided by the App.

Usability in mobile applications is one of the fundamental elements for their success. Improvements in the quality of mobile applications have brought about a real revolution in the interaction of users with their mobile devices. Mobile phones have gone from being simple tools to keep in touch with family and friends to becoming real management centers for everyday tasks. Much of the success that mobile apps have achieved depends in part on the usability they offer.

The app is very easy to use and has interfaces that make the user interact quickly.

4. Are you satisfied with the confidentiality of the information provided by the "App for the Detection of Factors in Cervical Cancer"?

Table 05: Frequency Question 4

| Scale | Frequency |
|----------------------|-----------|
| Very satisfied | 22 |
| Satisfied | 3 |
| Indifferent | 1 |
| Not very satisfied | 1 |
| Not at all satisfied | 0 |
| TOTAL | 27 |

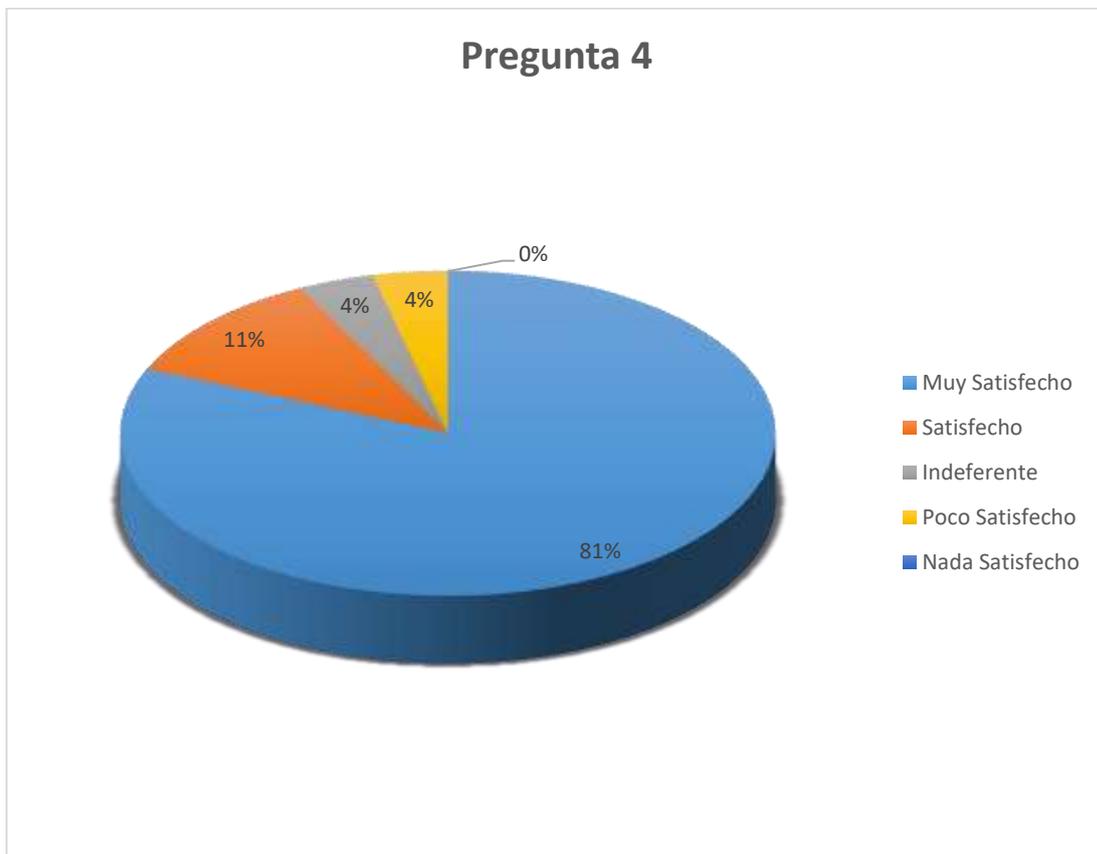


Figure 04: Confidentiality of Information

Discussion

Of all the students surveyed, 81% responded that they are very satisfied with the reliability of the information provided by the App for the detection of uterine cancer factors, 11% responded that they are only satisfied with the application, while 4% are indifferent to the feasibility of the

information provided by the app, and 4% feel little satisfaction with the information provided by the mobile application.

Information security is the set of preventive and reactive measures of organizations and technological systems that allow safeguarding and protecting information in order to maintain the confidentiality, availability and integrity of data and of the same.

The concept of information reliability should not be confused with that of computer security, since the latter is only responsible for security in the computer environment, but information can be found in different media or forms, and not only in computer media.

For this research, the reliability of the information was addressed, respecting the confidentiality and data protection policy, mentioned in Law 29733 (Protection of personal data).

5. Are you satisfied with the speed of the "App for the Detection of Factors in Cervical Cancer"?

Table 06: Frequency Question 5

| Scale | Frequency |
|----------------------|------------------|
| Very satisfied | 22 |
| Satisfied | 3 |
| Indifferent | 1 |
| Not very satisfied | 1 |
| Not at all satisfied | 0 |
| TOTAL | 27 |

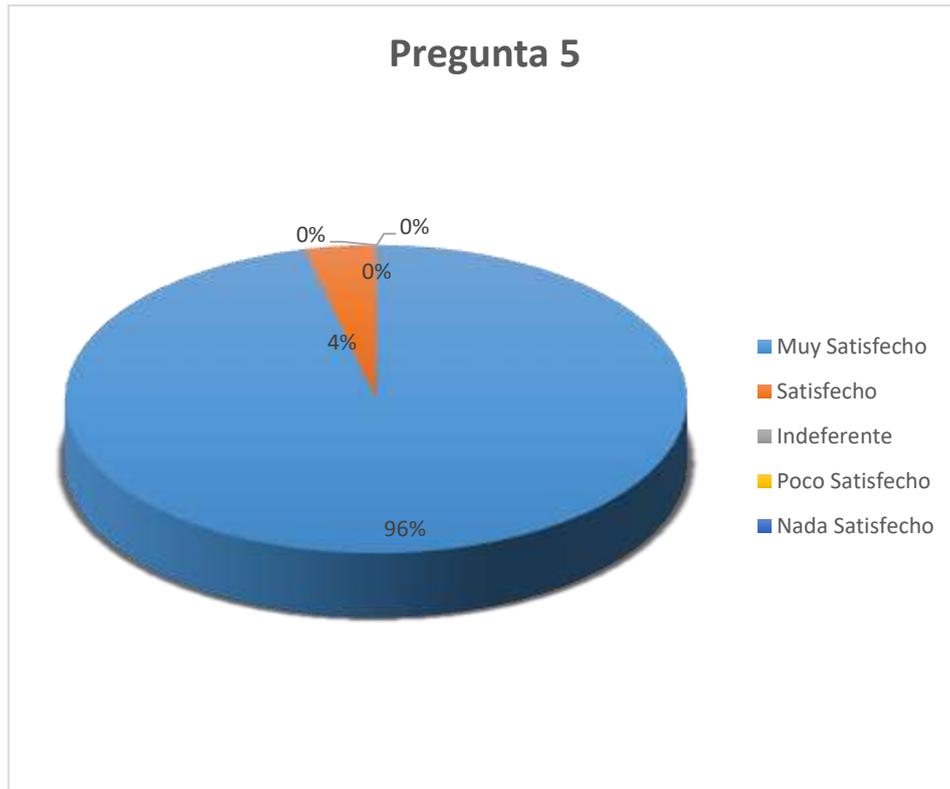


Figura 05: Rapidez de la App

Discussion

Of all the students surveyed, 96% responded that they are totally satisfied with the speed of the application for the detection of factors in cervical cancer, while only 4% felt satisfied with the application.

An organization's activities are influenced by its ability to process transactions quickly and efficiently. The processing speed that an application can have is an important factor that can influence its quality and success. For this research, it is very important that the mobile application is fast in providing the diagnosis of risk factors for possible cervical cancer.

Table 07: Frequency Question 6

| Scale | Frequency |
|----------------------|-----------|
| Very satisfied | 22 |
| Satisfied | 4 |
| Indifferent | 1 |
| Not very satisfied | 0 |
| Not at all satisfied | 0 |
| TOTAL | 27 |



Figure 06: Overall Analysis of Results

Discussion

Of all the students surveyed, 96% responded that they are totally satisfied with the speed of the application for the detection of factors in cervical cancer, while only 4% felt satisfied with the application. Women’s health is one of the fundamental concepts in development. The condition of women’s health has a significant effect on the health of children, family, and society.[1,2] Cervical cancer is the fourth most common cancer among women worldwide.[3]

It is possible to verify the degree of satisfaction of the application in the students of the EPISI of the National University of Santa due to its ease of use, speed of processing,

reliability of the information and because it provides important information on the risk factors of cervical cancer for early diagnosis, prevention and treatment.

It is necessary to design mobile apps based on user needs to increase the efficiency and stability of using electronic health programs.[31] M-Health apps are beneficial for solving problems that require changing health behaviors.[32] However, health interventions should take place in socio-cultural contexts that are acceptable to people.[33] Knowing the target group's demand and acting based on cultural and social sensitivities is necessary for the success of a screening program. On the other hand, to increase the participation of people in cervical cancer screening as a health behavior, it is necessary to consider the social and cultural aspects related to that behavior.[33]

In general, cervical cancer is still a health issue in some countries.[5,11] Although screening has been proposed as a preventive method to reduce cervical cancer,[9] many obstacles have been reported, including the low participation of women in screening programs, lack of knowledge to perform screening, and the advanced stage of the disease in a significant percentage of women.[18,19,20]

Since mobile apps have been proposed as low-cost and effective tools to increase people's participation in cancer screening programs and lift some barriers.[34] This multi-phase study aims to developing such applications that may help improve cervical cancer screening.

Electronic health can be used to increase women's awareness of cancer and increase participation in cervical cancer screening and HPV1 vaccination.[22,39] Since increasing women's awareness of cervical cancer has been associated with the success of cervical cancer programs,[40,41] applications have been increasingly used to increase cancer information. On the other hand, this tool has been proposed as a method for educational interventions to improve people's health.[29,38]

In addition, the use of applications to raise awareness may encourage women to participate in cancer prevention programs.[30,38] The use of applications in developing

countries is also beneficial to solving the health problems in these countries, and their utilization can improve the health of mothers.[34] A systematic review by Salmani et al. (2020)[38] showed that using mobile applications positively promotes cancer screening and people's health. Kessel et al. (2016)[42] showed that most healthcare service providers have a positive attitude toward the use of mobile applications in the field of cancer.

One of the goals of using mobile applications is to empower patients. Patient empowerment in medical care is only possible if it meets the needs of patients.[25] Therefore, the design and development of mobile applications should be based on the target group's needs. If the application is not based on the target group's needs, it will lead to a waste of money and time and dissatisfaction among users.[43] Awareness of cultural factors is one of the most effective factors in policymaking and planning to improve people's health.[44] Neglecting people's culture in health care is the biggest obstacle to improving people's health worldwide. The failure of many cervical cancer prevention programs is related to the lack of attention to the cultural and social norms among the people.[45]

CONCLUSIONS

- Cervical cancer is one of the most common cancers in women. It is considered preventable due to the possibility of screening. The common barriers to cervical cancer screening include lack of knowledge, lack of time, and wrong beliefs. The use of e-Health technologies is one of the approaches for health promotion. The present study is aimed to the development of a mobile application for cervical cancer screening in women.
- The general objective was achieved, developing an app for the detection of risk factors for cervical cancer in university students that allows for an early, reliable diagnosis and timely prevention of complications of the disease.
- It was possible to identify the necessary elements for the solution of the problem, carrying out a comparison with expert professionals.

- The knowledge base was designed, which encompasses 70% of the knowledge and experience of the expert professional, which makes the mobile application very reliable. The knowledge base is based on rules, where it is a matter of representing knowledge.
- It was possible to demonstrate the satisfaction of the students of the EPISI of the National University of Santa when using the mobile application in 96%.
- It was possible to reduce the time to diagnosis of cervical cancer risk factors by 66% compared to the current system of going to a specialist for a diagnosis
- Of the evaluations acquired, it was possible to imitate the human expert with an accuracy of 84%
- For the construction of the mobile application, the programming language Android, JavaScript and HTML were used.

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