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Design, implementation, and evaluation of a virtual pulmonary rehabilitation training course for medical interns in COVID-19

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Abstract:

Pulmonary rehabilitation has an influential role in improving the symptoms, reducing subacute and chronic complications, and increasing the performance of patients with COVID-19. Medical interns can play an essential role in training patients. Since, at the time of the research, these concepts were not in the general medical curriculum in Iran, the interns were not trained in this field. This study aimed to design, implement, and evaluate the virtual training course for pulmonary rehabilitation for medical interns in the COVID-19 crisis. A cross-sectional study (with an instructional design approach) was conducted at an academic center in 2021 on 25 medical interns. The newly designed educational content included multimedia files and educational videos offered to the participants. The data collection tools were pre- and post-test, attitude, and satisfaction evaluation questionnaires. Data were analyzed using SPSS (one-sample and paired *t*-test). The average age of the participants was 26.24 ± 0.92 , and most were women (14 (56%)). The average knowledge score after the course (18.52 ± 4.44) compared to before (11.12 ± 2.38) was significant ($P < 0.001$). The average score of attitudes (55.04 ± 6.49) and satisfaction (92.92 ± 10.69) had a significant difference ($P < 0.001$ and $P < 0.001$) and indicated the desirability of the course. Considering the results of this course in improving students' knowledge, attitude, and satisfaction, it is suggested to add this topic to the general medical curriculum (pulmonary or infectious diseases courses).

Keywords:

COVID-19, curriculum, students, telerehabilitation

Introduction

Two thousand and nineteen novel coronaviruses, named COVID-19, which is mainly transmitted through respiratory droplets and close contact, attacks the lungs, and induces serous fluid, fibrin exudates, and hyaline membrane formation in the alveoli and causes a variety of disorders in respiratory, physical, and psychological function.^[1] Pulmonary rehabilitation (including patient education, exercise training, physiotherapy, and nutrition management) is one of

the well-known treatments for many pulmonary diseases, such as chronic obstructive pulmonary disease (COPD) or cystic fibrosis (CF).^[2] Based on the studies conducted during the COVID-19 epidemic, this treatment method can effectively reduce complications of patients with COVID-19, improving performance, and helping them return to society.^[1,3,4] Patients must be well-trained to perform rehabilitation exercises such as breathing, aerobic, stretching, and strengthening exercises during hospitalization and after discharge.^[5] Medical interns can play an important role

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in training patients, so training rehabilitation principles to medical students seems essential.^[6] At the time of this study, pulmonary rehabilitation principles did not exist in the general medical curriculum in Iran. So, the present study aimed to design, implement, and evaluate the virtual pulmonary rehabilitation training course for medical interns in COVID-19.

Materials and Methods

This cross-sectional study (with an instructional design approach) was conducted at Kashan University of Medical Sciences, Kashan, Iran, in 2021. Sampling was performed by census method, and all student interns in the first semester of 2020-2021 (February 2021 to July 2021) voluntarily participated in the study.

1. Design phase

Since there was no lesson plan or content on pulmonary rehabilitation, the corresponding lesson plan was written for the first time within six parts (the importance of principles of pulmonary rehabilitation, tools and techniques, aerobic and anaerobic exercises, indications, and contraindications in different stages of the disease of COVID-19). To evaluate knowledge, multiple-choice and matching questions were designed based on clinical cases. The face and content validity were confirmed by five experts. The reliability of pre-test and post-test with the Kuder-Richardson coefficient was obtained as 0.892 and 0.78, respectively. The theoretical content of the course includes a PowerPoint and podcast file, and four educational video files of pulmonary rehabilitation exercises (breathing, aerobic, stretching, and resistance exercises) were prepared by a physical medicine and rehabilitation (PM and R) specialist (EM) and a medical intern student as a simulated patient (EZ), who are also the authors of the article. In fact, part of the innovation of this research, which is also its main focus, is related to its "design and compilation of educational videos" as an educational product. A 15-item researcher-made questionnaire was prepared to evaluate students' attitudes, and another one with 24 items in six areas based on a 5-point Likert scale was prepared to evaluate their satisfaction. Both questionnaires were completed face-to-face and online forms (Porsline software). The face and content validity of two questionnaires were evaluated using CVR (content validity ratio) and CVI (content validity index) indices by five experts. The reliability of questionnaires was also calculated using Cronbach's alpha method (0.842 for attitude and 0.959 for satisfaction questionnaire).

2. Implementation phase

First, the objectives and implementation methods of the course were explained to the interns in a briefing session.

Then, the pre-test (in person and online (WhatsApp)) was given to the interns. After that, the educational content of the course was sent to students via WhatsApp. Students were given two weeks to study the educational content, and follow-up was performed during this time. In case of ambiguity about the content, the questions were provided to the instructor through voice and text messages, and appropriate answers were sent to the students. Two weeks later, the post-test was given to participants. Finally, the satisfaction and attitude evaluation questionnaires were provided to the students.

3. Evaluation phase

Knowledge, attitude, and satisfaction evaluation were evaluated through pre-test and post-test, and related questionnaires, respectively. Data analysis was carried out using SPSS 26 and descriptive statistics (frequency distribution and central and dispersion indicators) and inferential statistics (one-sample and Paired *t*-test).

Ethical consideration

This study is part of a general doctoral thesis with the code of ethics IR.KAUMS.MEDNT.REC.1399.193

Results

A total of 32 interns entered the study. However, 7 of them were excluded from the study due to their unwillingness to continue cooperating or not completing the pre-test, post-test, and questionnaires, so only 27 students continued until the end of the study. Their average age was 26.24 ± 0.92 (range = 25-29 years), and the majority of them were female (14 (56%).

The average knowledge of interns after the intervention (18.52 ± 4.44) was significantly higher than before the intervention (11.12 ± 2.38) ($P < 0.001$, $t = -7.40$) [Table 1].

Results also showed out of 15 items, four items, namely: 1—The necessity of acquiring skills in the field of disease rehabilitation along with drug treatments for general practitioners (GPs), 2—The condition of teaching pulmonary rehabilitation in all types of lung diseases for medical students, 3—The applicability of the content of this course in the future and the visit and treatment of patients, 4—using exercises and techniques recommended in this course received the highest mean attitude scores, respectively, and the reverse item: 1—Appropriate time to teach the topic of pulmonary rehabilitation during clerkship, received the lowest mean attitude score [Table 2].

Results also demonstrated that out of 6 areas and 24 items, the items: 1—The role of educational video in

facilitating practical work, 2—the attractiveness of the presence of a medical student on the part of a simulated patient, 3—The appropriate interaction between the instructor (in the role of a doctor) and a simulated patient was assigned the highest satisfaction scores, respectively. Also, the reverse item, “Virtual education method was less effective than the face-to-face method in improving my learning in this course,” was assigned the lowest mean satisfaction score [Table 2].

The results of the attitude and satisfaction questionnaire are reported in Table 3. The results of the one-sample *t*-test showed that the mean of the total attitude score (55.04 ± 6.49) was higher than the test value (or the average limit) and had a significant difference ($P < 0.001$, $t = 7.73$). Also, the results of the one-sample test for the questionnaire satisfaction showed that the mean total score of students' satisfaction was significantly higher than the test value (average limit) ($P < 0.01$, $t = 9.87$).

Therefore, the results of both questionnaires indicated that the interns had a favorable attitude and satisfaction toward the course.

Discussion

The results showed that the students scored higher in the post-test than in the pre-test, indicating this method's effectiveness in improving their theoretical knowledge of pulmonary rehabilitation. The results of various studies show that the knowledge and skills of GPs in the field of PM and R are not enough.^[7-9] There is no study about teaching pulmonary rehabilitation to medical students, and this is the first study in this field. So, a similar analysis is not available to compare the results.^[10]

Most interns believed that pulmonary rehabilitation training should not be limited to the COVID-19 pandemic period and should continue for other pulmonary diseases

Table 1: Comparing the knowledge score of interns before and after the course

Variable	Pre-test Mean±SD (Min-Max)	Post-test Mean±SD (Min-Max)	t	P
Knowledge of interns regarding pulmonary rehabilitation	11.12±2.38 (7-18)	18.52±4.44 (9-24)	-7.40	<0.001

Table 2: The mean attitude and satisfaction scores of interns (highest and lowest average) regarding the pulmonary rehabilitation virtual education course

Questionnaire	Area	Item	Mean±Standard deviation (SD)
Attitude (score of 5 items out of 15 items)	---	In my opinion, it is generally necessary for GPs to acquire skills in the field of disease rehabilitation and drug treatments.	4.12±0.72
		Apart from the COVID-19 pandemic, I generally consider it essential to teach pulmonary rehabilitation to medical students because of its dominance in various pulmonary diseases.	4.08±0.57
		In my opinion, the content of this course will be used in future patient visits and treatments.	4±0.58
		I will apply the exercises and techniques recommended in the educational content of this course.	4±0.58
		In my opinion, a clerkship is a right time to teach the topic of pulmonary rehabilitation.	3±1.08
Satisfaction (score of 4 items out of 24 items)	Content	The educational video facilitated practical work.	4.40±0.50
	Design	A medical student's presence in the simulated patient role was attractive.	4.32±0.69
	Instructor	The educational video interaction of the instructor (in the role of the physician) and a simulated patient was appropriate.	4.20±0.50
	General opinion	Virtual education was less effective than face-to-face in my learning in this course	3.24±0.83

Table 3: One-sample t-test to investigate the attitude and satisfaction of interns toward the pulmonary rehabilitation virtual training course

Questionnaire	Area	Test value	Mean±SD	t	P
Attitude	---	45	55.04±6.49	7.73	<0.001
Satisfaction	Content	24	31.48±3.75	9.96	<0.001
	Design	9	11.56±1.68	7.59	<0.001
	Technical-structural	18	23.96±1.86	16.03	<0.001
	Evaluation	3	4.04±0.61	8.51	<0.001
	Instructor	9	11.32±1.72	6.72	<0.001
	Overall opinion	9	10.56±2.08	3.74	<0.001
	Total		72	92.92±10.69	9.87

in the future. So, the educational content prepared in our study was published on various platforms, including KAUMS website,^[11] the Aparat website,^[12] and the Telegram channel.^[13] for offering to patients with a wide variety of lung diseases, such as COPD and CF.

A high percentage of participants believed that the virtual education of this course could be an excellent alternative to its traditional (face-to-face) education. In some studies, students do not accept virtual education as a substitute for formal education but as a supplement to it. For example, Bahadorani *et al.*^[14] showed learners were more satisfied with blended education (virtual and traditional). Chen *et al.*^[15] compared the results of face-to-face and online training. They found that video training can be as practical as traditional lecture training and, in some cases, improve learners' knowledge.

Most students stated that they would use the content of this course in their patient visits. This result was consistent with Razavi *et al.*^[16] They also found that students' attitudes differed in the pre-and post-intervention phases to the extent that students considered the PM and R course as one of the options for continuing their studies until gaining their medical specialty in this field.

Participants' satisfaction with the 'evaluation area' was lower than in other aspects of this training course. It may be because the pre-test and post-test questions did not cover all the course content. The questions only focused on the theory but not the practical points. This finding was consistent with the results of Noghan *et al.*,^[17] who reported that the lowest level of student satisfaction was related to practice evaluation.

This research had some strengths, including the fact that the participants were in social medicine rotation and did not have hospital shifts, so they had more opportunities to study the materials. Also, most had experience contracting COVID-19 (personally or with their relatives), so they felt a great need to obtain pulmonary rehabilitation information. Another advantage was using a medical intern (as a simulated patient) in educational videos that caused students' better attitudes.

The small sample size (25 medical interns) was one of the research's limitations. Not fulfilling psychomotor objectives and focusing on cognitive and attitudinal ones were the other limitation of the study, which was caused by the virtual presentation of the course.

Conclusions

Due to the COVID-19 disease, pulmonary rehabilitation training for medical students is a new educational need. Considering the effect of holding this course

in improving the student's knowledge, attitude, and satisfaction, it is recommended that this topic be added to the infectious or pulmonary diseases course plan. Of course, this action requires further studies regarding the feasibility of adding this topic to the curriculum and also checking its alignment with the policies of the Ministry of Health. It is recommended to compare educational videos and other traditional methods in virtual education for medical students in future studies.

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Conflicts of interest

There are no conflicts of interest.

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