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Nursing Team Work Training Program and its effect on Tuberculosis Patients' Outcomes

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Abstract

Background: Teamwork is a serious component in highly productive nursing practice. Tuberculosis leftovers a noteworthy health issue, which globally infected about 10.6 million individuals and affected 1.6 million deaths in 2021. **Aim:** This study aimed to explore the effect of nursing team work training program on tuberculosis patients' outcomes among nursing personnel. **Design:** Quasi experimental research design was utilized in this study. **Setting:** the current study was conducted at Badr University Hospital, which is affiliated to Helwan University. **Subjects:** Convenience sample of (n =80) nurses was used. **Tools of data collection:** Two tools used for gathering data; (I) Teamwork perceptions questionnaire and (II) Tuberculosis knowledge assessment questionnaire. **Results:** clarifies that (91.3%) of the studied nursing personnel during the post-test phase gained a high perception regarding teamwork, then (82.5%) of the follow-up test phase as compared with the pre-test (28.7%) phase. Additionally, (93.8%) of the studied nursing personnel through the post-test phase gained a good level of knowledge regarding TB, shadowed by the follow-up test phase (90%) in relation to the pre-test phase (25%). **Conclusion:** This study concluded that team-work training program had a positive large effect size on nursing personnel's perception regarding teamwork and knowledge regarding tuberculosis during pre, post & three-month follow-up phases. **Recommendations:** Develop and enforce organizational policies that teamwork and interdisciplinary collaboration in tuberculosis management.

Key words: *Nursing Personnel, Patients' Outcomes, Perception, Team Work, Training Program, and Tuberculosis.*

Introduction

Healthcare organisations reinforce the concept of teamwork between the staff to increase the level of output and creativity in order to win competing advantages and improve performance. Additionally, the centre benefit of teamwork is the reduction of assigned work that helps the nurses to perform better outside somewhat work pressure because the tasks were delivered equitably among all the representatives of that team. Efficiency of team influences not just nurses but the organisation eventually, as nurses who work in teams enhance the standard for the organisation **(Marques et al., 2020)**.

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Teamwork is the process of persons cooperating in a team or group to attain a universal goal that is calculated individually with the same aims, excitement, clear roles and accountabilities, productive communication, conflict judgement, joint capacity, and expertise bewitched by the representative group and should be a mix of older and more youthful nurses (**Arifin, 2024 and Kourkouta et al., 2021)**.

The nursing-trained workers incorporate various levels of nurses in the delivery of care. Collaboration grant permission is improved with a joint mental model in performing fundamental nursing care assignments, mutual support for duties and responsibilities administration, better organisation practices, productive communication, improved interpersonal friendships, and better team orientation **(Goh et al., 2020)**.

Direct teamwork is a fundamental requirement for the supply of cautious and quality care. Accomplished nursing care is not given particularly by nurses at the bedside but by the entire nursing team, which contains various professions. The value and safety of nursing care are affected by professional skills and nursing information, but likewise by the smooth abilities displayed in teamwork and its dimensions **(Kohanová et al., 2024)**.

A healthy work environment frequently involves good and supportive work connections. In team circumstantial connections, the supportive friendship comprises job task support, social support, team members' agreement, and signing up. Circumstantial conduct in attending teams may be displayed through the team's individual and public support and the friendship dimensions (nurse and physician cooperation) that generally bring about better patient effects. An extreme operating clinical team normally indicates extreme cooperation, strength, and understanding of each additional duty. All these factors desire the significance of extreme team circumstantial efficiency in forceful teams' achievement **(Zawawi, 2021)**.

In today's healthcare system, transfer contains many interfaces and patient handoffs between healthcare experts at various instructional and occupational preparation levels. Then, direct clinical practice includes various cases, at which point main facts must be correctly ideas. Cooperation and teamwork are essential. When healthcare experts do not correspond efficiently, patient security is at a hazard for various reasons: lack of critical knowledge, misunderstanding, and unsettled telephone orders **(Alkhaqani, 2023)**.

Everywhere, tuberculosis (TB) is the superior cause of death from infectious disease **(PAHO, 2024)**. Completely this TB epidemic, the World Health Organisation (WHO) submitted a complete TB approach to solve the achievements and objectives for 2030 and 2035 **(United Nations, 2022)**. TB remains an important worldwide wellness issue that affected about 10.6 million people and made 1.6 million die in 2021. Joined, patient-focused care is one of the leaders of the end TB plan, and it focuses on distinctive patient desires, needs, and principles and addresses not only the first-contact medical care but further public and financial determinants **(WHO, 2024)**.

Tuberculosis can influence some means but influences the lungs in 70%–80% of cases. Usual TB syndromes involve extended cough, fever, haemoptysis, midnight sweats, deteriorated appetite, and weight deficit. Ultimate prevalent sites for TB outside the lungs (Extra pulmonary TB) are the bladder, cartilages and joints, brain and meninges, genitals, kidneys, lymph nodes, and pleura **(CDC, 2024)**.

Drug resistance is a concern for the profitable situation of TB cases. There have existed between one and eight stated cases of multidrug-resistant TB (MDR-TB). TB is preventable, treatable, and correctable; still, it stands as the ultimate destructive of all infectious diseases globally. An increase in TB examinations and announcements on a lowering epidemic presentation skill is a forceful improvement accompanying TB services, bettering wanted to enhance relation to care and situation benefit **(Mathema, 2024)**.

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Nurses play a main role as an unspecified interdisciplinary team while providing 24-period care of sufferers and interplay accompanying them. As a result of nurses conducting their clinical practice and establishing collaboration and cooperation accompanying additional nurses, teamwork is a distracting detail useless nursing practice. Specifically, of the patient care areas in in the most complicated and extreme-risk environments **(Wenlu et al. 2024)**.

Significance of the study

Teamwork in tuberculosis patient nursing care is a limited research field, constituted of studies within a broad scope**.** Teamwork in healthcare is the co-ordination of the work of several people towards the common goal of providing safe, high quality patient care. Teamwork is essential to delivering high quality care and is central to nursing. Nurses deliver much of the care in hospitals and comprise 25% of the National Health Service (NHS) in the United Kingdom workforce, with support workers, including healthcare assistants, comprising an additional 25%**.** healthcare must become more effective, and teamwork is perceived to increase effectiveness***(Baek et al., 2023).***

TB remains a major global health concern with 10.6 million estimated new cases, 1.6 million deaths and 1.7 billion latently infected in 2021. Although able to affect anyone anywhere, in low- and middle-income countries TB stands as the eighth and seventh most common cause of death, respectively, and these countries bear the burden of 80% of all TB cases. In 2020, the World Health Organization (WHO) regions of South-East Asia and Africa accounted for more than two-thirds of all new TB cases (43% and 25%, respectively), with 46% of deaths estimated in South-East Asia and 39% in Africa **(Villar-Hernández et al., 2023).**

Aim of the study

This study aimed to explore the effect of nursing team work training program on tuberculosis patients' outcomes.

Research hypothesis

After develop and implement of nursing team work training program among nursing personals will enhance nurses' knowledge and awareness about nursing team work and improve the tuberculosis patients' outcomes.

Subject and methods

Research design: Quasi experimental research design was utilized to conduct this study.

Setting: The study was directed at Badr University Hospital affiliated to Helwan University and localized the region of Badr City, Cairo, Egypt.

Sampling: A convenience sample of all available nurses (80 nurses) working in the critical care unit, emergency room, and inpatient department, accepted to participate in this study, and available at the time of data collection.

Tools for data collection:

Tool (I): Self-administration teamwork perceptions questionnaire: It consisted of two main parts

- Part (I): Personal characteristics data; used to collect data related to personnel characteristics of the study subjects composed of: (Age, current residence, gender, material status, nursing education level, years of experience, and work shift).

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- Part (II): A structured self-administrative questionnaire; constructed and adapted by the researcher based on ***Yilma (2020),*** reviewed by experts, and pilot tested. It involved 35 items under 5 dimensions as the following (Team structure, leadership, situation monitoring, mutual support, and communication), every dimension included 7 items; it used to measure the knowledge and awareness for the nursing personnel.

The scoring system:-

Teamwork perception questionnaire consisted of 5 dimensions with (35 items) and had a total score of (105 grade). 3 grades for agree response, 2 grades for neutral response and 1 grade for disagree response. The total grades of items summed up, converted into a percentage score, and classified in to three levels as the following:-

- The low level is less than 60%.
- The moderate is equal or more than 60 % to less than 75%.
- The high level is equal or more than 75%.

Tool (II): The Tuberculosis Knowledge Assessment Questionnaire (TKAQ): A structured self-administrative questionnaire constructed and adapted by the researcher built on literature review as ***Salad et al. (2014) and Kusuma et al. (2022),*** then validated by experts, and pilot tested. This questionnaire consisted of 30 items covered 6 dimensions as the following; the first dimension aversion against treatment was included (7) items, the second dimension negative perception of TB treatment was included (3) items, the third dimension was general knowledge about TB infection, included (6) items, the fourth dimension knowledge about TB causes, was included (4) items, the fifth dimension knowledge about TB transmission was included (4) items and the sixth dimension knowledge about TB prevention was included (6) items.

The scoring system:-

Tuberculosis Knowledge Assessment questionnaire involved 6 dimensions with (30 items) had a total score of (30 grades). 3 grades were given for agree response, 2 grades were given for neutral response and 1 grade given for disagree response. The total grades of items summed up, converted into a percentage score, and classified into three levels as the following:-

- The poor level is less than 60%.
- The Average is equal or more than 60 % to less than 75%.
- The good level is equal or more than 75%.

Validity and reliability of the tools:

Validity:

Validity of the tools was approved (face and content). The forms were interpreted into numbers and tested by a group of five experts of jury specific to Nursing Administration from Faculties of Nursing in various four Universities, three professors from Ain sham University; Damanhour University (one professor); and Cairo university (one professor).

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Reliability:

Cronbach's Alpha was used to determine the internal reliability of the tools and the extent to which the questionnaire items are related to each other, the result were (0.997 & 0.989) for teamwork perception questionnaire and the tuberculosis knowledge assessment questionnaire, respectively.

Ethical and legal consideration:

The research authorization got from the Faculty of Nursing Ethical Committee of Helwan University before starting the training, an authorization got from the Manager of Badr Hospital that affiliated to the University. Informed consent was given from each sharing subject, superior to information accumulation; participants informed about the determination and wanted consequences of the study, and confident about harmless presence, participant's partnership was willing, and they had the right to withdraw from the study at whatever time outside without reason. Participants still were confident that anonymity and confidentiality remained approved, as were the assembled information second-hand for the study purpose. Ethics, principles, civilization and trust were esteemed.

Pilot study

The pilot study was completed activity on (10%) of the total sample content (8 nurses) to test relevance and clearness of forms and occasion wanted to complete it. No adjustments existed finished so participant in the pilot study remained contained in the study sample.

Field work:

First Phase: Assessment:

The researcher changed the tools for data accumulation, join the Director of Badr Hospital connected with university to clarify the purpose and course of the study, together all essential knowledge about nursing personnel as (Code numbers, qualifications, departments, gender, age and years of experience working in the hospital). Attended the pilot study on 10% of the total nursing staff (8), furthermore the researcher start to accumulate data from origin of August 2023 and completed at beginning of September 2023 (one months), by utilizing the changed tools accompanying the study participants in the setting thought out applicable work opportunity outside bothering the everyday work and subsequently demonstrating the purpose of the study.

Furthermore the researcher start to accumulate data from origin of September 2023 completely of November 2023 (3 months), by utilizing the advanced tools accompanying the participants in the study location advised applicable opportunity outside interfering day-to-day work and subsequently disclosing the study ruling class. The researcher scheduled the visits to the ward accompanying the preparation area as following; the researcher visited the hospital 3 visits per week eventually shift; each visit was categorized from 4-5 hours (from 9am to 2pm).

Firstly, the researcher began with the knowledge about teamwork perceptions questionnaire (pre-test) to determine the information of nursing personnel before achieving educational program. The time wanted to end this tool categorized between (15-20) minutes.

Secondly the researcher used the self- administrative questionnaire (pre-test) to evaluate the nurses' knowledge about tuberculosis before applying educational program. The interval desired

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to complete this tool ranged between (15-25) minutes. Total period wanted to complete two questionnaires was (30-45) minutes.

Second Phase: Designing

The researcher planned a training session and established an information assessment questionnaire concerning nurses' teamwork perceptions and tuberculosis knowledge. Focused on the pre-test results, the over-all objectives of the knowledge assessment regarding teamwork training program was to heighten nurses' knowledge about teamwork and tuberculosis. Knowledge estimate questionnaire concerning electronic waste that training program was created expected constant with the nursing work force needs. This phase, begun initially in December 2023 completely ended in January 2024 (two months).

Nursing teamwork training program was directed by the researcher through distributed nurses into (8 groups had 10 nurses for every one), under regulation and provision of Badr University Hospital nursing director seeing the routine assigned work.

Third Phase: Implementation

Application of training program regarding nursing teamwork acquired 8 weeks as subsequent; Nursing teamwork training program was occupied 6 sessions / week (2 months) as subsequent: each group from the 8 nursing groups appropriated (3 sessions/week) to bearing the program content, 2 visits comprised (2 sessions for 6 hours) with 15 minutes for break period. Diverse teaching methods were used in directing the training program as (Lectures, group discussion and brain storming). Also diverse media performed as (Power point, data show, white board and program booklet) that were arranged for nurses by the researcher which helped nurses to revise and refresh program content taken during sessions. At the end of every session nursing staff were oriented about the next session interval.

The teamwork training program for nurses was applied in the education room of Badr University Hospital during the day shift in organization with Nursing Director and agreeing to the day-to-day work schedule activities as carried out in the program framework.

Fourth Phase: Evaluation

Pre-test evaluation: before the starting of the program session, a knowledge appraisal questionnaire was given (pre-test) to participants to determine nurses' knowledge about nursing teamwork and the tuberculosis.

Immediate evaluation: after the accomplishment of the program session, a knowledge appraisal questionnaire was given (post-test) to participants to determine nurses' knowledge about nursing teamwork and the tuberculosis.

Follow-up evaluation: re-evaluation was finished afterwards, 3 months post-attending the training session. The unchanging tools that were used in the post-program evaluation were likely for the nursing personnel. Follow-up evaluation was begun in April 2024 and completed in May 2024 (two months).

Administrative design

Authorization to complete this study was acquired from the Dean of the Faculty of Nursing, Helwan University, and the Manager of Badr Hospital affiliated to the University to conduct the study. Individual spoken consent was still acquired by each fostering work force to contribute in the study

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Statistical analysis

Data admission and exploration were completed using SPSS statistical package version 26. Categorical variables were articulated as number and percentage while incessant variables were conveyed as (mean ±SD). Chi-Square (x2) tested the association between row and column variable of qualitative data. ANOVA test associate the mean of typically disseminated quantitative variables. While T independent test associate the mean of typically disseminated quantitative variables in two groups. As well, Pearson correlation measured correlation between quantitative variables.

For all tests, a two-tailed p-value ≤ 0.05 was considered statistically significant, P-value ≤ 0.01 was considered highly statistically significant, while, p-value> 0.05 was considered not significant. Eta square **(η2)** measured the effect size (The referential framework for identifying the effect size for ANOVA-test value) **(Cognitive and Brain Science Unit, 2021*)*.**

Results

Table (1): Frequency distribution of personal characteristics among the studied nursing personnel (n=80)

Personal characteristics data items		No	%
Age (in years)	< 20	7	8.8
	20- < 30	52	**65.0**
	30- < 40	14	17.5
	40- < 50	6	7.5
	50- < 60	1	1.3
	$\bar{x}$ ± SD	**28.40 ± 7.05**	
Gender	Female	44	**55.0**
	Male	36	45
Current residence	Rural	39	48.8
	Urban	41	**51.2**
Marital status	Single	49	**61.3**
	Married	30	37.5
	Divorced	1	1.3
Education	Diploma of nursing	35	**43.8**
	Technical institute	22	27.5
	Bachelor's degree	23	28.7
Job title	Staff nurse	67	**83.8**
	Head nurse	7	8.8
	Supervisor	6	7.5
Year of experience	1 < 5 years	44	**55.0**
	5 years < 10 years	30	37.5
	≥ 10 years	6	7.5
	$\bar{x}$ ± SD	**6.72 ± 5.11**	
Department	Critical Care Unit.	27	33.8
	Emergency room.	13	16.3
	Inpatient Department	40	**50.0**
Work shift	Full time	73	**91.3**
	Part time	7	8.8

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Table (1) describes that (65%) of the age of the studied nursing personnel are ranged from 20- < 30 years old, with a mean age of 28.40 ± 7.05. Regarding place of residence, (51.2%) of nurses is from urban. Considering marital status, (61.3%) are single. Moreover, (43.8%) of nurses are holding a diploma of nursing certificate, with (83.8%) of nurses being staff nurses. Moreover, (55% & 50%) of them are female had experience lasting from 1 year < 5 years with a total age of 6.72 ± 5.11 and working at inpatient departments, respectively. Finally, more than four-fifths (91.3%) are working full time.

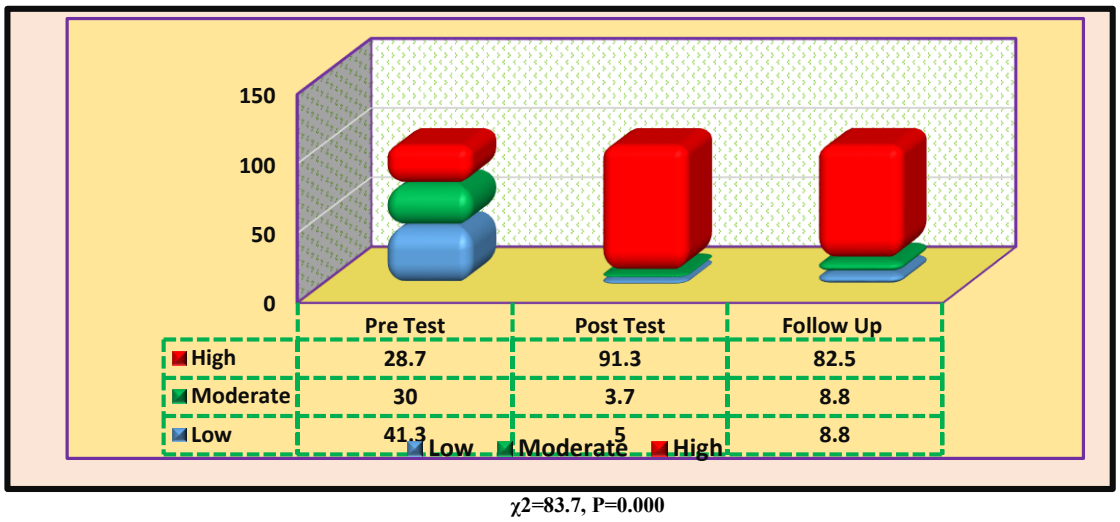

Figure (1): Percentage distribution of level of nursing personnel perception regarding teamwork during pre, post & three-months follow-up (n=80)

Fig (1) clarifies that (91.3%) of the studied nursing personnel gain a high perception regarding teamwork during the post-test phase, then the follow-up test (82.5%) as compares with the phase of the pre-test (28.7%). In addition to presence of difference between at $\chi 2=83.7$, P=0.000.

Table (2): Comparison between mean score of nursing personnel perception regarding teamwork during pre, post & three-months follow-up (n=80)

Items		Pre	Post	3 months follow-up	F Test	P- Value
		$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD		
Team Function	Low	7.67±1.45	8.75±2.36	7.86±1.57	59	0.000 ***
	Moderate	14.04±0.20	13.5±0.70	14.0±0.57		
	High	20.22±1.44	20.70±1.03	20.82±0.74		
	Total	**13.19±5.3**	**19.92±3.02**	**19.09±4.07**		
Leadership	Low	7.64±1.45	8.50±1.91	7.86±1.57	61	0.000 ***
	Moderate	14.05±0.21	13.67±0.57	13.86±0.37		
	High	20.30±1.18	20.84±0.72	20.79±0.85		
	Total	**12.96±5.50**	**19.95±3.08**	**19.05±4.10**		
Situation Monitoring	Low	7.40±1.19	9.0±2.34	8.13±1.8	53	0.000 ***
	Moderate	14.0±0.39	14.50±0.70	14.0±0.0		
	High	20.43±1.08	20.90±0.53	20.82±0.82		
	Total	**13.37±5.39**	**20.0±3.11**	**18.95±4.21**		

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Mutual Support	Low	7.50±1.21	8.25±1.89	8.13±1.8	62	0.000 ***
	Moderate	13.96±0.35	13.67±0.57	14.0±0.57		
	High	20.29±1.38	20.81±0.75	20.83±0.74		
	Total	**12.87±5.34**	**19.91±3.12**	**18.96±4.2**		
Communication	Low	7.53±1.04	8.25±1.89	7.71±1.49	60	0.000 ***
	Moderate	14.0±0.28	13.50±0.70	13.83±0.40		
	High	20.22±1.53	20.80±0.84	20.88±0.66		
	Total	**13.20±5.35**	**19.99±3.07**	**19.20±4.10**		
Total	Low	37.94±6.49	42.0±9.8	38.57±6.87	**59.7**	**0.000*** **
	Moderate	69.75±1.59	69.67±5.50	69.29±3.03		
	High	100.96±7.28	104.18±3.44	104.02±4.0		
	Total	**65.60±26.8**	**99.77±15.3**	**95.25±20.6**		

*Significant p ≤ 0.05 **Highly significant p ≤ 0.01 F: ANOVA Test

Table (2) denotes that, during the post-test phase, the studied nursing personnel have a higher mean score (99.77±15.3) of perception regarding teamwork, matches by follow-up test (95.25±20.6) likened with pre-test (65.60±26.8) (Total score=105).

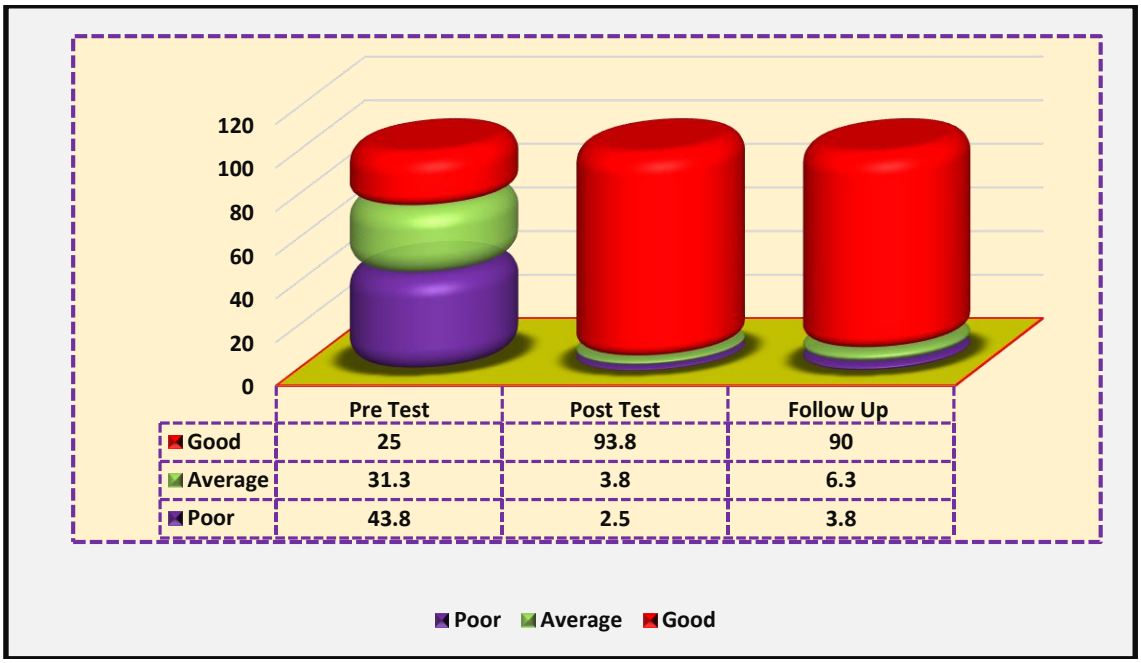

Figure (2): Percentage distribution of level of nursing personnel knowledge regarding TB during pre, post & three-month follow-up (n=80)

Fig (2) describes that (93.8%) of the studied nursing personnel gain a good level of knowledge regarding TB via the post-test, shadows by the follow-up test (90%) in relation to the pre-test (25%).

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Table (3): Comparison between mean score of nursing personnel knowledge regarding TB during pre, post & three-months follow-up (n=80)

Items		Pre	Post	3 months follow-up	F Test	P-Value
		$\bar{x}$ ± SD	$\bar{x}$ ± SD	$\bar{x}$ ± SD		
Aversion against treatment	Poor	8.42±1.29	9.67±2.08	8.75±2.21	81	0.000 ***
	Average	14.0±0.48	14.67±0.57	13.75±0.95		
	Good	19.19±2.0	20.26±0.72	20.15±0.76		
	Total	**13.18±4.94**	**19.65±2.38**	**19.26±2.93**		
Negative Perception of TB treatment	Poor	3.33±0.60	4.0±0.0	3.67±1.15	156	0.000 ***
	Average	6.0±0.0	6.0±0.0	6.0±0.0		
	Good	8.81±0.54	8.97±0.22	8.92±0.39		
	Total	**5.06±2.24**	**8.84±0.75**	**8.65±1.17**		
General Knowledge about TB Infection	Poor	7.18±1.54	7.50±2.12	7.0±1.73	104	0.000 ***
	Average	11.89±0.73	11.0±0.0	12.25±0.50		
	Good	17.17±1.19	17.00±0.58	17.90±0.44		
	Total	**11.17±4.46**	**17.54±1.89**	**17.21±2.43**		
Knowledge about TB causes	Poor	4.80±1.27	6.0±1.00	5.25±1.50	139	0.000 ***
	Average	8.0±0.00	8.0±0.00	8.0±0.00		
	Good	10.85±1.26	11.93±0.29	11.92±0.40		
	Total	**6.91±2.82**	**11.66±1.25**	**11.44±1.68**		
Knowledge about TB Transmission	Poor	4.33±0.85	5.00±1.15	5.29±1.38	83	0.000 ***
	Average	8.00±0.00	8.00±0.00	8.00±0.00		
	Good	11.17±1.16	11.93±0.34	11.93±0.31		
	Total	**7.11±3.13**	**11.44±1.71**	**11.20±2.04**		
Knowledge about TB prevention	Poor	6.79±1.25	8.00±2.82	8.20±2.04	106	0.000 ***
	Average	12.17±0.49	12.00±0.00	12.0±0.00		
	Good	16.61±1.46	17.89±0.57	17.85±0.67		
	Total	**11.16±4.29**	**17.50±1.90**	**17.18±2.55**		
Total	Poor	33.46±4.49	38.50±7.77	34.0±6.08	**108**	**0.000*** **
	Average	59.76±3.95	62.00±7.00	59.40±5.89		
	Good	85.15±6.30	88.89±2.14	88.83±1.91		
	Total	**54.60±21.58**	**86.62±9.63**	**84.94±12.6**		

*Significant $p \leq 0.05$ **Highly significant $p \leq 0.01$ F: ANOVA Test

Table (3) clarifies that via the post-test, the studied nursing personnel perceive a higher mean score (86.62±9.63) of knowledge regarding TB, afterward the follow-up test (84.94±12.6) as compared with the pre-test (54.60±21.58) (Total score=90).

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Table (4): Effect size and η2 of enhancing awareness about organizational diagnosis on organizational change during pre, post & three months follow up among the studied nursing personnel (n=60)

Interval	Mean	SD	F Test	P value	η	η2	Effect size
Pre-test	65.0	26.85	59.7	0.000***	0.579	0.335 ***	Large effect
Post-test	99.77	15.38					
Follow up	95.25	20.64					
Total	86.88	26.23					

*Significant p ≤ 0.05 **Highly significant p ≤ 0.01 F: ANOVA Test

* Small effect size = 0.01 to < 0.06 **Medium effect size =0.06 to < 0.14 ***Large effect size ≥ 0.14

Table (4): clarifies Effect size and η2 of enhancing awareness about organizational diagnosis on clarifies that team-work training program has a positive large effect size on nursing personnel's perceptions regarding teamwork during pre, post and three-months follow-up at η2= 0. 335. Therefore, this provides enough evidence to support research hypothesis.

Discussion

Furthermore, determinants, in the way that persuasive nursing teamwork enhances information about the disease, control repeating diseases frequently brings about raised situation devotion, and decreases unfavourable drug responses, so touching the influence of hospitalization. Therefore, the persuasive nursing team addresses all situations to enhance patients' understanding of the disorder, foster agreement with the situation, and safeguard drug security, all of which play a crucial role in restoring the therapeutic effect **(Feng et al., 2023)**.

In relation to the personal characteristics of the studied nurses; the study results showed that less than two-thirds of the nurses' ages were ranged from twenty to less than thirty years old, with a mean age of 28.40 ± 7.05. As well, more than half of them were females and more than half of them live in Urban. As researcher opinion, the studied nurses were newly graduated, more male nurses prefer to work in private hospital, and live near from the hospital place.

This result was in consistant with **Gad et al. (2021)** study entitled "Staff nurses' perception about teamwork and its effect on their job performance at Menoufia University Hospitals" who reported that two-thirds of the studied nurses' age were twenty to less than thirty-five years old, more than two-thirds of them were females but more than half of them from different rural area.

In the same line the study performed by **Kakemam et al. (2021)** entitled "Nurses' perception of teamwork and its relationship with the occurrence and reporting of adverse events: a questionnaire survey in teaching hospitals" and mentioned that around two-fifths of nurses' age were twenty-three to less than thirty years old, more than two-thirds of nurses were females live near the hospital in urban.

Similarly, the study performed by **Alghennai et al. (2023)** entitled "Development and validation of a questionnaire on the knowledge, attitude and practice (KAP) regarding tuberculosis among nurses working in tuberculosis centers in Libya" revealed that two-thirds of the studied sample age less than thirty years old, less than four-fifths of the studied nurses were female, more than half of them live in rural area.

As well, **Hassan et al. (2024)** finished study entitled "Evaluating the effect of team STEPPS on teamwork perceptions and patient safety culture among newly graduated nurses"

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who stated that two-thirds of the studied nurses were newly graduated female nurses live in Mansoura City deferent areas with mean age 21.92 ± 0.89.

In contrast the study done by **Kohanová et al. (2024)** entitled "Teamwork among nursing staff: a cross-sectional study" who reported that the most of the studied nurses were female live in deferent urban area with one-third of them were (20- < 35) years old.

Additionally, the results showed that more than three-fifth of the studied nurses were single, less than half of nurses had diploma of nursing degree, while most of nurses attend a full time work, half of nurses were working in inpatient departments with more than half of nurses had from one to less than five and more than one-third had from five to less than ten years of experience with mean 6.72 ± 5.11. As well, the majority of the studied nurses were staff nurse.

As researcher opinion most of nurses who had bachelor's degree or get enough experience prefer to work in privet hospital or travel for financial causes. As well, hospital need only limited number of nurses had high job titles due to limited positions.

In the other hand, **Gad et al. (2021)** found that more than two-thirds of the studied nurses were married, more than half of nurses had associated nursing degree, while all of nurses attend a full time work, less than two-thirds of nurses were working in inpatient departments with years of experience about one-third for each group from less than five, five to less than ten, and equal or more than ten and most of nurses were staff nurse.

In the same line the study finished by **Hassan et al. (2024)** entitled "Evaluating the effect of team STEPPs on teamwork perceptions and patient safety culture among newly graduated nurses" who stated that all the studied nurses were working a full time as staff nurse, more than two-thirds of them were married, less than two-thirds of them had bachelor's degree with mean years of experience were 10.98 ± 6.41.

Similarly, the study performed by **Kakemam et al. (2021)** who mentioned that all the studied nurses were working a full time as most of them were staff nurse work in general word, less than two-thirds of nurses were married, the majority of nurses were had bachelor's degree with two-fifths of nurses had more than ten years of experience and about one-third had less than five years. In the same way, **Alghennai et al. (2023)** revealed that all the studied nurses had full time work in general ward, two-fifths of nurses had diploma of nursing, with two-thirds of nurses' years of experience were less than five years.

As regard to percentage distribution of mean score and level of nursing personnel perception regarding teamwork throughout the study illustrated that most of the studied nursing personnel gained a high mean score and level perception regarding teamwork items (Team function, leadership, situation monitoring, mutual support, and communication) during the post-test which decline to the majority of nurses at follow-up test compared with one-quarter at the pre-test with a highly statically difference between total level and mean score of perception regarding teamwork throughout the program phases.

As researcher opinion, teamwork is crucial to providing high quality care and is vital to nursing. Nurses need to get a high perception regarding the practices that reinforce nursing teamwork and how these affect the patients' care, by intend recognize the association among apparent teamwork and observed quality of care

This result was in agreed with the study performed by **Hassan et al. (2024)** who revealed a significant increase in mean scores of Team STEPPS perceptions across multiple assessments throughout program phases. This detection highpoints the positive influence of the Team STEPPS training program regarding (Team function, leadership, situation monitoring, mutual support, and communication) in enhancing the perceptions of teamwork among these trainee nurses.

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Similarly, **Gad et al. (2021)** study demonstrated that after study implementation and at follow-up the Staff Nurses' had a high mean score and total level of perception about teamwork and its effect on nurses' job performance at Menoufia University Hospitals in relation to (Team function, leadership, situation monitoring, mutual support, and communication).

Alike, the study performed by **Kakemam et al. (2021)** that recognized the effects of teamwork training on the learning outcomes, including teamwork, incidence and the recording of adverse events among nurses. The results mentioned that nurses' perception of teamwork was ranged from moderate to high level and accompanying with the occurrence and reporting of adverse events.

Correspondingly, the study performed by **Kakemam et al. (2021)** who mentioned that the level and the mean score of the team work subitems (Team function, leadership, situation monitoring, mutual support, and communication) were at lowest level at pre-test which improves to highest level for the most of nurses at post-test but decline to from moderate to high level at follow-up test, with a highly statically difference between total level and mean score of perception regarding teamwork throughout the program phases.

As well, the study completed by **Bragadóttir et al. (2019)**, entitled "The extent to which adequacy of staffing predicts nursing teamwork in hospitals" and mentioned when adjusting the unit type, role, experience on current unit and intent to leave, and observed adequacy of staffing that lead to improving of inclusive teamwork subscale at both post and follow-up of the intervention program within hospital.

As regard to percentage distribution of mean score and level of nursing personnel knowledge regarding tuberculosis throughout the study demonstrated that the most of the studied nursing personnel gained a good mean score and level of knowledge regarding tuberculosis including (Aversion against treatment, negative perception of treatment, general knowledge about infection, causes, transmission, and prevention) during the post-test and follow-up phases associated with one-quarter of nurses at of the pre-test phase with a highly statically variance between total level and mean score of knowledge regarding tuberculosis throughout the program phases.

As researcher opinion, tuberculosis control be influenced by healthcare professional knowledge, practice, and multidisciplinary teamwork when handling with patients and augmenting the quality of care. As well, nurses consider at frontline tuberculosis healthcare team proficiency, behaviors, and activities about tuberculosis to optimizing responses for challenges and shortcomings and progress capability for development.

Similarly, the result of the study achieved by **Ntinda** and **Kadhila (2022)** entitled "Knowledge and Practices of the Fourth Year Degree Nursing Students Regarding Tuberculosis Management" and displayed that the global perceived knowledge regarding TB management intervention program (General Knowledge about TB Infection, causes, transmission, and prevention negative perception of TB treatment and aversion against treatment) was generally satisfactory at post program intervention compared to pre-program.

This result agreed with **Akande (2020)** study entitled "Knowledge and practices regarding tuberculosis infection control among nurses in Ibadan, south-west Nigeria: a cross-sectional study" and exposed that minor quantities of the nurses had respectable knowledge scores at pre-intervention program implementation which designed based on nurses' needs (Tuberculosis treatment, treatment, infection, causes, transmission, prevention, weak managerial support, poor funding, limited work space and inadequate staffing) compared to the majority of nurses who perceived a good knowledge scores post-intervention program.

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Oppositely, **Alotaibi et al. (2019)** study entitled "Tuberculosis knowledge, attitude and practice among healthcare workers during the 2016 Hajj" performed and testified that overall mean knowledge score and total level; four-fifths of nurses had average or above mean knowledge score regarding (TB type, screening, diagnosis, symptoms, infection, and prevention) at post-program compared to important knowledge gaps were noted at pre-program implementation.

Concerning the effect size of team-work training program; the results clarifies that team-work training program had a positive large effect size on nursing personnel's perceptions regarding teamwork and knowledge regarding tuberculosis with a highly statically significant difference throughout the study of program phases. As researcher opinion, the effect of the program was obvious in the results related to improvement of nursing personal response throughout the study program phases.

This results supported by **Hassan et al. (2024)**, who reported that the training program had a positive large effect size on the studied nurses regarding teamwork and job performance with a highly statically significant deference throughout the study program phases.

As well, the result of the study was completed by **Awad et al. (2023)**, entitled **"**The team building training program effects on effectiveness of teamwork of staff nurses' at Zagazig University Hospitals" and stated that the training program had a positive large effect size on the studied nurses about team building knowledge and teamwork effectiveness with a statistically significant difference between pre and post program intervention implementation.

Also, **Elgazzar et al. (2023)** study entitled "Improving nurses' knowledge, practice, and self-efficacy regarding caring patients with tuberculosis: A quasi-experimental design", and stated that the training program had a positive large effect size on improving nurses' knowledge, practice, and self-efficacy regarding caring patients with tuberculosis with a highly statically significant deference during program phases.

Conclusion

Based on the study result, most of the studied nursing personnel gained a high perception regarding teamwork during the post-test phase and decreased to the majority at the follow-up phase as compared with more than one-quarter at the phase of the pre-test**.** In addition, most of the studied nursing personnel had a good level of knowledge regarding tuberculosis during the post-test and follow-up phases as compared with the one-quarter at phase of the pre-test**.** As well, the teamwork training program had a positive large effect size on nursing personnel's perceptions regarding teamwork and knowledge regarding tuberculosis throughout the study. Therefore, this provides enough evidence to support the research hypothesis.

Recommendations

Nursing personnel's level

- Provide training focused on improving interpersonal communication among nurses to minimize errors and ensure seamless patient care.
- Develop systems for nurses to provide and receive constructive feedback on teamwork and patient care practices.

Organizational level

- Develop and enforce organizational policies that prioritize teamwork and interdisciplinary collaboration in tuberculosis management.
- Ensure the availability of necessary resources, such as training tools and technological support, to facilitate effective teamwork.

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Educational level

- Develop an educational curriculum focusing on teamwork and its impact on managing chronic and infectious diseases.
- Create online courses and digital platforms that teach teamwork strategies tailored for tuberculosis care settings.
- Pair nursing students or new graduates with experienced team-oriented nurses to guide them in collaborative practices.

Research level

- Design and test new team-based care models specifically for improving tuberculosis management outcomes.
- Publish research findings on teamwork in nursing journals and present them at conferences to promote evidence-based practices.

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