Effect of Lean System Program on Nursing Staff Performance for Eliminating Time Wasters at Tanta University Emergency Hospital

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Abstract

Background: Lean system program is essential to help emergency department (ED) nursing staff abhors time waster, add value to the service they are producing and to improve performance of their roles. **Aim**: Determine effect of lean system program on nursing staff performance for eliminating time wasters at Tanta University emergency hospital (TUAH). **Subjects and Method: Setting:** ED at TUEH. **Subjects:** ED nursing staff (N= 95). **Tools:** (1) Structured questionnaire to assess nursing staff knowledge (2) Assessment of time waster (3) Nursing staff practice to eliminate time waster observational checklist. **Results:** Preprogram only 7.4 of ED nursing staff showed good total knowledge about lean system compared to 88.4% immediately post-program and 81.1% in the follow-up phase. Nursing staff 55%,53%, 44%, ,43% reported respectively that motion, inventory, over-processing, defect and overproduction as their high time waster. Also, nursing staff 32%.31% reported respectively that waiting and transportation as high time waster. Preprogram no head nurses or staff nurses showed satisfactory level of practice to eliminate time waster but at post program the head nurses 88.4%, and 81.1 of staff nurses showed satisfactory practice. But at follow up, few of nursing staff showed satisfactory practice for eliminating time waster. **Conclusion:** Preprogram nursing staff at (TUEH) were at low level of knowledge and unsatisfactory practice to eliminate time waster, they significantly improved post program and have good knowledge and satisfactory practice, but at follow up they significantly relapsed back. **Recommendation**: Conduct periodical regular training programs for nursing staff about lean systems.

Keywords: Eliminating time wasters, Emergency department, Lean system, Nursing staff practice.

Introduction

Emergency department (ED) is the most complex section of Tanta University Hospital where more people seek emergency care. As ED is available for patients coming through 24 hours/7day a week **(Kelen, 2021)**. Deferent cases admitted ED include heart attacks, strokes, gunshots, wounds, motor vehicle accidents, toxic, suicide attempts and fractured bones. The emergency department consumes a significant amount of the hospital budget, because it requires more staff allocation than other services to maintain high-quality health care, and is heavily dependent on external services, such as laboratory, radiology, and consulting services **(Fava, Giovannelli, Messedaglia, & Roma, 2021)**. While facing a heavy-duty workload, delayed screening (triage), patient overcrowding, and long waiting times leading to the deterioration of quality of care and the patients leave without being seen.

Overcrowding of patients in (EDs), results in an increased burden on nursing staff, and excessive waiting times for patients to receive appropriate care. So, nursing staff must learn to quickly triage patients, based on immediate observation and acute assessment skills **(Spencer, Stephens, Swanson-Biearman, & Whiteman, 2019)**. As well as they required to have skill in order to quickly treat patient symptoms and for his life-threatening priority. Nursing staff required to communicate immediately with patients about their treatment plan. While after intervention they have to discuss with patients their recovery process and how they keep their general health and hygiene. Also nursing staff should be able to provide immediate attention to patients' health issues, to decrease unnecessary costs and to overcome nursing staff time waste problems **(Johnson, Schumacher, & Lee, 2021)**.

Many healthcare organizations are adopting approaches such as flexible thinking to better integrate healthcare delivery **(Elamir, 2018; Savioli, 2022)**. Lean system is one of the methods of flexible thinking designed to provide tools for nursing staff to improve their work and add value to the service they are producing. In order to implement Lean methodology, ED usually has to follow different stages as, training of lean specialists and raising awareness about waste within operations. Sequencing of activities within operations using tools such as value stream map (VSM). As well as making elimination of activities that do not add value to the process **(Harrou, Dairi, Kadri, & Sun, 2020)**.

Then designing the future state of the process, and improve the process (starting over) with interactive teams

that remove waste as it is identified and using standardized Lean tools. The lean thinking methodology focuses on continuous process improvement, staff partnership, problem-solving, and eliminating types of waste. There are also seven types of waste including (waiting, defects, motion, inventory, overproduction, transportation, and processing), that can affect negatively the quality provided in ED **(Borges, Tortorella, Rossini, & Portioli-Staudacher, 2019; Järvenpää, & Lanz, 2020)**. The lean 5s tools (sort, set, shine, standardize, sustainability) is dedicated to the physical work environment and is the simplest application for organizing, standardizing and maintaining the ED workplace **(Chipu, & Downing, 2022).**

Aim of the study

Determine the effect of lean system program on nursing staff performance for eliminating time wasters at Tanta University Emergency Hospital.

Research hypothesis

Nursing staff performance for eliminating time waster is expected to be improved post program implementation.

Subjects and Method

Study design:

Quasi-experimental design was used to achieve aim of present study. (**Kelen, G. D., 2021**).

Subject:

The study subject consisted of all (n=95) nursing staff working in the Emergency Department (ED).

Setting:

The present study was conducted at Tanta University Emergency Hospital. (296) beds capacity. The hospital included a casualty department surgical department, burn, medical-surgical, neurology, orthopedic, and urology departments. Tanta Emergency Hospital provides complete and continuous care for the seriously ill patient who can benefit from the service provided.

Tools of data collection:

To achieve the aim of this study the following tools were used:

Tool (I): Structured Questionnaire

This tool was developed by the researcher guided by a review of litterateur to assess the knowledge of nursing staff regarding the lean system for eliminating of a time waster **(Bohl, & Kaplan, 2020; Jain, & Jha, 2022; Cardoso, 2020)**. It consisted of two parts:

Part (1): Nursing staff characteristics data including age, sex, level of education, marital status, years of experience in nursing, nature of work, and kind of work in unite position.

Part (2): Knowledge Questions on lean system, consisted of 73 questions in the form of true & false (50 items), matching (10 items), and multiple choice (13 items). These

questions cover the following aspects.

- Lean system definition, goal and concept.
- Principles of lean system.
- Factors affecting lean system application.
- Lean system implemented tools and
- Methods.
- Time waster aspects.
- Successful elimination of time waster.

Scoring system:

Each item of knowledge tokes a score of (1) for the correct answer and (zero) for the wrong answer. The total scores were classified into levels according to cutoff points as follows:

- Good level of knowledge > 75 %
- Fair level of knowledge > 60% - 75%
- Poor level of knowledge < 60%

Tool (II): Assessment of Time Waster Questionnaire

This tool was developed by the researcher guided by review of recent related literature. It was used to assess nursing staff time waster in the emergency department is self-report scale included 34 items distributed into seven subscales as follows:

- Waiting subscale.
- Defect subscale.
- Motion subscale.
- Inventory subscale.
- Overproduction subscale.
- Transportation subscale.
- Over processing subscale.

Scoring system:

The nursing staff responses were measured in five points Likert scale ranging from (1-5) as always done = 5, often done =4, sometimes done = 3, rarely done =2, and never done =1. The total scores were calculated by summing all categories and classified into levels according to the cutoff point as follows:

- High-frequency time waster > 75%
- Moderate frequency time waster 75%-60%
- Low-frequency staff time waster < 60%

Tool (III): Nursing Staff Practice to Eliminate Time Waster Observation

This tool checklist was developed by researcher guided by **(Bowers, Lauring, & Jacobson, 2001; Jimmerson, Weber, & Sobek 2005)** and related literature review. The tool included 2 scales having 69 items.

- Head nurses practice to eliminate time waster subscale.
- Staff nurses practice to eliminate time waster subscale.

Scoring system:

Nursing staff Practice observation to eliminate time waster was measured in two points scale done (1) and not done (zero). The total scores of practices were classified into levels according to cutoff points as follows:

- Satisfactory practice ≥ 60%
- Unsatisfactory practice < 60%

Method

1. Official permission was obtained from responsible authorities at Tanta Emergency Hospital to conduct the study and get approval and assistance in data collection.
2. Ethical consideration:

- Approval of the ethical committee at the faculty of nursing was obtained from the faculty of nursing.
- Staff nurses' consents to participate in the study was obtained after an explanation of the nature and purpose of the study.
- Participation in the study was voluntary: they had the right to withdraw at any stage.
- The participants' rights were protected by informed oral consent obtained by explaining the purpose and nature of the study. Potential benefits of the study, how data was collected, expected outcome, and respondents' rights to withdraw from the study at any time.
- The respondents were assured that the data was treated as strictly confidential, furthermore, the respondent autonomy was maintained as they were not allowed to mention their names.

3. Tools of study were developed and designed by the researcher based on review of related literature.
4. Tools (II, III) were presented to a jury of seven experts in nursing administration to check content validity and reliability of its items. The seven experts were one professor, one assistant professor and three lecturers of Nursing Administration of Faculty Nursing Tanta University, one professor of Nursing Administration Faculty Nursing Damanhur University. Also, One lecturer of Nursing Administration Faculty of Nursing Alexandria University.
5. The expert's responses were represented on four points rating scale ranging from (4-1); 4=strongly relevant, 3= relevant, 2= little relevant and 1= not relevant. Necessary modifications were done including clarification, omission of certain questions, adding others and simplifying work-related words. The content validity was 89% for tools II and 81% for tool III.
6. Pilot study was carried out after the expert's opinion and before starting the actual data collection. It was carried out on 10 % of the sample (n= 10). They were not from the main study sample during the actual collection of data. The aim of pilot study was to test the sequence of items, clarity, applicability and relevance of the questions. Necessary modification was done. Pilot study also served to estimate the time needed for fulfillment, tool (II) took 30

minutes and tool (1) Knowledge test, took 20 minutes.

7. Reliability of tools were tested using Chronbach alpha coefficient test, its 0.956 for tool (I), it was value =0.772 for tool (II) and 0.752 for tool (III).
8. Nursing staff identification of time waster was used to determine the need for program using tool (I).
9. Nursing staff Knowledge regarding Lean System Program tool (I) was distributed by the researcher before and after implementation of the program. Performance of nursing staff practices was observed by the researcher pre, during and post the actual collection of data using tool (III).
10. Emergency department nursing staff were divided into 10 groups; program time was 12 hours for each group. One session every day (2 hr./day for 6 days).
11. The appropriate time for data collection was according to the type of work and workload for each unit.
12. After 3 months of program implementation and researcher follow up the post-test were re-conducted using tool (I) and (II) to determine the level of nursing staff hold accountable for eliminating time waster using tool (I) and (III).

Results

Table (1): Nursing staff characteristics data

Shows characteristics data of nursing staff. Equal (22.1%) of nursing staff aged < 25, 35- and ≥45. Their age ranged from 22 years to 59 years with a mean of 35.12±10.97 years. Nursing staff 73.7% were females, 45.3% were single, and 35.8% were married. Regarding level of education, 36.8%of nursing staff have diploma and 38.9% have associate degree in nursing and 24.2% had bachelor degree in nursing. Nursing staff 32.6% have <5 years of experience, and 30% have ≥ 20 years with mean (13.80 ±11.73). The majority (94.7%) of nursing staff were staff nurses, and 5.3% head nurses.

Figure (1): Levels of nursing staff total time waster

Shows levels of nursing staff assessment of time waster. The figure shows that around two-thirds of nursing staff reported moderate levels of total time wasters, and about one-third reported high level of total time wasters.

Table (2) levels of nursing staff total frequency type of time waster

Shows levels of nursing staff total frequency of type of time waster. Motion (55.0%) and inventory (53.0%) were the two highest frequency types of time waster and ranked 1.2 respectively. Followed by over-processing (44.0%), defect (43.0%), over-production (42.0%) and waiting (32.0). The least ranking type of time waster was transportation (31.0%) and (55%)

was the highest rank for motion time waster.

Figure (2): Levels of nursing staff total knowledge about lean system at pre, post and follow up program

Pre-program few of nursing staff compared to most of them post and at follow up program were at good level of total knowledge about lean system.

Table (3): levels of nursing staff total knowledge about each session of lean

Before the program phase 18.9% of nursing staff had a good level of knowledge about Lean system definition, goal and concept, which raised to 91.6% immediately post program, then dropped to 43.2% in the follow up phase. Nursing staff 26.3% had good knowledge about the factors affecting learn system preprogram, compared to 90.5% and 80.0% at immediately post program and in the follow up respectively. A minority of 5.3% of nursing staff preprogram had good knowledge about tools and methods of lean system which elevated to 87.4% and 51.6% at immediately post program and in the follow up phase respectively. Nursing staff 18.9% had poor level of knowledge about aspects of time waster before program raised to 86.3% at immediately post program and 30.5% in the follow up phase. Preprogram, 37.9% of nursing staff showed good knowledge about successful elimination of time waster and hinder factor, compared to a post program and follow up phase 93.7% and 73.7 respectively.

Figure (3): Head nurses levels of total practice to eliminate time waster pre, post and follow up program

Preprogram no head nurse showed satisfactory level of total practice to eliminate time waster, improved post program to be all head nurses showed satisfactory level of practice. More than a quarter of head nurses showed satisfactory level of total practice at follow up program.

Table (4): Levels of head nurses' total practice dimensions to eliminate time waster pre, post and follow up program

Pre-program, head nurses 86% did not assess the current condition for time wasters, while 14% did. Head nurses, 66% did not establish standards for care procedures, while 34% did. Also, 72% of head nurses did not provide directions and not encourage staff nurses to follow standards, while 28% did. While post-program 91% of head nurses assessed the current condition for time waster, and 96% established standards for care procedures. Head nurses 82% provided direction and encouragement for staff nurses to follow stander. At follow-up phase head nurses 38% assessed the current condition for time waster and 66% made standards for care procedure. Also, 60% of head nurses provided direction and encouragement for staff nurses to follow stander.

Figure (4): Staff nurses level of total practice to eliminate time waster at pre, post and follow up program

No staff nurse had satisfactory level of practice to eliminate time waster pre-program. While the majority of staff nurses showed satisfactory level

of practice to eliminate time waster post- program, and more than half of staff nurses had satisfactory level of practice in follow-up phase.

Table (5): Levels of staff nurses total practice dimensions to eliminate time waster pre, post and follow up program

Pre-program, staff nurse 64% observed assess the current condition for time wasters, 33% observed follow the stander for care procedures, and 26% observed accountable to eliminate time waster. While the post-program 48% of staff nurses observed assesses the current condition for time waster. And 77% follow the stander for care procedures and 87% were accountable to eliminate time waster. The follow-up phase represents that staff nurses 58%, 66%,74 observed respectively assess the current condition for time waster follow the stander for care procedures were accountable to eliminate time waster.

Table (6): Correlation Matrix of the ED nursing staff across pre, post and follow up phases

Correlation matrix of nursing staff across pre, post and follow up program phases. The table shows statistically significant relationship between nursing staff knowledge in the follow up phase and their knowledge at pre and immediately post program at (R=0.984, P=0.002 and R=0.276, P=0.007) respectively. A statistically significant relationship was found between nursing staff practice score in the immediate post program and preprogram knowledge as well their knowledge in the follow up phase of program (R=0.317, P=0.002 and R=0.204, P=0.047 respectively).

Table (1): Nursing staff characteristics data (N=95)

	Characteristics	No.	%
Age (years)	<25	21	22.1
	25-	32	33.7
	35-	21	22.1
	≥45	21	22.1
	Min –Max (Mean ± SD)	22.0-59.0 (35.12±10.94)	
Sex	Male	25	70
	Female	26.3	73.7
Level of Nursing Education	Diploma	35	36.8
	Associate degree	37	38.9
	Bachelor's degree	23	24.2
Marital status	Single	43	45.3
	Married	34	35.8
	Divorced	10	10.5
	Widowed	8	8.4
Years of experience	<5	31	32.6
	5-	14	14.7
	10-	12	12.6
	15-	9	9.5
	≥20	29	30.5
	Min –Max (Mean ± SD)	1.0-41.0 (13.80±11.73)	
Kind of work in the unit	Staff Nurse	90	94.7
	Head Nurse	5	5.3

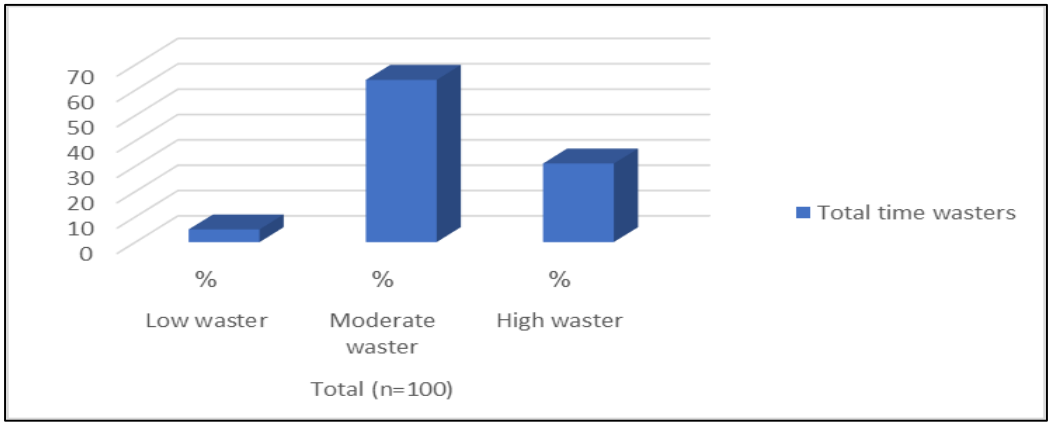

Figure (1): Levels of nursing staff total time waster (N=95)

Table (2): levels of nursing staff total frequency type of time waster (N=95)

Types of time waster	Nursing staff report						Rank
	Low		Moderate		High		
	N	%	N	%	N	%	
Waiting waster	37	37.0	31	31.0	32	32.0	6
Defect waster	23	23.0	34	34.0	43	43.0	4
Motion waster	16	16.0	29	29.0	55	55.0	1
Inventory waster	23	23.0	24	24.0	53	53.0	2
Overproduction waster	26	26.0	32	32.0	42	42.0	5
Transportation waster	48	48.0	21	21.0	31	31.0	7
Over processing waster	23	23.0	33	33.0	44	44.0	3
Total time wasters waster	5	5.0	64	64.0	31	31.0	

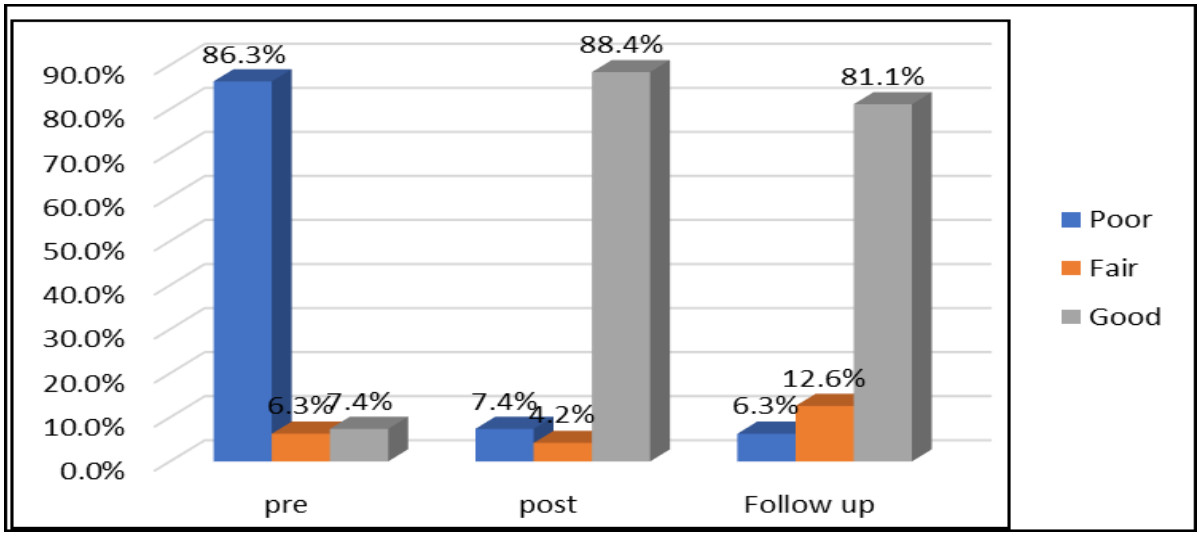

Figure (2): Levels of nursing staff total knowledge about lean system at pre, post and follow up program (N =95)

Table (3): levels of nursing staff total knowledge about each session of lean system program at pre, post and follow up phases (n= 95)

Sessions of knowledge		Nursing staff					
		Pre		Post		Follow up	
		No.	%	No.	%	No	%
Lean system definition, goal and concept	Poor	58	61.1	5	5.3	32	33.7
	Fair	19	20.0	3	3.2	22	23.2
	Good	18	18.9	87	91.6	41	43.2
Test of Significance		X^2= 109.311 P= 0.000*					
Lean system principal and factor affecting	Poor	29	30.5	1	1.1	4	4.2
	Fair	41	43.2	8	8.4	15	15.8
	Good	25	26.3	86	90.5	76	80.0
Test of Significance		X^2= 104.391 P= 0.000*					
Lean system implemented tools and methods	Poor	61	64.2	8	8.4	5	5.3
	Fair	29	30.5	4	4.2	41	43.2
	Good	5	5.3	83	87.4	49	51.6
Test of Significance		X^2= 176.329		P=0.000			
Aspects of time Waster	Poor	32	33.7	5	5.3	20	21.1
	Fair	45	47.4	8	8.4	46	48.4
	Good	18	18.9	82	86.3	29	30.5
Test of Significance		X^2= 102.153 P= 0.000*					
Successful elimination of time waster and hindering factor	Poor	26	27.4	2	2.1	6	6.3
	Fair	33	34.7	4	4.2	19	20.0
	Good	36	37.9	89	93.7	70	73.7
Test of Significance		**X^2= 73.896 P= 0.000***					

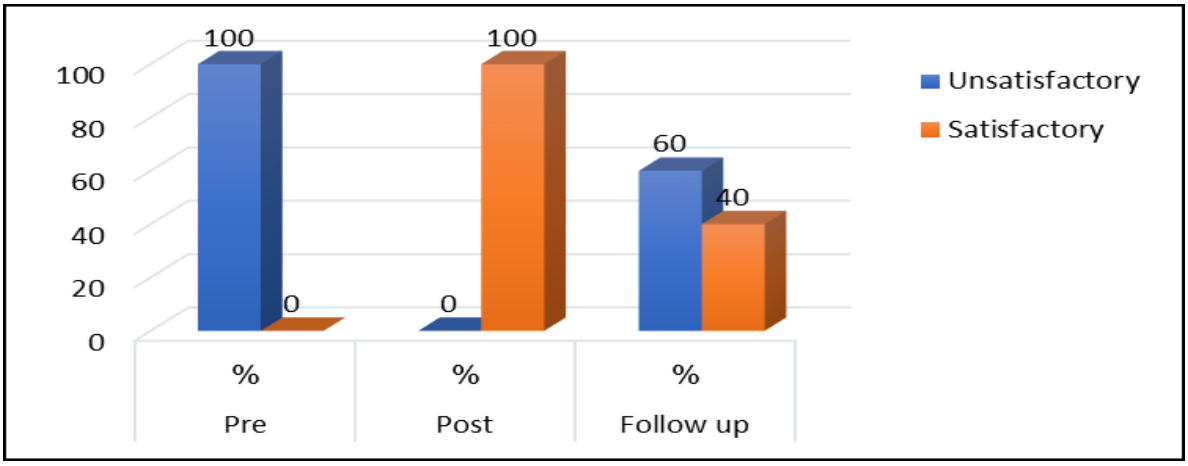

Figure (3): Head nurses levels of total practice to eliminate time waster pre, post and follow up program (N= 5)

Table (4): Levels of head nurses' total practice dimensions to eliminate time waster pre, post and follow up program (N=5)

Head nurses practice to eliminate time waster	Pre		Post		Follow up	
	Not done	Done	Not done	Done	Not done	Done
	%	%	%	%	%	%
- Assess current condition for time waster	86	14	9	91	62	38
- Make stander for care procedures	66	34	4	96	34	66
- Providing directions and encourage staff nurses to follow stander	72	28	18	82	40	60

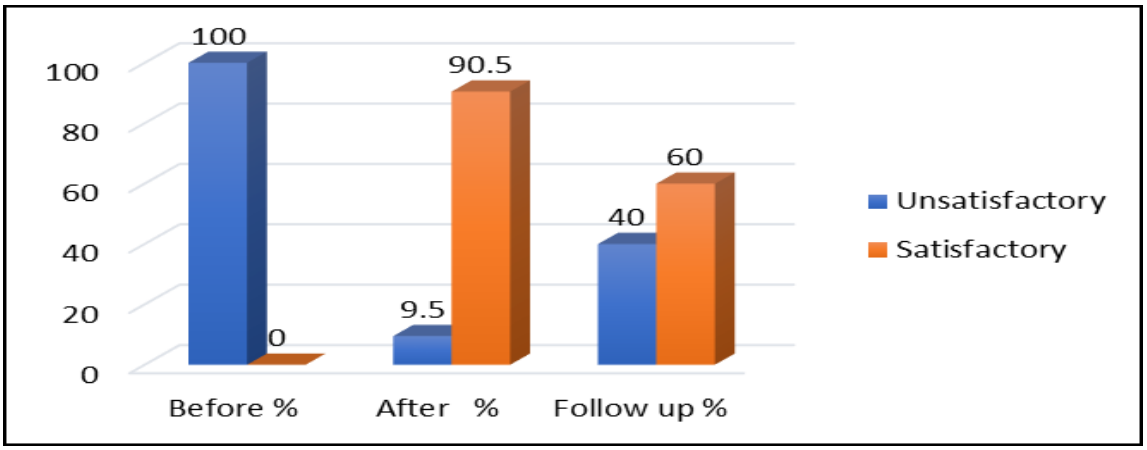

Figure (4): Staff nurses level of total practice to eliminate time waster at pre, post and follow up program (N=90)

Table (5): Levels of staff nurses total practice dimensions to eliminate time waster pre, post and follow up program (N=90)

Staff nurses diminution of eliminated time waster	Pre		Post		Follow up	
	Not done	Done	Not done	Done	Not done	Done
	%	%	%	%	%	%
- Assess current condition for time waster	36	64	52	48	42	58
- Follow the stander for care procedures	67	33	23	77	34	66
- Accountable to eliminate time waster	74	26	13	87	26	74

Table (6): Correlation Matrix of the ED nursing staff across pre, post and follow up phases

Items		Knowledge PRE	Knowledge Immediate	Knowledge Follow up	Time waster	Practice PRE	Practice Immediate
- Knowledge PRE	r						
	P						
- Knowledge Immediate	r	0.037					
	P	0.724					
- Knowledge Follow up	r	0.984	0.276				
	P	0.002*	0.007*				
- Time waster	r	-0.474	0.160	0.143			
	P	0.074	0.122	0.167			
- Practice PRE	r	0.415	-0.433	-0.054	0.097		
	P	0.085	0.081	0.605	0.351		
- Practice Immediate	r	0.317	-0.058	0.204	-0.154	-0.069	
	P	0.002*	0.580	0.047*	0.135	0.504	
- Practice Follow up	r	0.011	0.275	0.077	0.128	0.112	-0.122
	P	0.915	0.007*	0.461	0.217	0.279	0.239

R = Correlation Coefficient * Significant p at ≤0.05

Discussion

Lean system theoretical and practical training program at present study aims to create a culture of no ambiguity and quickly resolving nursing staff time waster problems at emergency department. Through explaining theoretical path main steps and training staff nurses for raising their awareness and practice skills about time wasters were involved in the processes. Determining the precise sequence of activities, practice for eliminating those without add value and improving the processes through agile and quick responses to remove waste, as soon it is identified. Besides, improve the flow of patients between the emergency room and recovery areas. As well as declaring important principles of the lean methodology, VSM and 5s tools used in healthcare management **(Vashi, 2019)**.

Findings of the present study revealed that nursing staff reported either high or moderate level of total time waster. Motion and inventory were the highest two ranking time wasters of nursing staff, followed by over-processing, defect, over-production and waiting. While the least ranking type of time waster was transportation. However, the types of wasters may be present in different proportions according to the nursing

staff workload. Analysis of workload can be viewed from aspects such as tasks that carried out based on the main functions and additional tasks performed. Also, viewed from the number of patients to be treated, work capacity according to education obtained, and work time used to do their work according to work hours that take place every day. Besides the presence of overall facilities to complete work well.

Harahap, Ginting, Nasution, and Amansyah, (2023), study about the effect of lean approach on hospital service quality and inpatient satisfaction, supported present study result. The study showed that all variables have significant effect on the inpatient satisfaction including over production, followed by waiting time, transportation, excess processing, inventory, motion, and satisfaction defects. Based on multivariate analysis it was concluded that the hospital service quality affects inpatient satisfaction, the inventory waster has the highest rank, and transportation waster has the lowest rank.

Result of present study shows that nursing staff experience waiting time wasters. Nursing staff reported that often patients leave before receive care, patient ask many questions when tripping, and patient registration takes long time. Also nursing staff reported that sometimes patients wait a long time in triage. However, the reasons for why patients leave before being seen by a provider, most probably due to their fed up with waiting so they are leaving. Occasionally with serious consequences, waiting times as long as 6 hours have been associated with higher rates of "leaving without being seen **(Al-Moteri, 2023)**. However, while **Faber, Coomes, Reinemann, and Carlson, (2023)** study about creating a rapid assessment zone with limited emergency department capacity, decreases patients leaving without being seen, support present result they showed that rate of patients who left without being seen 64.5%.

The result emphasizes the importance of a well-organized and easily accessible storage system for caregiving materials. The study also indicates that walking along stations to chart in records is recognized as time-wasting activity. This suggests that the layout of workstations and documentation areas may need improvement to streamline the workflow. Nursing staff also reported that it takes a long time to go to the lab and return, this could be related to the physical layout of the facility or potential inefficiencies in the lab-related processes. Addressing these issues by implementing changes in workflow, optimizing the layout of supplies and workstations, and improving access to essential materials can contribute to a more

efficient and effective work environment for nursing staff.

Al-Moteri et al., (2023), study about the road to developing standard time for efficient nursing care: A time and motion analysis, supported present study results and showed that there were 5100 min of observations over 10 working days. Nurses spent 69% (330 min) of time during their 8 h morning shift on direct patient care, (19.4%) ward/room activities (18%), documentation (14%), indirect patient care (12%) and in professional communication (5%). Around 94 min of activities seem to be wasted (that threaten patient care quality and) can be potentially detrimental to nurses' overall productivity.

Preprogram results of the current study revealed that the nursing staff does not have enough knowledge regarding the definition, purpose, and concept of Lean. But post-program, the majority of them understand that Lean is a way to find activities that do not add value to the service and can eliminate all forms of waste. They showed correct answers that the Lean system can eliminate all forms of waste. As well as they know that it can help to standardize work, reduce ambiguity, increase service quality and act to reach price competitiveness, as well as meet customer need in a short possible time.

Carrillo, Muñoz, and Diaz-Porta, (2023). Study about application of the Lean principles of the Toyota production system for the improvement of the emergency service attention times of a high complexity hospital. The study supported the present result that detailed knowledge of service-striking was achieved. This study enabled the recognition of 13 general processes in the care route that varied according to the triage type, as well as the areas with a greater flow of patients, information, triage, admissions, consulting room, sampling, and billing.

The results of the current study showed that pre- program more than half of nursing staff gives uncorrected knowledge regarding Lean system principles and factors affecting. While post-program all nursing staff answered more than 90% of Lean system principle and its factor affecting items correctly. Also, they understand that their improvement of lean principles knowledge led to reduced operating costs, and created flow by eliminating waste, help to improve patient outcomes, and to empower nursing staff to increase patient value. While they identified the importance of communication leadership and management as factors affecting lean implementation and determining the add value of service.

Barbosa, et al., (2023) study about the method of applying knowledge management to Lean in emergency care units. In cases on Lean thinking applications in unconventional

systems, supported present study result. The study showed that the learning theory brought varied views of thinking about learning, and when associated with the Lean philosophy allowed a broad understanding of the convergent points of establishing sequenced and logical planning, goal setting, having motivated and committed teams, validate socialization and group work, create successful experiences and learning in adverse situations, and stimulating the behavioral side.

Finding revealed that there were highly statistically significant improvements of nursing staff knowledge post than pre-program and follow up in all items of aspects of time waster. These results suggest that the nursing staff knowledge regarding the main goals of lean transformation improved after the program, with a higher percentage of correct answers in the post and follow-up stages. In addition, the nursing staff knowledge regarding the negative impact of searching for supplies or equipment on patient care, improved after the program with a higher percentage of correct answers in the post and follow-up stages. This is an important aspect of lean thinking, such as reducing waste and improving the availability of supplies and equipment to enhance patient care.

Saleh, (2020) studied about the effect of the time management training program on nurses' daily time wasters, supported the present study result, and showed highly significant difference between studied nurses' knowledge at pre-, post, and follow-up program.

The current study result represents nursing staff knowledge regarding the successful elimination of time waster and hinder factors at pre-, post, and follow-up programs. There was highly statistically significant improvement of nursing staff knowledge post than pre-program and follow up in all items of successful elimination of time waster and hinder factor. The percentage of correct answers tends to increase, which suggests that the program has been effective in enhancing nursing staff knowledge, and in many cases, the improvement in knowledge is sustained in the follow-up phase, indicating that the program's impact is not just temporary.

Waiman, Achadi, and Agustina, (2023) study about reducing hospital outpatient waiting time using lean six sigma: a systematic review. supported present study results. The study showed reduction in outpatient waiting time which reduced from (5.2% to 97%) after knowledge and training for implementation of Lean Six Sigma. Process redesign, improvement in appointment scheduling, patient communication, and improvement in workplace design, were strategies used to reduce outpatient waiting time. Understanding and application of

these strategies increased the number of patients seen and hospital gross revenue, as well as patient satisfaction.

Preprogram finding of present study illustrated that none of head nurses practice showed satisfactory level of total practice to eliminate time waster, which improved post program to all head nurses had satisfactory level. Most probably these post program result made due to their assessment of current condition of time waster, make stander of care for providing direction and encourage staff nurses to follow stander. Also due to their success for indicating positive trend towards eliminating due to of staff nurses time wasters, and improve efficiency and productivity in work place.

Tofighi et al., (2022) study about time management behaviors and emotional intelligence in head nurses in emergency and intensive care units. Supported the present study result and showed that there was a significant relationship between work experience and overall time management skills. Time management skills may help head nurses to cope with the challenges they face, which may also improve the quality of nursing care. Nursing leaders should consider the importance of time management in increasing motivation and satisfaction of nursing staff and improving quality of care.

Present study results revealed that all items of staff nurses practice to assess current condition for time waster were highly statistically significant improved post than pre-program. Most probably because the program had a significant positive impact on staff nurses' engagement in activities related to problem resolution, time management with patients, and supply organization. The program also showed significant positive impact on reducing staff nurses' activities that could lead to inefficiencies and waste, such as consuming more supplies than needed and bringing supplies from other departments. As well as reducing various activities like unassay paperwork, phone calls and bringing supplies from other departments.

Abd Al Fadeel, Abd El Megeed, and Etway, (2023), study about effect of lean management training program on waste management knowledge and practices among nursing staff. The study supported present study results and showed statistically significant improvement in levels of nursing staff waste management practices as (97.8%) of them had low waste management practices level at three months post program.

The correlation matrix of the present study revealed significant relation between nursing staff knowledge and practice at different phases of

program. Actually, this relation was due to the well-designed program. The session explained to nursing staff lean system goal and concept, principles, implementation tools, and training on successful elimination of timewaster. For the emergency department to sustain and increase productivity, required to routinely reduce waste. As well as promoting a continuous improvement culture through establishing in place a lean system.

Nursing staff required to be equipped to efficiently identify and resolve time-wasting issues through providing them with periodical extensive training including Lean principles, waste identification, process mapping, and the actual application of Lean tools. Sustaining good changes requires engaging head nurses, leadership and staff nurses in creating a culture that promotes continuous improvement. The emergency department can accomplish improved staff satisfaction and patient care by streamlining operations, improving communication, and providing thoughtful training that is used consistently.

Conclusion

Nursing staff at Tanta University Emergency Hospital had a low level of knowledge about lean system and an unsatisfactory level of performance to eliminating time wasters preprogram, which reflected on their demand of lean management program. They were in need for information about benefits of lean system, causes and type of waste in ED, implementation tools, barriers, principles and factor affecting of lean system, the implemented lean system program enhanced the talents of nursing staff.

Recommendations

On the basis of the finding of current study, the following recommendations are suggested:

1. Conduct periodical regular training programs for nursing staff about lean system.
2. Head nurses are required to strictly supervise staff nurses elimination of time waster.
3. ED staff nurses are required to be aware of the importance of good time management practices and set goals as a habit of work. Nursing research.
4. Educational institutions required to introduce the lean system approach and its branches in the nursing curriculum to acquaint students with up-to-date knowledge and skills in lean system.

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