Original Article

Improving Nurses' Knowledge, Practice, and Self-Efficacy Regarding Caring Patients with Tuberculosis: A Quasi-Experimental Design

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Abstract

Background: Tuberculosis (TB) control depends on healthcare professionals 'knowledge, practice, and self-efficacy when managing high-risk groups. So the study aimed to evaluate the effectiveness of a structured educational program in improving nurses' knowledge, practice, and self-efficacy in caring for patients with TB. **Material and Methods:** A pre-test post-test quasi-experimental design was conducted on 36 nurses at Chest hospital Al Masah al Bahri in port said city and the Chest Hospital in Damietta City, Egypt. Data were collected using three self-administered questionnaires to assess knowledge, practice, and self-efficacy by using convenience sampling from March to August 2019. Data analyses were done by using a paired t-test, a Student *t*-test, and an F-test analysis of variance. **Results:** Based on data related to the two groups before and after the study in knowledge, practice (t = 8.27, $p < 0.001$), and self-efficacy (t = 28.91, $p < 0.001$), there was a significant difference between knowledge and overall knowledge scores (t=14, $p < 0.001$). Mean scores were significantly increased for practice items about the nursing role in medication, directed observed therapy, and the overall practice score; and for self-efficacy, which increased from 27.58 to 37.86 ($p = <0.001$). The results indicate that nurses' knowledge, practice, and self-efficacy were enhanced by the implementation of the educational program. **Conclusions:** There is scope for development in knowledge, practice, and self-efficacy using the educational program among nurses. Training programs must be implemented in quality control to aid nurses in realizing the significance of information in reducing disease and death and enhancing the quality of care.

Keywords: *Knowledge, nurses, practice, self-efficacy, tuberculosis*

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Introduction

Tuberculosis (TB) is a contagious disease caused by Mycobacterium TB infection, which causes a significant number of deaths worldwide. In 2019, an estimated 10 million people were infected with TB, and 79 percent of those infected live in high-burden countries, where most of the 1.2 million annual fatalities from the disease reside.[1] TB is the preeminent health problem in many developing countries; Egypt is considered a mid-level TB country, and the illness is a major public health problem.[2] Control of TB can be facilitated if healthcare workers working with high-risk populations have more awareness of the disease.[3] To effectively treat TB, healthcare workers must be properly educated and trained.[4] By participating in the three elements of WHO's Directly Observed Treatment Short-Course Approach (recovery facilities, monitoring, and patient care), frontline staff members are intrinsically related to the effectiveness of TB control systems.[5] As a result, evaluating frontline TB healthcare workers' expertise, behaviors, and activities regarding TB is critical to optimizing responses to challenges and shortcomings and improving capacity for improvement.

Self-efficacy can be understood as faith in one's ability to perform particular acts in specific circumstances.[6] It refers to people's assumptions about how effectively they can carry out a strategy to achieve desired results. It affects performance, choices, and people's energy and persistence in following their choices. Patient self-efficacy can significantly contribute to improved outcomes and disease management, such as through improved medication compliance, seeking care,[7] preventive risk behaviors,[8] and gaining improved health consequences through these specific

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actions.[9,10] Thus, self-efficacy has been a main factor in designing interventions to progress patients' illness management.[11] Even though TB is treatable, it has proved difficult to eradicate, and the number of drug-resistant cases has risen.[12] Early detection and treatment of TB cases by experienced and trained healthcare workers are critical in combating this global health issue.[13]

Nurses play critical roles in the management, care, recovery plan, and support of TB patients during their treatment; however, several obstacles can obstruct their effective performance.[14] It was found that nurses' problems become more apparent as a result of their direct and close participation in inpatient care in settings, where both human and material resources are typically scarce, especially in developing countries. Nurses' perspectives on this case and patients' perspectives on their treatment processes are seldom explored. Some studies have found that healthcare workers' knowledge of TB is generally lacking in terms of both diagnosis and treatment.[15] In addition, TB training, including recent TB training, is insufficient.[16]

On the other hand, other research indicates that pre-training TB awareness is adequate and can even increase after brief education.[16] Furthermore, although the outcomes of one-time training programs can be unpredictable, there are examples of how healthcare workers' TB awareness and skills can be improved through periodic training and supervision.[17] Therefore, this study evaluates the effectiveness of a structured educational program in improving nurses' knowledge, practice, and self-efficacy in caring for patients with TB. Hence, we planned the present study to evaluate the effectiveness of a structured educational program for improving nurses' knowledge, practice, and self-efficacy in caring for patients with TB. Research hypothesis: knowledge, practice, and self-efficacy mean the scores of nurses in caring for patients with TB are improved after implementing the educational program.

Material and Methods

This quasi-experimental, one group, pre-test post-test design was conducted at Chest hospital Al Masah Al bahri in port said city and the Chest Hospital in Damietta City, Egypt, from March to August 2019. The sample size was calculated as 36 according to the power analysis with 95%, $Z\alpha = 1.960$, $Z\beta = 0.842$, $n = 36$.[18,19] Sampling was performed using a convenience sampling of nurses (n = 36) providing frontline care for patients with TB in these settings. This implicitly includes the 10 nurses used for the pilot study. The data collection tools included tool 1, composed of Part (1): Demographic variables of nurses – nurses', age, gender, level of education, years of experience, and training courses about care. Part 2: Knowledge assessment of nurses – a self-administered knowledge questionnaire developed based on relevant literature[20-23] and by adapting content from related studies[7,10] to assess nurses' knowledge. The knowledge section contained 39 questions subdivided into six items: risk factors and causative factors questions (4 questions), symptom and TB diagnosis (12 questions), multidrug-resistant TB (6 questions), appropriate nutrition (4 questions), treatment and side effects (3 questions), and infection control (9 questions). Responses were recognized as one score for correct knowledge and zero for incorrect knowledge regarding the nature of TB, such as pulmonary TB is contagious; these scores were transformed into score percentages. Part 3: Assessment of nurses' practice includes four main questions about the nurse's role regarding medication, Directly Observed Therapy (DOT), infection control, and education of the patient. Every nurse implemented an interview for 20–30 minutes by attaining data about their actual practice in caring for patients with TB. Responses were recognized as one score for done correctly and 0 for done incorrectly and not done. Part 4: New General Self-Efficacy Scale.[24] This scale was used to evaluate nurses' self-efficacy before and after the educational program. It includes eight items with a total score ranging between 10 and 40, with a higher score indicating more self-efficacy. Each item is valued on a five-point Likert-type scale, from (1) strongly disagree to (5) strongly agree. The scale has been tested for internal consistency and reliability by the original authors, with 316 participants and has high reliability with a Cronbach's alpha coefficient of 0.97. Data collection techniques consist of a preparatory phase: After explaining the study's purpose to the hospital authorities, permission to perform the study was granted. The researcher created the data collection method after examining the related literature. These tools were used before and after implementing the educational program to assess knowledge, practice, and self-efficacy. Pilot study: 10% of nurses (n = 4) were sampled to pilot practice, knowledge, and self-efficacy and determine its applicability and feasibility to study this target group, as well as identify any difficulties that might be faced during the data gathering process. The researchers excluded nurses who participated in the pilot study from the main study. Content validity: A jury of five experts in medical surgical nursing departments and faculties and a chest specialist determined the content validity and essential modifications. Calculated Cronbach's alpha coefficients indicate the reliability of the knowledge assessment tool (0.810) and practice assessment tool (0.733). The implementation phase includes an assessment of knowledge that was completed twice, once at baseline (pre-test assessment) and one after the educational intervention (post-test), to determine changes in nurses' knowledge scores. The nurse practice and self-efficacy tools were applied before and immediately after the implementation of the educational program. The educational program was developed based on relevant literature pertaining to nursing care for TB patients.[25-27] As a guide for the nurses, an illustrative organized booklet was prepared and written in clear Arabic language with illustrative images, and different methods were used for the theoretical part, such as film, group discussion, and

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PowerPoint, as well as the practical dimension. Every nurse received a booklet to refresh their knowledge during the sessions. The educational program was accomplished over four sessions: two for theoretical awareness and two for practical information. It was applied to all participant nurses, who were divided into six classes, each with six nurses, in two 2-hour weekly sessions. The research objectives were created with the study subjects' goals and needs in mind. Topics covered by the educational materials related to TB: cause, mode of transmission, risk and causative factors, symptoms, diagnosis, multidrug resistance, appropriate nutrition, treatment and side effects, and infection control. To collect data, every nurse was interviewed during their break at work. During the evaluation phases, the knowledge, practice, and self-efficacy of each nurse were evaluated twice, before and after the implementation of the program. SPSS software, version 20.0. (Armonk, NY: IBM Corp) was used to analyze the data

Range (minimum and maximum), mean, and standard deviation (SD) were used to characterize quantitative data. A 5% level of significance was used. A student *t*-test was used for normally distributed quantitative variables to compare the two studied groups. F-test analysis of variance was used for normally distributed quantitative variables to compare more than two groups.

Ethical considerations

Ethical approval was gained from the Research Ethics Committee of the Faculty of Nursing Port Said University NUR (7-11-2021) (7) After a thorough description of the study's purpose, advantages, and procedures, the directors of the participating hospitals gave their approval. Furthermore, each nurse participant's oral consent was obtained before data collection, after the study's goal and procedures were explained.

Results

Of the total 36 nurses who participated in this study, 72.20% were female. Over half (52.80%, n = 19) were 30–39 years old, while 38.90% (n = 14) were 40 and over, and only 8.30% (n = 3) were 29 or under. The vast majority (91.70%) had a secondary nursing diploma, and 66.70% had worked with TB patients for 5 years or more. Most of them (72.2%) had not attended patient care training courses. Of the 27.80% who had attended such courses, over a third (36.1%) reported average benefits and 44.40% reported a lot of benefits [Table 1].

Tables 2a and 2b demonstrate the noticeable improvement in nurses' knowledge post-implementation of the educational program regarding the care of patients with TB compared to the pre-test. A significant difference can be seen between the pre-educational and post-educational program scores regarding all knowledge items and overall knowledge scores ($p < 0.001$). Also, the mean score of all knowledge items and the overall knowledge score improved after attending the educational program (t= 14, $p < 0.001$).

Table 1: Frequency and percentage distribution of the studied nurses according to demographic data

Demographic data	n(%)
1. Gender	
Male	10 (27.80)
Female	26 (72.20)
2. Age (years)	
20-29	3 (8.30)
30-39	19 (52.80)
40+	14 (38.90)
3. Level of education	
Secondary Nursing Diploma	33 (91.70)
Bachelor of Nursing	3 (8.30)
4. Years of experience	
less than 5 years old	12 (33.30)
From 5 years or more	24 (66.70)
5. Training courses	
Yes	10 (27.80)
No	26 (72.20)
6. The extent of benefit from these courses	
A few	7 (19.40)
Average	13 (36.10)
A lot	16 (44.40)

Table 3 illustrates a marked enhancement in nurses' practice post-implementation of the teaching intervention compared to the pre-educational program. The mean score in practice items such as the role of the nurse regarding medication, DOT, and overall practice score at post-teaching intervention was significantly higher than the mean practice score of participants in the pre-test (t = 8.27, $p < 0.001$).

Table 4 shows that most respondents agreed before the test with self-efficacy statements relating to succeeding in their endeavors, overcoming many challenges, performing effectively, having intrinsic value, and performing well at pre-intervention; after the educational program, all nurses strongly agreed with all self-efficacy scale items. The mean score of post-test self-efficacy (37.86) of the nurses was significantly higher ($p = <0.001$) than the pre-test self-efficacy mean score (27.58). This means educational programs improve nurses' self-efficacy (t = 28.91, $p < 0.001$).

Table 5 demonstrates statistically significant differences in nurses' knowledge before the program about gender and age. Post-intervention, there was a statistically significant difference between nurses' practices and the extent of benefit from these courses. While there is no statistically significant relationship between self-efficacy and socio-demographics pre- and post-intervention.

Discussion

This study evaluates the effectiveness of a structured educational program in improving nurses' knowledge,

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Table 2a: Comparison between pre and post-test knowledge regarding the care of patients with tuberculosis (*n*=36)

Knowledge items	Pre-test		Post-test	
	Incorrect n (%)	Correct n (%)	Incorrect n (%)	Correct n (%)
Risk factors and causative factors				
1. Pulmonary Tuberculosis(TB) is contagious	0 (0.0)	36 (100.0)	0 (0.0)	36 (100.0)
2. A causative agent for TB	12 (33.30)	24 (66.70)	0 (0.0)	36 (100.0)
3. Environmental factors causing pulmonary TB	18 (50.0)	18 (50.0)	10 (27.80)	26 (72.20)
4. A disease that does not cause pulmonary TB infection	21 (58.30)	15 (41.70)	9 (25.0)	27 (75.0)
5. Who can be infected with TB?	14 (38.90)	22 (61.10)	5 (13.90)	31 (86.10)
Min.-Max.	1.0-5.0		3.0-5.0	
Mean (SD)	3.19 (1.06)		4.33 (0.63)	
	t=5.04**p*<0.001*			
Symptom and TB diagnosis				
1. Symptoms of pulmonary TB	14 (38.90)	22 (61.10)	4 (11.10)	32 (88.90)
2. Areas that do not get TB	9 (25.0)	27 (75.0)	5 (13.90)	31 (86.10)
3. Diagnosis of pulmonary TB	5 (13.90)	31 (86.10)	0 (0.0)	36 (100.0)
4. When should the first sputum sample be taken after starting treatment for a confirmed TB case?	18 (50.0)	18 (50.0)	7 (19.40)	29 (80.60)
5. How many sputum samples are needed for a diagnosis?	29 (80.60)	7 (19.40)	12 (33.30)	24 (66.70)
6. How should the sputum sample be stored before laboratory analysis?	15 (41.70)	21 (58.30)	7 (19.40)	29 (80.60)
7. Is there a role for X-rays in diagnosing pulmonary TB?	0 (0.0)	36 (100.0)	1 (2.80)	35 (97.20)
8. Do TB patients need to be tested for HIV?	12 (33.30)	24 (66.70)	0 (0.0)	36 (100.0)
9. Is there high stiffness of the skin after a TB test?	23 (63.90)	13 (36.10)	18 (50.0)	18 (50.0)
10. How will you collect a sputum sample?	3 (8.30)	33 (91.70)	0 (0.0)	36 (100.0)
11. When is the patient's arm examined after the TB test?	19 (52.80)	17 (47.20)	0 (0.0)	36 (100.0)
12. What is the difference between latent TB infection and active TB disease?	15 (41.70)	21 (58.30)	0 (0.0)	36 (100.0)
Min.-Max.	3.0-10.0		7.0-12.0	
Mean (SD)	7.50 (1.80)		10.50 (1.36)	
	t=8.81**p*<0.001*			
Multidrug-resistant TB				
1. Is TB a curable disease?	0 (0.0)	36 (100.0)	0 (0.0)	36 (100.0)
2. What is the duration of treatment for pulmonary TB?	0 (0.0)	36 (100.0)	0 (0.0)	36 (100.0)
3. What is Multidrug-resistant tuberculosis (MDR-TB)?	30 (83.30)	6 (16.70)	12 (33.30)	24 (66.70)
4. In which group of people is MDR TB most likely to occur?	14 (38.90)	22 (61.10)	5 (13.90)	31 (86.10)
5. What are the consequences of incomplete treatment?	9 (25.0)	27 (75.0)	4 (11.10)	32 (88.90)
6. What are the causes of increased TB resistance to multiple drugs?	16 (44.40)	20 (55.60)	6 (16.70)	30 (83.30)
Min.-Max.	2.0-5.0		4.0-6.0	
Mean (SD)	4.08 (0.94)		5.25 (0.65)	
	t=6.63**p*<0.001*			

t=Paired t-test, *Statistically significant at $p \leq 0.05$, SD=Standard deviation

practice, and self-efficacy in caring for patients with TB. Moreover, the nurses' knowledge level, practice, and proficiency are very significant issues in the achievement of TB treatment. In addition, the nurses' practice affects patient compliance with the TB treatment regimen.[28] The findings of this research indicated that the participants' mean scores regarding risk factors and causative factors, symptoms and TB diagnosis, multidrug-resistant TB, appropriate nutrition, treatment, and side effects, infection control, and their overall knowledge score improved after attending the educational program. This reflects the positive impact of the education program on improving nurses' knowledge about TB, with a strongly significant difference between the pre-educational and post-educational programs ($p < 0.001$). These results are congruent with previous results,[15,29] which reported related results and found a significant improvement in nurses' knowledge regarding TB nutrition after the intervention. Likewise,

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Table 2b: Comparison between pre- and post-test knowledge regarding the care of patients with tuberculosis (*n*=36)

Knowledge items	Pre-test		Post-test	
	Incorrect n (%)	Correct n (%)	Incorrect n (%)	Correct n (%)
Appropriate nutrition				
1.What kind of diet should be recommended for a TB patient?	11 (30.60)	25 (69.40)	0 (0.0)	36 (100.0)
2. Protective food	0 (0.0)	36 (100.0)	0 (0.0)	36 (100.0)
3. Protein-rich ich food	2 (5.60)	34 (94.40)	0 (0.0)	36 (100.0)
4. Calorie intake per day	33 (91.70)	3 (8.30)	11 (30.6)	25 (69.4)
Treatment and side effects				
1. What medicine causes patients to sweat and have orange urine?	17 (47.20)	19 (52.80)	0 (0.0)	36 (100.0)
2. Which of the following are considered first-line drugs for TB?	27 (75.0)	9 (25.0)	15 (41.70)	21 (58.3)
3. What are the side effects of TB medicine?	36 (100.0)	0 (0.0)	0 (0.0)	36 (100.0)
Min.-Max.	2.0-5.0		4.0-5.0	
Mean (S. D.)	3.56 (0.65)		4.69 (0.47)	
	t=7.88**p*<0.001*			
Infection control				
1. The room door and window should be left open whenever a patient in the hospital suspects or has TB	23 (63.90)	13 (36.10)	5 (13.90)	31 (86.10)
2. Is the N95 mask protecting against the spread of TB?	6 (16.70)	30 (83.30)	0 (0.0)	36 (100.0)
3. 16. Patients suspected of or confirmed to have TB should be kept separate from other patients	4 (11.10)	32 (88.90)	0 (0.0)	36 (100.0)
4. Healthcare providers should try to reduce the time TB patients spend in the health facility	4 (11.10)	32 (88.90)	0 (0.0)	36 (100.0)
5. Surgical masks cannot protect TB carriers from spreading microbes	20 (55.60)	16 (44.40)	18 (50.0)	18 (50.0)
6. Respirators can protect workers from inhaling airborne TB	28 (77.80)	8 (22.20)	25 (69.40)	11 (30.60)
7. TB patients should be educated to cover their mouths with a tissue or a scarf	4 (11.10)	32 (88.90)	0 (0.0)	36 (100.0)
8. Every health facility must establish an infection control committee	0 (0.0)	36 (100.0)	0 (0.0)	36 (100.0)
9. Patients with suspected or confirmed TB and coughing should be seen first by the nurse/doctor.	8 (22.20)	28 (77.80)	0 (0.0)	36 (100.0)
10. Fans (ventilators) can be used in rooms for TB patients to reduce TB transmission	35 (97.20)	1 (2.80)	11 (30.60)	25 (69.40)
Min.-Max.	3.0-7.0		6.0-9.0	
Mean (SD)	5.50 (1.0)		7.36 (0.93)	
	t=7.56**p*<0.001*			
Overall knowledge (total score)				
Min.-Max.	17.0-29.0		27.0-39.0	
Mean (SD)	24.61 (2.95)		34.72 (2.55)	
	t=14 p<0.001*			

t=Paired *t*-test, *Statistically significant at $p \leq 0.05$, SD=Standard deviation

in a study conducted by Kande[19] on knowledge and practices regarding infection-control measures, there was a significant increase in the mean scores for awareness and practices among nurses after the intervention.

The findings indicate that the mean score in practice items concerning the role of the nurse regarding medication, DOT, and overall practice score post-teaching intervention was significantly higher than at baseline ($p < 0.001$). This affirms the findings of Buregyeya *et al*.[30] in Uganda, where the majority of healthcare workers had correct TB infection control (TBIC) awareness, values, and practices after national TB guidelines were implemented and infection control training was given in the years before the study. They also found that those who did not undergo the training had bad knowledge and practices, despite the lack of information on pre-training levels. Also, consistent with previous research, nurses in Nigeria and elsewhere improved their skills and practices via such educational interventions.[31-33]

This study also corroborates the findings of[34] concerning the poor baseline knowledge of nurses. They found that two-thirds of nurses had insufficient practice knowledge before implementing program-based learning about arterial blood puncture, while the majority had adequate practice after implementing the program concerning learning about arterial blood puncture. Conversely, a pedagogical study exploring the effectiveness of instructional videos to prepare nurses for clinical performance reported no significant

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Table 3: Comparison between pre- and post-test practice regarding care of patients with tuberculosis (*n*=36)

Practice items	Pre-test	Post-test
Role of the nurse regarding medication		
Min.-Max.	1.0-4.0	3.0-5.0
Mean (SD)	2.33 (0.89)	4.53 (0.65)
	t=10.26 *p* <0.001*	
Directly Observed Therapy (DOT)		
Min.-Max.	2.0-6.0	6.0-6.0
Mean (SD) .	5.56 (0.91)	6.0 (0.0)
	t=2.94* *p*=0.006*	
Infection control		
Min.-Max.	2.0-6.0	3.0-5.0
Mean (SD)	3.81 (1.09)	3.89 (0.52)
	t=0.41 *p*=0.686	
Educate the patient		
Overall practice (total score)		
Min.-Max.	15.0-22.0	19.0-23.0
Mean (SD)	18.0 (1.84)	20.92 (1.11)
	t=8.27* *p* <0.001*	

t=Paired *t*-test, *Statistically significant at $p \leq 0.05$, SD: Standard deviation

improvements associated with the use of educational training via video technique (intervention) in parallel with the grouping of demonstration methods in comparison to using traditional lecture learning (control).[35] These divergent findings indicate the highly contextual nature of learning and related solutions in healthcare education and emphasize the need for careful consideration by educators, particularly in terms of continuous professional development among clinical practitioners.

The present study showed a marked enhancement in nurses' practice post-implementation of the educational program compared to pre-program and overall practice scores at post-teaching intervention were significantly higher than the mean practice score of participants in the pre-test ($p < 0.001$). This study is consistent with the findings of research conducted by Buregyeya *et al*.[30] in Uganda, which found that most health care workers had accurate TBIC knowledge, beliefs, and practices when national TB guidelines were implemented and TBIC training was provided in the years leading up to the study.[15]

The current study found that the post-test self-efficacy of the nurses was significantly higher ($p = <0.001$). The mean pre-test score was 27.58, and the mean post-test score was 37.86. In contrast, results revealed that nurses' self-efficacy score improved in certain dimensions compared to their pre-intervention self-efficacy score, in line with.[36] In addition, these results were congruent with those[37] who reported the efficiency of a 1.5-hour simulation-based

Table 4: Comparison between pre- and post-test results according to self-efficacy (*n*=36)

General Self-Efficacy Scale	Pre-test					Post-test				
	Strongly disagree n (%)	Disagree n (%)	Neither agree nor disagree n (%)	Agree n (%)	Strongly agree n (%)	Strongly disagree n (%)	Disagree n (%)	Neither agree nor disagree n (%)	Agree n (%)	Strongly agree n (%)
1. Able to achieve my goals	0 (0.0)	11 (30.60)	18 (50.0)	5 (13.90)	2 (5.60)	0 (0.0)	0 (0.0)	0 (0.0)	10 (27.80)	26 (72.20)
2. I accomplish difficult tasks	0 (0.0)	9 (25.0)	21 (58.30)	4 (11.10)	2 (5.60)	0 (0.0)	0 (0.0)	0 (0.0)	12 (33.30)	24 (66.70)
3. I can obtain outcomes	0 (0.0)	1 (2.80)	18 (50.0)	17 (47.20)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	8 (22.20)	28 (77.80)
4. I can succeed in my endeavor	0 (0.0)	0 (0.0)	11 (30.60)	21 (58.30)	4(11.10)	0 (0.0)	0 (0.0)	0 (0.0)	12 (33.30)	24 (66.70)
5. I overcome many challenges Intrinsic value	0 (0.0)	0 (0.0)	10 (27.80)	23 (63.90)	3 (8.30)	0 (0.0)	0 (0.0)	0 (0.0)	9 (25.0)	27 (75.0)
6. I can perform effectively	0 (0.0)	0 (0.0)	16 (44.4)	18 (50.0)	2 (5.60)	0 (0.0)	0 (0.0)	0 (0.0)	8 (22.20)	28 (77.80)
7. I can do most tasks very well	0 (0.0)	0 (0.0)	21 (58.30)	14 (38.9)	1 (2.80)	0 (0.0)	0 (0.0)	0 (0.0)	10 (27.80)	26 (72.20)
8. I can perform well	0 (0.0)	0 (0.0)	17 (47.20)	18 (50.0)	1 (2.80)	0 (0.0)	0 (0.0)	0 (0.0)	8 (22.20)	28 (77.80)
Total score										
Min.-Max.			25.0-30.0					35.0-40.0		
Mean (SD)			27.58 (1.57)					37.86 (1.33)		
						t=28.91* *p*<0.001*				

t=Paired *t*-test, *Statistically significant at $p \leq 0.05$, SD: Standard deviation

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Table 5: Relation between overall knowledge, practice and self-efficacy with demographic data

Demographic data	Knowledge		Practice		Self-Efficacy	
	Pre-test Mean (SD)	Post-test Mean (SD)	Pre-test Mean (SD)	Post-test Mean (SD)	Pre- test Mean (SD)	Post-test Mean (SD)
Gender						
Female	63.17 (7.30)	87.02 (7.07)	75.16 (6.82)	87.02 (4.91)	61.54 (4.74)	93.27 (4.12)
Male	57.25 (5.95)	86.25 (4.29)	74.58 (9.91)	87.50 (3.93)	60.31 (5.52)	93.44 (4.53)
t (*p*)	2.29* (0.029*)	0.32 (0.751)	0.17 (0.868)	0.28 (0.784)	0.66 (0.511)	0.11 (0.915)
Age (years)						
20-29	59.17 (3.82)	90.83 (9.46)	81.94 (4.81)	87.50 (7.22)	65.63 (5.41)	90.63 (3.13)
30-39	58.55 (7.23)	85.92 (7.37)	75.44 (8.88)	87.28 (4.70)	60.53 (5.43)	93.75 (4.77)
40+	66.07 (5.94)	87.14 (3.90)	72.92 (5.36)	86.90 (4.28)	61.16 (3.82)	93.30 (3.44)
F (*p*)	5.47* (0.009*)	0.79 (0.461)	1.88 (0.169)	0.03 (0.966)	1.43 (0.255)	0.77 (0.496)
Level of education s						
Secondary Nursing Diploma	61.74 (7.62)	86.44 (6.09)	74.37 (7.59)	87.12 (4.46)	60.80 (4.76)	93.56 (4.20)
Bachelor of Nursing	59.17 (3.82)	90.83 (9.46)	81.94 (4.81)	87.50 (7.22	65.63 (5.41)	90.63 (3.13)
t (*p*)	0.57 (0.570)	1.15 (0.259)	1.69 (0.101)	0.13 (0.894)	1.67 (0.104)	1.17 (0.249)
Years of experience						
less than 5	58.54 (7.42)	86.25 (5.49)	78.12 (6.19)	86.81 (5.28)	60.68 (4.70)	94.01 (5.07)
From 5 years or more	63.02 (7.03)	87.08 (6.86)	73.44 (7.94)	87.33 (4.34)	61.46 (5.10)	92.97 (3.71)
t (*p*)	1.77 (0.086)	0.37 (0.717)	1.79 (0.083)	0.32 (0.754)	0.44 (0.660)	0.70 (0.488)
Did you take training courses on caring for patients with tuberculosis?						
No	64.75 (6.71)	88.0 (4.53)	74.17 (5.83)	87.50 (4.39)	61.88 (3.55)	93.44 (3.74)
Yes	60.29 (7.36)	86.35 (6.97)	75.32 (8.33)	87.02 (4.76)	60.94 (5.39)	93.27 (4.39)
t (*p*)	1.67 (0.105)	0.70 (0.493)	0.40 (0.691)	0.28 (0.784)	0.51 (0.616)	0.11 (0.915)
Extent of benefit from these courses						
A few	66.79 (8.13)	86.79 (1.89)	73.81 (3.15)	84.52 (3.96)	61.16 (4.72)	92.86 (3.92)
Average	60.0 (7.0)	88.65 (5.06)	75.32 (8.06)	89.42 (2.75)	62.74 (4.68)	94.47 (4.63)
A lot	60.47 (6.72	85.31 (8.21	75.26 (8.93)	86.46 (5.38)	59.96 (5.13	92.58 (3.93)
F (*p*)	2.40 (0.106)	0.99 (0.384)	0.10 (0.905)	3.28* (0.049*)	1.16 (0.327)	0.78 (0.466)

t=Student *t*-test, *F*=ANOVA test, SD=Standard deviation *: Statistically significant at $p \leq 0.05$

workshop on nursing student knowledge, self-efficacy, skills, and overall competence regarding arterial blood gases. Moreover,[38] it articulated that more than half of nurses felt this extension of the scope of practice would improve their sense of autonomy and confidence.

Our study showed that there were only statistically significant differences between gender, age, and nurses' knowledge before the teaching intervention. Perhaps with the increase in age, the nurse's experience increases, and the women are always more eager to receive information, and the percentage of women was more differing from previous works.[39,40] It was found that an increase in age did not affect the increase in the level of nurses' knowledge of TB.[41] It found no significant correlation between nurses' knowledge and their socio-demographic variables, including age, sex, and experience. Our study established no relationship between education level and TB knowledge before and after the educational program; perhaps with the increase in age, the nurse's experience increases, and the women are always more eager to receive information, and the percentage of women was more differing from previous works, similar to.[39,42] Regarding the relationship between educational sessions and nurses' practice before and after the educational program, the only statistically significant difference between nurses' practice and the extent of benefit from these courses was after the teaching intervention.

Numerous studies found a significant correlation between performance, age, and years of experience.[40,42,43] This is intuitive, since an increase in age is directly correlated with increased nursing experience and performance. However,[39] it described that the socio-demographic variables of educational level, age, and years of experience have no significant link with the level of nurses' practice in caring for patients with TB. Our study results showed that there was no association between demographic variables and nurses' self-efficacy regarding caring for patients with TB. This may be because self-efficacy involves not only level of education and expertise but also individual views about what is achievable. This result is inconsistent with,[44] who found significant relationships between efficacy and the socio-demographic variables of education and years of experience. However, we are attentive that the current study may have some limitations. Firstly, the nurses used

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self-administered questionnaires to evaluate their TB practices, which are pre-disposed to social desirability bias. Due to time limitations, direct observation of their practice to cross-check their self-reported performance was not possible. Secondly, because the participants were limited to nurses from two Egyptian hospitals, the outcomes of this study cannot be generalized. Finally, this study relied on a convenience sample of nurses. As a result, it failed to randomly assign participants and analyze the program's benefits over time. It is required to increase the number of participants to overcome these limits.

Conclusion

The obtained findings of the current study displayed the positive effect of the structured educational program on nurses' knowledge, practice, and self-efficacy in caring for patients with TB. Nurses play an essential role in TB patients' adaptation to their treatment regime, efficient use of health resources, accurate assessment of treatment outcomes, proper monitoring of medication side effects, patient training, and successful DOT implementation. If a healthcare team displays an unsatisfactory level of TB knowledge, the management of TB and the actual implementation of TB safety programs are compromised. Consequently, it is essential to approve both international and national strategies to advance the knowledge and behaviors of healthcare workers toward TB. It is suggested to conduct a study with a higher sample size and follow-up to investigate the effect of the educational program not only on knowledge, practice, and self-efficacy but also on patient outcomes.

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Conflicts of interest

Nothing to declare.

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