

# Efficiency of an Online Intervention in the Knowledge Concerning COPD in Nursing Students

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**Background:** Chronic obstructive pulmonary disease (COPD) is a progressive and debilitating respiratory disorder. Nurses play a major role in managing the disease. This study aimed to test the effect of a brief online intervention in increasing the knowledge of COPD in a sample of nursing students in Greece.

**Materials and Methods:** The intervention entailed a combination of two ½ hour lectures focusing on the treatment and care of patients with COPD according to existing guidelines. Data were collected with a structured questionnaire specially designed for this study including questions regarding information on sociodemographic characteristics of the participants, and the Bristol COPD Knowledge Questionnaire (BCKQ) which is designed to assess the knowledge of 13 COPD-specific topics. The questionnaire was distributed three times and the one-way ANOVA test of repeated measures was applied to investigate the effect of the educational intervention by examining the periods before, immediately after, and one month after the intervention.

**Results:** 125 nursing students participated in this study of which 13.6% were men (n=17) and 86.4% were women. According to the results of the repeated measures ANOVA test, there was a statistically significant improvement in gained knowledge about COPD.

**Conclusions:** Short educational interventions can be effective in acquiring and cultivating nursing students concerning COPD. These short online tutorials seem to be cost-effective as they can be organized easily and with minimal financial resources.

**Keywords:** COPD; Knowledge; Nurse; Nursing students; Questionnaire

## INTRODUCTION

Chronic obstructive pulmonary disease (COPD) is a slowly progressing and debilitating respiratory disorder that is characterized by prolonged inflammation, tissue destruction, and airflow obstruction leading to the reduced functional capacity of the lungs. The condition affects millions of people worldwide and represents a large medical and financial burden (1). Its direct costs of treatment in the United States are greater than \$32 billion per year (2). The disease was one of the five leading causes

of “years of life lost” in 2017 and is also predicted to be the third most common cause of death by 2030 and fifth rank in the global disease burden (3).

COPD is a major public health problem that is underdiagnosed both in Greece and globally. COPD has a significant financial burden in terms of healthcare and disability costs. In 2008, there were more than 820,000 inpatient hospitalizations for COPD among adults in the United States. These patients often visit in the outpatient clinics and emergency departments. COPD has also a

significant mortality. According to the World Health Organization, COPD is the fourth leading cause of death worldwide (4,5). The role of nurses in managing the disease of these patients is crucial. Moreover, the need to cultivate knowledge and skills has been emphasized by researchers from time to time (6).

Healthcare providers face challenges when managing COPD, as patients have a variety of complex health and social care needs requiring life-long care, monitoring, and treatment. Nurses play a major role in managing the disease since they often represent the first point of contact for patients affected by COPD and are involved in all stages of care (7). Thus, improved nursing education is required to enable nurses to meet these challenges effectively. However, a lack of knowledge about COPD has been observed among those who care for such patients. For example, a recent study of hospital and primary care services found that only 11% of the participant nurses were able to demonstrate correct inhalation techniques to patients with COPD, as mentioned by Berland and Bentsen (8). The authors also mentioned other studies which report that the nurses feel worried and helpless when taking care of patients with severe COPD due to their lack of relevant knowledge and skills, or because nurses in primary care have insufficient knowledge and skills to provide proper care to such patients. Those studies also found that care could be improved only by learning more about the symptoms, complications, and outcomes of treatments for such patients and that upgrading skills positively affected the degree of confidence that nurses felt in their encounters with COPD patients (8).

While online or distance learning has gained popularity and is considered an effective instructional strategy by many researchers and students, including those in the nursing profession, some educators remain skeptical of this educational approach. However, online learning has been shown to result in high levels of satisfaction, knowledge gains, and skill development among students. On the one hand, it has been found that distance learning in nursing education can produce equal or superior results in

knowledge when compared to traditional, “in the classroom” learning, as well as some improvement in performing the nursing skills, and generally higher satisfaction as far as the learners are concerned (9). On the other hand, there are some concerns, especially for the mythological approach that is used to evaluate e-learning effectiveness and educational outcomes while some argue that e-learning can cause social isolation and requires strong self-motivation (10).

In this study, we employed validated questionnaires and a large sample size to eliminate those methodological issues. This study aimed to test the effect of a brief online intervention in increasing the knowledge of COPD in a sample of nursing students in Greece.

## **MATERIALS AND METHODS**

An online anonymous questionnaire consisting of two parts was used for data collection. The first part was specially designed for the main purpose of this study and included questions regarding information on the sociodemographic characteristics of the participants, such as gender, age, and years of study.

The second part consisted of the Bristol COPD Knowledge Questionnaire (BCKQ). The BCKQ is a multiple-choice questions tool that is designed to assess the knowledge of 13 COPD-specific topics. This questionnaire includes 65 questions divided into the following subscales: 1) epidemiology, 2) etiology, 3) symptom, 4) breathlessness, 5) phlegm, 6) infections, 7) exercise, 8) smoking, 9) vaccination, 10) inhaled bronchodilators, 11) antibiotics, 12) oral steroids, and 13) inhaled steroids. Each factor contains five items. The total score ranges from 0 (no knowledge) to 65 (high level of disease knowledge). The BCKQ has been validated for the Greek population and exhibited excellent reliability (11).

Nursing students were asked to answer the online questionnaire at three-time points: 1. T0 that was immediately before the online intervention, 2. T1 which was immediately after the lectures ended, and 3. T2 that was 1 month after the intervention. No assistance was

given to the participants regarding the correct answers and they were asked to not search for the responses in their textbook, or websites or collaborate with their colleagues. Additionally, the respondents were not aware before their first responses (T0) that they would be asked to answer the questionnaire again in the future. All participants provided informed consent before the participation.

#### **Design and description of the intervention**

We conducted an interventional cohort study. The intervention entailed a combination of two lectures focusing on the treatment and care of patients with COPD according to existing guidelines. The educational intervention was an intensive 1-hour session that was designed to increase the knowledge and skills required to provide evidence-based nursing care to patients with COPD. The first half of the intervention was the presentation of a case study of a patient with COPD, approached according to current guidelines. The second part was focused on evidence-based practice in the care of patients with COPD. During the intervention, several aspects of COPD were discussed including (patho) physiology, epidemiology, treatment guidelines, and immunization practices.

#### **Sample**

The sample consisted of nursing students attending a monthly seminar regarding "Evidence-Based Practice". The inclusion criteria were: (1) willingness to participate, (2) being a nursing student, (3) attendance in the online seminar of more than 75% of its duration (i.e. at least 45 minutes). A total of 125 nursing students were included in the study. The participants were asked to complete the questionnaire in three time points as discussed earlier. The sample size was calculated to provide a power of 90 percent ( $\alpha=0.05$  by two-sided test) to detect a difference of 0.6 times the standard deviation before and after the intervention. According to these data, a total of 120 participants were to be enrolled in the study

([http://hedwig.mgh.harvard.edu/sample\\_size/js/js\\_parallel\\_quant.html](http://hedwig.mgh.harvard.edu/sample_size/js/js_parallel_quant.html)).

#### **Statistical analysis**

Statistical analysis was performed with IBM SPSS 25. Descriptive and inferential statistics were applied to address the aims of the study. The reliability analysis of the questionnaire scale used to investigate the effect of student information on COPD shows a high Cronbach's Alpha value of 0.874. The results obtained by this questionnaire comply with the content validity parameters as the conclusions drawn to answer the research questions of the present research. Means and standard deviations were calculated for the total score of the BCKQ and its subdomains. The one-way ANOVA test of repeated measures was applied to investigate the effect of informing students about COPD regarding the knowledge they gained about the disease by examining the periods before the update (initial knowledge, T0), immediately after the update (T1), and one month after the update (T2).

## **RESULTS**

#### **Demographics**

The questionnaire to investigate the effect of informing students about COPD was answered by nursing students who participated in the hourly online educational seminar entitled "Evidence-Based Nursing Practice in COPD" organized by the Faculty of Nursing of the University of Thessaly. The questionnaire had to be completed in three phases (before the intervention, immediately after the intervention, and one month after the intervention). Of the 160 students who answered the questionnaire at T0, 159 completed it at T1, and 125 answered the questionnaire at T2. The three phases of completing the questionnaire were attended by 125 participating nursing students, of which 13.6% were men ( $n=17$ ) and 86.4% were women. Of the participants, 87.2% belong to the age group 18-25 years ( $n=109$ ), 3.2% belong to the age group 26-30 years and 9.6% belong to the age group > 30 years. Regarding the student's academic year of study, 51.2% ( $n=64$ ) were in the 1st year of study, 21.6% ( $n=27$ ) in the 2nd year of study, 1.6% in the

3rd year of study, 11.2% (n=14) in the 4th year of study, and 13.6% (n=17) in the 5th year of study.

The repeated measures ANOVA test was applied to investigate the effect of informing students about COPD regarding the knowledge they gained about the disease by examining the periods before the briefing (initial knowledge), immediately after the briefing, and one month after the briefing. There is a statistically significant difference in the time of informing students about COPD regarding the Epidemiology factor of the Bristol questionnaire by examining the periods before the update, immediately after the update, and one month after the update, as the value Wilks' Lambda=0.760, F(2.123)=19.453, p<0.001. The same goes for the factor Etiology (Wilks' Lambda=0.727, F(2.123)=23.059, p<0.001), the factor Symptoms (Wilks' Lambda=0.748, F(2.123)=20.773, p<0.001), the factor Breathlessness (Wilks' Lambda=0.769, F(2.123)=18.523, p<0.001), the factor Phlegm (Wilks' Lambda=0.690, F(2.123)=27.673, p<0.001), the factor Infections (Wilks' Lambda=0.775, F(2.123)=17.838, p<0.001), the Exercise factor (Wilks' Lambda=0.860, F(2.123)=10.014, p<0.001), the Smoking factor (Wilks' Lambda=0.865,

F(2.123)=9.629, p=0.000), the factor Vaccination (Wilks' Lambda=0.854, F(2.123)=10.550, p<0.001), the factor Inhaled bronchodilators (Wilks' Lambda=0.705, F(2.123)=25.784, p<0.001), the factor Antibiotics (Wilks' Lambda=0.829, F(2.123)=12.691, p<0.001), the factor Oral steroids (Wilks' Lambda=0.763, F(2.123)=19.106, p<0.001), the factor Inhaled steroids (Wilks' Lambda=0.826, F(2.123)=12.955, p<0.001), and for the total score (Wilks' Lambda=0.532, F(2.123)=54.124, p<0.001) (Table 1).

When examining for any differences in the effectiveness of the intervention regarding demographics, we observed two statistically significant differences between men and women in the Exercise factor and the overall score of the questionnaire. Women showed a higher score in all three periods than men in both the Exercise factor and the overall score (Table 2).

A statistically significant effect among the age groups was found in the age group 30 and over when compared to the age group of 18-25 years. People over the age of 30 showed a higher overall score in all three periods when compared to people aged 18-25 (Table 3).

**Table 1.** Bristol subscale results in each time point for the participants

	Baseline (before the intervention)	After the intervention	One month after the intervention	Pairwise Comparisons
	T0	T1	T2	
<b>Epidemiology</b>	2.10 ±1.30	2.62±1.04	2.89±1.01	T0<T1,T2*** ;T1<T2*
<b>Etiology</b>	2.74±1.57	3.63±0.98	3.46±1.16	T0<T1,T2***
<b>Symptoms</b>	2.29±1.25	3.05±0.86	2.61±0.86	T0<T1***; T0<T2*; T1>T2***
<b>Breathlessness</b>	1.92±1.17	2.48±0.92	2.51±0.98	T0<T1,T2***
<b>Phlegm</b>	2.58±1.42	3.40±1.03	3.28±1.04	T0<T1,T2***
<b>Infections</b>	1.68±1.11	2.37±1.01	1.99 ±1.11	T0<T1***; T0<T2*; T1>T2**
<b>Exercise</b>	2.22±1.16	2.70±0.99	2.61±0.94	T0<T1,T2***
<b>Smoking</b>	2.87±1.12	3.30±0.75	3.27±0.91	T0<T1***; T0<T2**
<b>Vaccination</b>	2.58±1.02	3.01±0.86	2.97±0.94	T0<T1,T2***
<b>Inhaled bronchodilators</b>	1.28±1.26	2.14±1.15	2.07±1.40	T0<T1,T2***
<b>Antibiotics</b>	2.50±1.24	3.04±0.83	3.02±0.86	T0<T1,T2***
<b>Oral steroids</b>	1.18±1.22	1.72±1.40	2.01±1.49	T0<T1,T2***
<b>Inhaled steroids</b>	0.45±0.86	0.78±1.01	1.08±1.32	T0<T1*; T0<T2*** ; T1<T2*
<b>Total Score</b>	26.40±10.23	34.24±6.29	33.76±7.23	T0<T1,T2***

\*p≤0.05, \*\*p<0.01, \*\*\*p<0.001 , Data are presented as mean±SD

**Table 2.** Comparison of “Exercise” subscale and total score in Bristol questionnaire according to gender

		T0	T1	T2	p-value
Exercise	Females	2.32±0.11	2.70±0.09	2.68±0.08	0.017
	Males	1.58±0.27	2.70±0.24	2.11±0.22	
Total Score	Females	27.28±0.96	34.24±0.61	34.07±0.69	0.014
	Males	20.76±2.43	34.23±1.53	31.76±1.75	

Data are presented as mean±DS. p-value corresponds to between group comparison (females versus males) for the three time points

**Table 3.** Comparison of “total score in Bristol questionnaire according to age group

	T0	T1	T2	p-value
<b>Total Score</b>				
18-25 years	24.97±0.92	33.77±0.59	33.24±0.68	0.019
26-30 years	32.75±4.79	32.50±3.07	33.50±3.56	
>30 years	37.25±2.76	39.08 ±1.77	38.50±2.06	

Data are presented as Mean±SD. p-value corresponds to between group comparison (subjects>30 years versus subjects 18-25 years) for the three time points

Regarding the effect of the academic year, we observed that there is a statistically significant difference in the average score of the factor Symptoms, Inhaled bronchodilators, and Total score. It seems that students of higher education (three or more years in nursing school) achieve a higher score in “Symptoms” than students of younger years in all three periods (Table 4).

**Table 4.** Comparison of Symptoms, Inhaled bronchodilators, and Total score according to the academic year of the nursing student

	T0	T1	T2	p-value
<b>Symptoms</b>				
1 <sup>st</sup> academic year	1.86±1.27	3.16±0.90	2.54±0.85	0.000
2 <sup>nd</sup> academic year	2.63±1.15	2.88±0.80	2.74±1.02	
3 <sup>rd</sup> academic year	4.00±0.00	2.50±0.71	2.00±0.00	
4 <sup>th</sup> academic year	2.85±0.95	2.71±0.73	2.57±0.65	
5 <sup>th</sup> academic year	2.71±1.05	3.35±0.70	2.71±0.85	
<b>Inhaled bronchodilators</b>				
1 <sup>st</sup> academic year	1.06±1.27	1.89±1.17	1.75±1.37	0.046
2 <sup>nd</sup> academic year	1.59±1.12	1.96±1.02	1.77±1.12	
3 <sup>rd</sup> academic year	0.00±0.00	2.50±0.71	1.00±0.98	
4 <sup>th</sup> academic year	1.35±1.28	2.71±0.91	3.29±1.33	
5 <sup>th</sup> academic year	1.77±1.35	2.94±0.97	2.88±1.27	
<b>Total Score</b>				
1 <sup>st</sup> academic year	21.95±11.23	32.36±6.39	31.67±7.38	0.010
2 <sup>nd</sup> academic year	29.78±6.53	34.67±4.94	33.11±6.78	
3 <sup>rd</sup> academic year	37.00±7.07	40.00±5.66	37.00±9.90	
4 <sup>th</sup> academic year	32.00±6.05	36.50±6.27	39.36±5.96	
5 <sup>th</sup> academic year	31.94±6.39	38.82±4.07	37.59±4.30	

Data are presented as mean±SD). p-value corresponds to between group comparison (1<sup>st</sup> vs. 2<sup>nd</sup> vs 3<sup>rd</sup> vs 4<sup>th</sup> vs 5<sup>th</sup> academic year) for the three time points

## DISCUSSION

In the present study, we evaluated the effectiveness of a short online educational intervention in nursing students to increase their knowledge about COPD. According to our results, the level of knowledge of nursing students was relatively low. We noticed that there was a significant increase in the level of knowledge immediately after the intervention in most dimensions of BCKQ. This increase was maintained over time, as this improvement remained in the third measurement a month later. In addition, we observed that socio-demographic factors (such as gender and age) seem to influence the acquisition and maintenance of knowledge about COPD.

According to the results of the present study, the initial level of knowledge of nursing students on COPD issues was limited. The Total BCKQ score as well as its subscales were well below the average value of the theoretical scope of the questionnaire. Even though the intervention was effective and there was an increase in the score of the questionnaire in several dimensions, this increase just exceeded the theoretical range in some subscales while in others it did not (Infections, inhaled bronchodilators, Oral steroids, and Inhaled steroids). Similar results were reported by Ma et al. who showed that nurses working in internal medicine departments lack in their level of knowledge when compared to those working in respiratory medicine departments. They also had low scores in the fields of Oral and Inhaled steroids (12). Our results are in agreement with other studies which report that nurses have several gaps in the knowledge and management of COPD patients (13,14). Nurses themselves recognize these gaps and the importance of their training on COPD issues for the provision of quality of nursing care (15). Although the intervention included all aspects of COPD management, we acknowledge that the lack of an increase in the knowledge of some subscales of the Bristol questionnaire may be attributed to the course itself, and therefore no definite conclusions can be drawn.

Several studies have highlighted the effectiveness that educational interventions can have in enhancing and

cultivating nurses' knowledge about COPD (16-18). According to the results of the present study, the short online educational intervention that took place was effective for all knowledge, but there were areas such as Inhaled steroids where the increase in knowledge, although statistically significant, was not sufficient. This result is in agreement with the study of Staiou et al. where it was found that working nurses have knowledge gaps on oral and inhaled steroids even after an educational intervention. The authors attribute these gaps to various misconceptions about their necessity and action (18). This finding highlights the need for more intensive and narrow educational interventions on this issue so that nurses who are or may be involved in the care of patients with COPD can have the necessary knowledge and skills to care for these patients.

An additional important finding of the present study was that some demographic factors such as gender and age as well as the academic year of study were found to affect the knowledge that students have about COPD. Interestingly, we observed an increase in the total score between T0 and T1, which further increased one month later in students of the 4<sup>th</sup> academic year. Additionally, men and women differed in the exercise scale and the Total score while age groups differed in terms of Total score. This is in contrast to other studies that present the acquisition of knowledge after educational interventions in nursing students to not be different (19). The discrepancy among academic years may be attributed to the fact that in our institution, the curriculum of the 4<sup>th</sup> year involves a lot of clinical practice hours. In addition, Shinnick et al. had come to the same conclusion that gender and age are not factors related to the acquisition of knowledge (20). Finally, according to a systematic review of the literature on academic and clinical performance and the papers in nursing students, it was found that both genders performed similarly in different aspects. The majority of studies revealed that the clinical placement satisfaction of the males was similar to that of the female students (21).

This difference in our findings may be due to the different educational approaches, the different content, and subject material. Additionally, that may be attributed to the academic year that the participants may have and the existence - or not - of previous service. Finally, according to the present study, the level of knowledge was higher as the students progressed in academic education. This is explainable since as students' progress their studies, they are introduced to classes such as medical nursing, nursing for patients with chronic diseases, etc. that address health care issues for individuals with COPD. The effects that the curricula structure and content have on students' knowledge in the specific subject have also been highlighted by others (22,23). This finding, combined with similar findings in the literature, provides useful information and a basis for those planning curricula on how they can increase and cultivate the knowledge of future clinical nurses.

Despite the originality of both the subject and the brief educational intervention, the present study has some limitations. A key limitation was the absence of a control group. It would be useful to conduct future studies which on the one hand will involve a control group and on the other will involve the comparison of different educational approaches and strategies. Additionally, we acknowledge that the study sample is heterogenous in terms of academic year and that the effectiveness of the intervention in one month may not correlate with improvements in real clinical care. Students were instructed to not use textbooks or internet, or ask their colleagues for the correct answers when responding to the questionnaire. However, we acknowledge that some may have not followed these instructions. Finally, our sample consisted mostly of younger, female respondents which may have influenced the interpretation.

## **CONCLUSION**

The present study is a quantitative evaluation of a short educational intervention in the acquisition and cultivation of nursing students concerning COPD and the issues that

fall within the care and treatment of these patients. These short, online tutorials can be organized easily and with minimal financial resources. Therefore, their integration in both formal and non-formal education may have a significant impact on the formation of well-trained nursing staff and therefore on the provision of quality nursing care.

### Institutional Review Board Statement

The study was conducted according to the guidelines of the Declaration of Helsinki, and approved by the Ethics Committee of Nursing Department of UTH (167/04.09.2020).

### Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

### Data Availability Statement

Data are available from the corresponding author upon reasonable demand.

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### Conflicts of Interest

The authors declare no conflict of interest.

## REFERENCES

- Easter M, Bollenbecker S, Barnes JW, Krick S. Targeting Aging Pathways in Chronic Obstructive Pulmonary Disease. *Int J Mol Sci* 2020;21(18):6924.
- Ritchie AI, Wedzicha JA. Definition, Causes, Pathogenesis, and Consequences of Chronic Obstructive Pulmonary Disease Exacerbations. *Clin Chest Med* 2020;41(3):421-38.
- Lu HH, Zeng HH, Chen Y. Early chronic obstructive pulmonary disease: A new perspective. *Chronic Dis Transl Med* 2021;7(2):79-87.
- López-Campos JL, Tan W, Soriano JB. Global burden of COPD. *Respirology* 2016;21(1):14-23.
- Singh D, Agusti A, Anzueto A, Barnes PJ, Bourbeau J, Celli BR, et al. Global Strategy for the Diagnosis, Management, and Prevention of Chronic Obstructive Lung Disease: the GOLD science committee report 2019. *Eur Respir J* 2019;53(5):1900164.
- Bunker J, Hermiz O, Zwar N, Dennis SM, Vagholkar S, Crockett A, et al. Feasibility and efficacy of COPD case finding by practice nurses. *Aust Fam Physician* 2009;38(10):826-30.
- Fletcher MJ, Dahl BH. Expanding nurse practice in COPD: is it key to providing high quality, effective and safe patient care? *Prim Care Respir J* 2013;22(2):230-3.
- Berland A, Bentsen SB. Patients with chronic obstructive pulmonary disease in safe hands: An education programme for nurses in primary care in Norway. *Nurse Educ Pract* 2015;15(4):271-6.
- Knopf-Amelung S, Gotham H, Kuofie A, Young P, Manney Stinson R, Lynn J, et al. Comparison of Instructional Methods for Screening, Brief Intervention, and Referral to Treatment for Substance Use in Nursing Education. *Nurse Educ* 2018;43(3):123-7.
- Bloomfield JG, While AE, Roberts JD. Using computer assisted learning for clinical skills education in nursing: integrative review. *J Adv Nurs* 2008;63(3):222-35.
- Staiou M, Kotrotsiou E, Gourgoulialis K, Raftopoulos V. The psychometric properties and test-retest reliability of the Bristol COPD Knowledge Questionnaire when adapted in a sample of Greek nurses. *International Journal of Caring Sciences* 2018;11(1):157.
- Ma Y, Peng Y, Chen P, Nie N, Chen Y. Assessment of COPD-Related Knowledge Among Internal Medicine Nurses: A Cross-Sectional Study. *Int J Chron Obstruct Pulmon Dis* 2019;14:2917-25.
- Young HM, Apps LD, Harrison SL, Johnson-Warrington VL, Hudson N, Singh SJ. Important, misunderstood, and challenging: a qualitative study of nurses' and allied health professionals' perceptions of implementing self-management for patients with COPD. *Int J Chron Obstruct Pulmon Dis* 2015;10:1043-52.

14. De Godoy I, Nogueira DL, Godoy I. Nurses' knowledge and abilities gaps concerning health care of COPD patients: Window for improvement. *Eur Respir J* 2016; 48: PA1613
15. Rouleau G, Gagnon MP, Côté J, Payne-Gagnon J, Hudson E, Dubois CA, et al. Effects of E-Learning in a Continuing Education Context on Nursing Care: Systematic Review of Systematic Qualitative, Quantitative, and Mixed-Studies Reviews. *J Med Internet Res* 2019;21(10):e15118.
16. Mahran SK, Marwa Radwan M. Comparative Study Of Critical Nurses ' Knowledge And Practice Before And After Education Program About Acute Exacerbation Of Chronic Obstructive Pulmonary Disease. *IOSR-JNHS* 2018; 7(2): 79-89.
17. Khadyer A, Hassan H. Effectiveness of an Instructional Program on Knowledge for Pa-tients with Chronic Obstructive Pulmonary Disease Toward Self-Care Management at Al-Hussein Teaching Hospital in Al-Nasiriyah City. *Indian J Forensic Med Toxi-col* 2019;13(4):997.
18. Staiou M, Gourgoulialis K, Kotrotsiou E, Raftopoulos V. Closing the gap: The effect of an evidence-based intervention in increasing COPD nurses' knowledge. *Nurs Forum* 2021;56(1):30-6.
19. Haukedal TA, Reiersen IÅ, Hedeman H, Bjørk IT. The Impact of a New Pedagogical Intervention on Nursing Students' Knowledge Acquisition in Simulation-Based Learning: A Quasi-Experimental Study. *Nurs Res Pract* 2018;2018:7437386.
20. Shinnick MA, Woo M, Evangelista LS. Predictors of knowledge gains using simulation in the education of prelicensure nursing students. *J Prof Nurs* 2012;28(1):41-7.
21. Chan ZC, Chan YT, Lui CW, Yu HZ, Law YF, Cheung KL, et al. Gender differences in the academic and clinical performances of undergraduate nursing students: a systematic review. *Nurse Educ Today* 2014;34(3):377-88.
22. Usher K, Woods C, Brown J, Power T, Lea J, Hutchinson M, et al. Australian nursing students' knowledge and attitudes towards pressure injury prevention: A cross-sectional study. *Int J Nurs Stud* 2018;81:14-20.
23. Wilschut VFC, Pianosi B, van Os-Medendorp H, Elzevier HW, Jukema JS, den Ouden MEM. Knowledge and attitude of nursing students regarding older adults' sexuality: A cross-sectional study. *Nurse Educ Today* 2021;96:104643.