

Raising Awareness in the Adoption of COVID-19 Preventive Measures in Higher Education Students Through an Epidemiological Surveillance Mobile App

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Abstract

COVID-19 disease has started several levels of alert and biosafety protocols to mitigate the risk of contagion everywhere, therefore causing universities to adopt the virtual environments in their teachings, but nowadays it became a necessity to return to classrooms in a short term basis; however, how prepared are we for this “new normal”? In this research, a validated questionnaire was used to measure the knowledge of COVID-19 and preventive measures adopted by university students, before and after the use of an epidemiological surveillance mobile app, developed as a tool to raise awareness in students. The research was quantitative, quasi-experimental, it was applied in a sample of 82 students, the analysis was global and gender inferential using the non-parametric T test for paired samples. The results indicated that the epidemiological surveillance mobile app made possible to raise awareness in the students in the adoption of preventive measures, proposing awareness strategies that allow establishing alerts and timely controls.

Keywords

Raising awareness, preventive measures, COVID-19, university higher education, epidemiological surveillance

1. Introduction

Since the first cases of COVID-19 appeared in December 2019 in the world, as Rivera refers in his investigation [1], Each country tried to mitigate the impact of the virus, based on the statistical information and transmitted as it progressed, health protocols were activated, making immediate decisions in a reactive manner, which were insufficient because it was not reinforced in the population in a permanent or organized way, not improving their behavior, as indicated by Baud [2], therefore, either due to ignorance regarding the symptoms, distancing conditions or other norms that were defined as they were discovered, they were moderately taken into account because they were not made known properly, as McCloskey refers [3].

As Bastian states [4], in the context of the COVID-19 pandemic, different risk circumstances have been manifested due to the behavior of the population, as it evolved, the information focused on disclosing statistics on levels of affectation, infection rate and deaths; in addition to the reports presented by Baud [2], on the matter of the outbreaks and the scarcity of hospital resources, generated a stigma in the population that triggered misbehavior by avoiding seeking specialized help during the first symptoms, as also evaluated by Roy et al. [5], all this has been increasing in the early stages and, as the pertinent measures were adopted, the growth curve of these indicators stabilized, to finally begin their decline with some variations.

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Evaluating the university population, the manifested problems as a result of the pandemic were not different from those manifested in the various studies of population strata since they assumed a confinement scenario; for the development of distance education, likewise, the educational authorities initially focused their concern on mitigating the impact that could be generated on the quality of higher education with these restrictions. For the above-mentioned, the information provided in *eEconomista* was reviewed [6] which focuses on evaluating 2,113 people in virtual educational environments, after two months of teaching and one additional month of exams, it presented results with an index of 82.8% of student satisfaction and 89.3% of professors', the latter, despite the result, shows a requirement of didactic training that allows professors to develop quality teaching in a virtual environment, and in the case of students, the need for technological support.

Another study published in the journal of the Autonomous University of the State of Hidalgo [7], found that a large part of the respondents have basic knowledge about the protection measures for the prevention of COVID-19, as well as an adequate application of them in daily life, in what we now know as the "new normal" [8]. Additionally, a study of the Indonesian population, using several social media search tools developed by Wibowo et al. [9] using twitter as a tool, applying the concepts of COVID-19, "stay home", confinement, etc.; in the study presented by Bolaños [10], it shows that in the case of the population, the more they assume its responsibility with the environment, better is their behavior in prevention and adoption of sanitary measures, which allows mitigating the risk of contagions, this information about the COVID-19 pandemic was exhaustively searched on various platforms. Also in the study carried out in the Philippines by Galido et al. [11], a survey was developed, and the Spearman correlation between new daily cases of COVID-19, COVID-19 terms and the different preventive measures was applied to the results, which determined a relative growth in the search volume of the disease until the pronouncement of the first case in the country, in other words, a strong correlation between the level of knowledge of the pandemic and the application of preventive measures, massifying the use of disinfection methods, correct use of the masks, and cleaning methods, which allowed to plan effective strategies. From an environmental point of view, Bolaños [10] assesses the relationship or influence of the population formation values in the face of the COVID-19 pandemic, analyzing the bad practices in the conservation of the environment, as well as the social responsibility of the population to promote respect for their surroundings.

In another study, the information selection criteria were based on the methodology of the documentary record by type of population, as indicated by Tejeda et al. [12] who interviewed 415 patients in a clinic, 95.4% of the patients had an adequate knowledge of general information about COVID-19, 80% had an adequate knowledge of clinical symptoms, and 93.7% in the differences between COVID-19 and other respiratory conditions, as a result, the most effective educational strategy was implemented because it achieved a high level of knowledge in the majority of the population. In the study carried out by UNICEF [13], the impact of the pandemic on socioeconomic strata and on the constitution of families with children and adolescents was measured, and according to Iglesias-Osores et al. [14], most respondents have general knowledge about COVID-19, however, some gaps regarding the level of fatality were found. Similarly, Konstat et al. [15] applied a survey to 2577 participants, where 76.2% showed a significant correlation between age, socioeconomic level, and level of education in contrast with the adequate knowledge about the disease.

Rivera [1] In his study, analyzes both genders and their adoption of good practices, to achieve this, the snowball sampling technique was used in 445 participants, obtaining as a result that women not only have better knowledge, but that their behavior, in real situations, is much better than their male counterparts. Roy et al. [5], in his study, infers that the respondents had a moderate level of knowledge about COVID-19 infection and adequate knowledge about its preventive aspects.

Due to the above-mentioned, the purpose of this research is to measure the knowledge that the population of university students has about COVID-19 and the preventive measures adopted, allowing the practice of prevention in order to mitigate the impact on the levels of contagion in a plan to return to the "new normal", and raise awareness in higher education students through the use of a mobile app. As specific objectives: (1) Describe the current knowledge of the characteristics of COVID-19 and preventive measures adopted, (2) Spread the use of the mobile app, as a means of raising awareness in the adoption of preventive measures against COVID-19, (3) Measure the awareness of university students, based on the knowledge of COVID-19 and the adoption of preventive measures to mitigate the incidences of contagion, (4) Propose awareness strategies in the adoption of preventive measures.

2. Methodology

The population was 458 students from the Computer Engineering School of a higher educational institution. To obtain the sample, a confidence level of 90% was considered, and with a permissible error of 2.5%, the result was 82 students, the sampling is simple random probabilistic and proportional by gender.

The type of research is applied with a quasi-experimental quantitative approach. The knowledge of both, the COVID-19 basic information and the preventive measures adopted by the university population, is the variable of interest that was evaluated.

The information collection instrument is the questionnaire, which consists of 30 questions, used in a pre-test and post-test, which made possible to measure the knowledge of the COVID-19 characteristics (10 questions) and its prevention measures (20 questions), using the survey technique. The questionnaire was validated using the Cronbach's Alpha indicator with a value of 0.897, obtaining high reliability, which means consistent and coherent results. The content of the instrument was validated by the judgment of health experts.

The questionnaire was prepared with Google forms and it was sent to the students by institutional email and, in a next stage, the form could be included as part of the mobile app.

First, the pre-test was applied; then, for 4 weeks, the students used the functionalities of the mobile epidemiological surveillance app, and finally the post-test was applied.

For the inferential statistical analysis, the SPSS v25 software was used, it was also used the Kolmogorov - Smirnov normality test and the non-parametric T test for paired samples. Comparative analysis between pre-test and post-test scores was carried out globally and according to gender.

3. Results and Discussion

3.1. Epidemiological surveillance mobile app

The mobile app was implemented using Android v5.0 +, which makes requests through a Web Service that can be found published on the Internet (using a Google Cloud Platform architecture), and extracts or modifies the information hosted on the PostgreSQL database server (version 12).

Among the functionalities of the mobile app we have, the registration of the person in the app, the registration of the Diagnostic Test, based on the epidemiological record of the MINSA and the experience of the medical specialists. This test has an evaluation of symptoms and the registry of clinical examinations that allows to determine the state of affectation, which could be negative, suspicious, probable, or confirmed.

Another important feature is the Complication Risk Test, where exposure risk factors and comorbidities are evaluated, giving as final results: low, medium and high.

A third functionality is the monitoring of the patient's treatment, which is assigned by the doctor of the respective Health Center and registered through a web app. And finally, several reports are shown that are useful for control and monitoring, the main interfaces of the mobile app are shown in Figure 1.

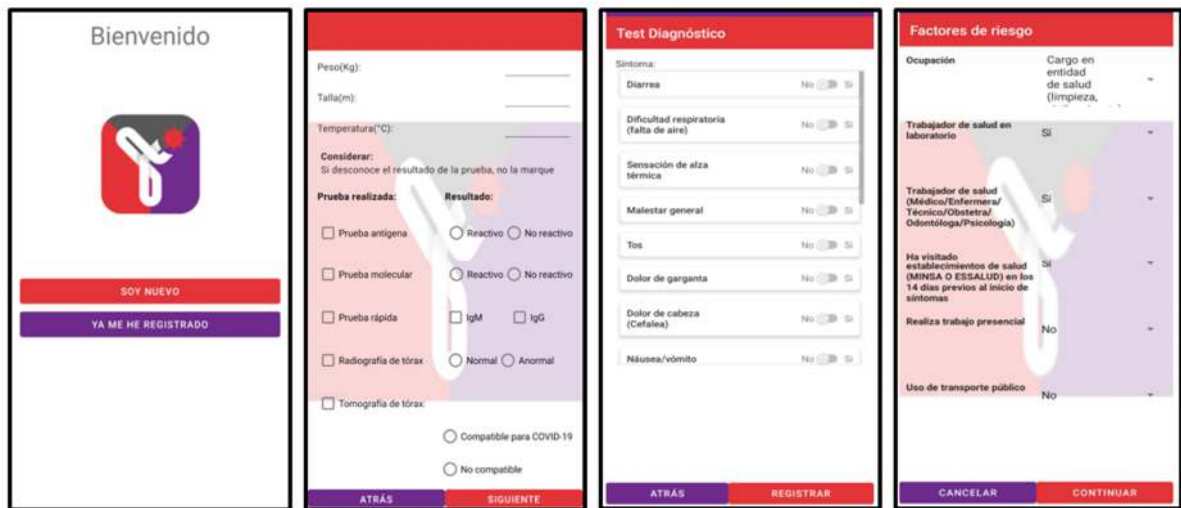


Figure 1: Mobile app interfaces

3.2. Statistical analysis and processing

For the statistical analysis, two studies were carried out, first, the general level scores and second, a study based on the gender of the university students.

In the analysis at a general level, the normality of the differences in pre-test and post-test scores was first tested with the Kolmogorov - Smirnov test, obtaining a Sig. $0.74 > \alpha = 0.05$; consequently, it can be stated that the differences in pre-test and post-test scores have a normal distribution.

Next, the T test for paired samples was used, where the hypothesis $H_0 =$ "There is no significant difference in the averages before and after the use of the mobile app in students" and $H_1 =$ "There is a significant difference in the averages before and after the use of the mobile app in students", where the Sig. $0.00 < \alpha = 0.05$, therefore, H_0 is rejected, concluding that there is a significant difference between the scores before and after the use of the mobile app, as observed in Table 1 and in Figure 2. Being, the average score after using the application (116.5) statistically higher than the average score before using the application (113.06).

Table 1

T-test analysis for paired samples

	Paired samples T test		
	t	gl	Sig. (bilateral)
Pre-test – Post-test	-3.675	81	0.00

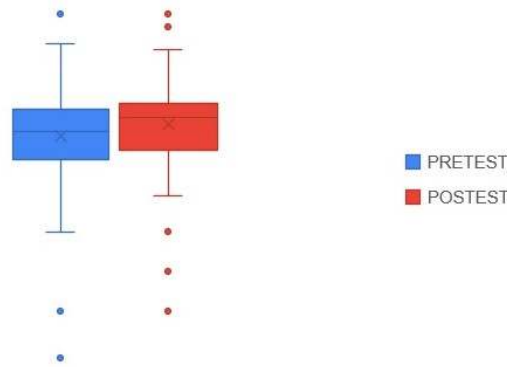


Figure 2. Comparison of averages pre-test / post-test

Likewise, the normality of the differences of the scores by gender was tested. Regarding the pre-test and post-test scores in female students, they have a normal distribution (Sig. 0.516 > $\alpha = 0.05$), similarly in male students (Sig. 0.2 > $\alpha = 0.05$).

Applying the T test for paired samples, it is concluded that there is no significant difference between the scores before and after the use of the app in female students (Sig. 0.082 > 0.05). On the other hand, in male students, there is evidence of a significant difference between the scores before and after the use of the app (Sig. 0.002 < 0.05), as can be seen in Table 2.

Table 2.

T-test analysis for gender-paired samples

	Female Group			Male Group		
	t	gl	Sig. (bilateral)	t	gl	Sig. (bilateral)
Pretest - Posttest	-1.836	19	0.082	-3.187	61	0.002

3.3. Pyramid approach to awareness strategies

Awareness strategies are proposed based on the results obtained, using a pyramidal approach as seen in Figure 3, since it was considered that the base of this structure is vital for the success of the proposed strategies and that all of them are aimed to the student, which is our main purpose, in order to reduce the contagion rate in the university and can also be replicated at home and in other universities.

At the pyramidal base, we have the Student Welfare area and the Executing Units. The Student Welfare function is to promote the comprehensive welfare of the student ensuring the best conditions for their academic and personal development; therefore, it is proposed that this area leads the process of raising awareness of the students through the planning, monitoring and control of the contagion detected cases. And as for the Executing Units, like the marketing area, school management, department management, tutoring and administration, will be in charge of putting the programmed procedures and strategies into practice.

The next level in the hierarchy are the professors, who will be intermediaries between the areas in the lower level and the students. These professors will be responsible for raising awareness in class sessions, disseminating the COVID-19 protocols and existing procedures, as well as being a link that allows processing the justifications for non-attendance and being in contact with the health area for the timely medical attention of the student.

Finally, at the top of the pyramid, the student to whom the talks and awareness campaigns, periodic medical check-ups and monitoring of compliance with biosafety protocols are mainly addressed.

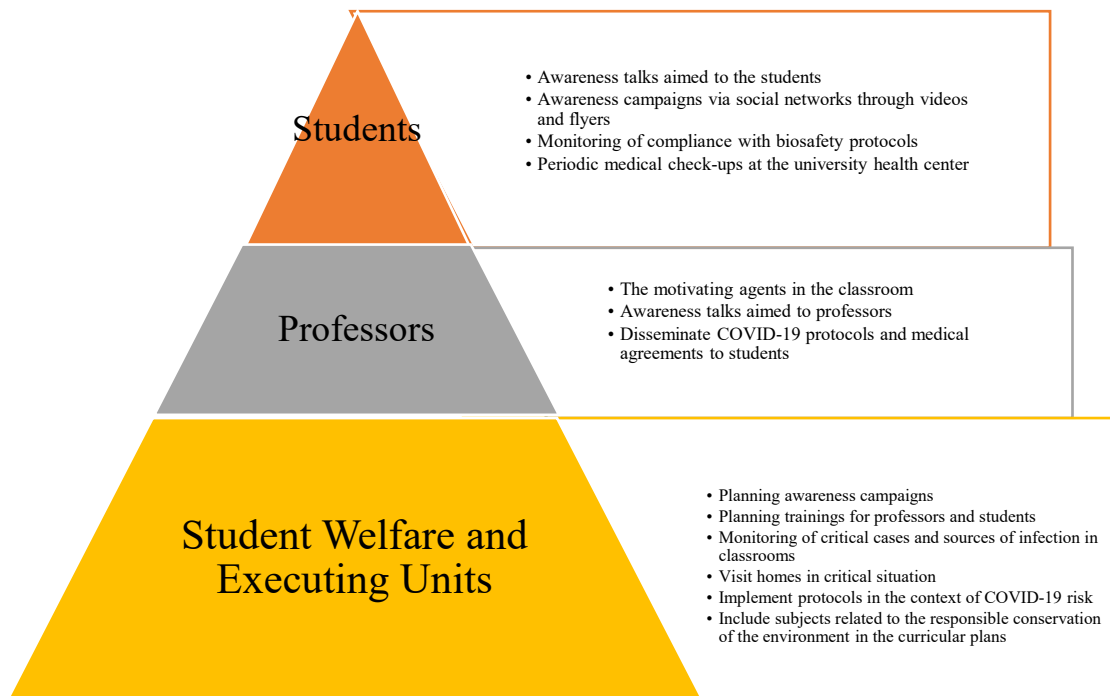


Figure 3: Pyramid approach to awareness strategies

3.4. Proposal for the awareness strategies implementation

In order to make the awareness strategies proposed in the previous section become integrated and applied in the universities when the students return to classes in the “new normal”, the following execution proposal is shown in Figure 4.

The student, through the mobile app, provides the necessary data that is stored in a Database hosted in the cloud; this information is used for both, the University Health Center and the Student Welfare office.

The University Health Center (entity that belongs to the university) through a web app records and collects data on the COVID-19 related health status of the students, which will allow its monitoring by specialist doctors regarding their treatment and recovery.

The Student Welfare Office collects and processes information, generating reports and graphics necessary to propose awareness strategies or update existing ones, which will be disseminated by the professors in the relevant class sessions, according to the protocol defined by the Student Welfare and Executing Units like the marketing area, school management, department management, tutoring and administration, which will be responsible for implementing awareness strategies.

Regarding the school management, it will be responsible for organizing teams of students that promote health care in classrooms, and to channel COVID-19 related cases of health and emotional state of the students detected during the academic semesters to the corresponding entities. Regarding the department management, it will be in contact with the professors so that, in the classroom motivation stage, they include the biosafety protocols and good prevention practices adopted.

The tutoring area is responsible for implementing and applying tests for the diagnosis of the emotional state of the students that allows establishing strategies according to the psychological profiles detected.

The marketing area must establish the means and mechanisms necessary to spread awareness messages efficiently based on the profile of the recipient.

Finally, the administration area must have the resources and budget required for the implementation of the awareness strategies.

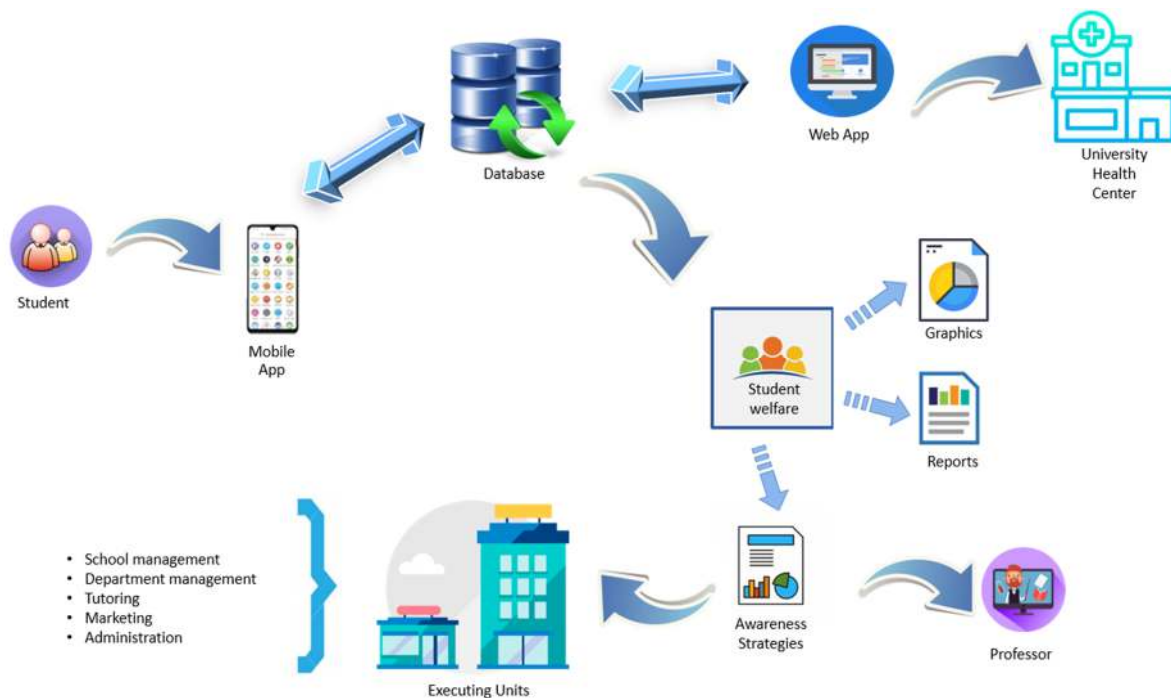


Figure 4: Architecture for the implementation of the awareness strategies

In this research, the awareness of the university student was evaluated through the knowledge of COVID-19 and the preventive measures adopted, with the purpose of proposing, based on the results, awareness strategies that support the continuous improvement of the students' behavior for the plan to gradually return to classes. So unlike Bastian's study [4] and Baud [2] who conclude in their results the various risk circumstances, levels of affectation, infection rate, and hospital resources, in the present research was considered pertinent to provide that information through the mobile application, therefore it becomes available everywhere at any time, guaranteeing the necessary information to ensure knowledge as a starting point.

Wibowo [9] analyzed the media that have been used most frequently to obtain information on COVID-19, pointing out to Twitter as the most used tool in the search for information, in the case of the present research, the search for information was facilitated through the use of the epidemiological surveillance mobile app.

Unlike the study by Tejada et al. [12], in which 95.4% of the population is aware of preventive measures, in our sample, a pre-test and post-test analysis was applied, determining that the mobile app had a significant influence on the adoption of preventive measures.

The research is in line with Rivera [1] in the fact that the female gender shows greater knowledge of preventive measures and their responsible practice. In the present study, women maintain that previously acquired knowledge; however, men improved their level of adoption of preventive measures after using the mobile app provided as a raising awareness tool.

Finally, Roy et al. [5] indicates that the level of knowledge of COVID-19 reduces the level of anxiety and allows a better aptitude to apply preventive measures, in our study, the level of knowledge was improved by the use of the mobile app, achieving awareness in the adoption of the preventive measures of the university community.

4. Conclusions

The use of the mobile epidemiological surveillance app managed to raise awareness in university students in the adequate adoption of preventive measures, these being necessary for the return to classes.

The female university students maintained their knowledge acquired previously, on the other hand, after the use of the mobile app, a greater impact was generated in the male university students, since they increased their knowledge of the preventive measures of COVID-19.

The awareness strategies, based on a pyramidal approach and the proposed implementation, will contribute to reduce the impact of the pandemic on the return to classes and serve as a prevention guide for the university community.

This study can be complemented in the future by measuring the impact generated by the use of the application over a longer period of time and covering the entire university community, and the information generated can be used to implement specific awareness strategies with the support of artificial intelligence algorithms.

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