

Effect of Implementing Guidelines Regarding Administering Inotropic Medications for Critically Ill Patients on Nurses' Knowledge

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Abstract Background: There is no teaching guidelines denoted for improving the nurses' knowledge regarding inotropic medication administration, that emphasizes the intervention teaching guidelines necessity. **Aim of the study:** To assess the effect of intervention teaching guidelines regarding administering inotropic medications for critically ill patients on nurses' knowledge. **Design:** Quasi-experimental research design was used in the study. **Setting:** the present study was carried out at Critical Care Units. **Sample:** A convenient sample of all staff nurses (60 nurses). **Tools of data collection:** The data were collected using one tool titled nurses' knowledge assessment questionnaire. **Results:** 86.7% of studied nurses had satisfactory level of knowledge regarding inotropic medications post implementing teaching guidelines. The post and follow up-intervention mean knowledge was high 29.33, 29.40 respectively when compared with pre-intervention practice mean score 18.10 with P value < .001.

Keywords: critically ill patients, inotropic medications, nurses' knowledge, teaching guidelines

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1. Introduction

Inotropes are drugs that affect the myocardium contractile activity. This group of medications is frequently used in critical care units. Inotropic medications are short- to medium-acting drugs which are used to increase vessels tone and cardiac output in numerous conditions that affect critically ill patients. They are shortly used as intervention until adequate cardiovascular function returns on the pathological process resolution. Inotropic medications are among the most widely used medications in Critical Care Units, since they help correct hemodynamic instability for critically ill patients [1].

Nevertheless, inotropes carry high risk for adverse drug effects if the administered dose and way of administration were wrong. Intravenous inotropic medications infusion presents a high risk for errors in their administration like myocardial ischemia and may induce hypotension in some cases. Apart from metabolic, cardiovascular and dermatologic side effects, these sympathomimetic medications may result in central nervous system stimulation including,

tremors, restlessness, and even confusion and psychosis. Moreover, infiltration and extravasation which might occur when the IV solution leaks into the surrounding tissues. It was observed that, in critical care practice, nurses presented difficulties in handling this type of medication that are frequently used for treatment and management of the most critically ill patients [2,3].

A critical care nurse is a vital part of the health care providers, the process of medication administration is considered as one core nursing action that spend about 40% of their time in the hospital for administering medications. In addition, the nurses' competency and following intervention teaching guidelines for inotropic medication administration is a warranty for quality of nursing care and critically ill patients' safety. Also, there are many reasons for medication administration errors done by a nurse, which are inadequate training, lack of knowledge regarding inotropic medications [4].

Furthermore, in Egypt and developing countries, it is difficult to obtain precise data and statistics regarding medication administration errors due to improper archiving and reporting system. Also, in Egypt, there is a lack of intervention teaching guidelines aimed at improving the nurses' knowledge in medication administration

in the critical care field that affects negatively on the quality of nursing care [5]. Observational studies have revealed that the majority of nurses fail to follow the protocols for the safe administration of medications [6]. Therefore; the core aim of this study is to evaluate the effect of implementing teaching guidelines regarding inotropic medications for critically ill patients on nurses' knowledge.

2. The Study Aimed to

Evaluate effect of implementing teaching guidelines regarding administering inotropic medications for critically ill patients on nurses' knowledge and practice.

3. Objectives

- Assess nurses' knowledge regarding administration of inotropic medications for critically ill patients.
- Evaluate effect of implementing teaching guidelines for administration of inotropic medications for critically ill patients on nurses' knowledge.

4. Research Hypothesis

The following research hypothesis was formulated to fulfill the aim of this study:-

The nurses' knowledge about administering inotropic medications for critically ill patients is improved after implementing guidelines regarding administering inotropic medications.

A-TECHNICAL DESIGN

The technical design included the research design, setting, participants and tools for data collection.

1- Design:

Quasi-experimental research design was used in the study.

2- Setting:

The present study was carried out at Critical Care Units affiliated to the Suez Canal University Hospital; Cardiac Care Unit which lies in 1st floor that composed of two rooms (7 beds) where one room contains 4 beds and the other 3 beds, Intensive Care Unit which lies in 1st floor which composed of 4 rooms (one large room which contains 7 beds and three special rooms which contains one bed in each of them with totally number of beds 10; Cardiothoracic Surgery Unit that lies in the 1st floor besides emergency department that contains totally 7 beds.

3- Participants:

A convenient sample was used in this study. At time of data collection^{1st} of June 2018 to end of March 2019 participants comprised nurses (male and female) working at Suez Canal University Hospitals (60 nurses) after exclusion of the pilot study regardless their age, years of experience, level of education.

4-Tool of data collection:

Data were collected using one tool as the following:

Knowledge questionnaire was developed by the researcher after reviewing of recent related literature to assess nurses' knowledge about inotropic medications in critical care units [7]. It was composed of two parts:

Part (1):

It was concerned with demographic data of the studied nurses (e.g. age and education, and work related data (department, years of experience and attending training courses related inotropic medications) and it includes five questions.

Part (2): Nurses' knowledge questionnaire and it included six items (34 questions):

(Item 1): It covers knowledge-related general pharmacological concepts of inotropic medications and it includes (4 true or false questions)

(Item 2): It covers knowledge-related adrenaline and it includes (4 multiple choice questions and 2 true or false questions)

(Item 3): It covers knowledge-related to noradrenaline and it includes 6 multiple choice questions

(Item 4): It covers knowledge-related to dopamine and it includes 3 multiple choice questions and 3 true or false questions.

(Item 5): It covers knowledge-related dobutamine and it includes 3 multiple choice questions and 3 true or false questions

(Item 6): It covers knowledge-related to digoxin and it includes 4 multiple choice questions and 2 true or false questions

Scoring System:

The total score of nurses' knowledge of 34 questions was ranged from 0 to 34. The respondent was given one point for each correct answer and zero for incorrect answers. A total score below 75% was considered unsatisfactory, while those equal to or above 75% were considered satisfactory [5].

1-Preparatory Phase:

A review of current and past relevant literature using the available local and international books, magazines and periodical to get acquainted with the research problem to develop the study tools and the content of the program.

Permission for data collection and implementation of guidelines in Suez Canal University Hospital in Ismailia were obtained from the hospital administrative personnel by the submission of a formal letter from the faculty of nursing, Ismailia, Suez Canal University. Meeting and discussion were held by the researcher and nurses to let them be aware of the aims, the nature of guidelines, as well as to get better cooperation during implementation phase of guidelines.

Assessment of the nurses' knowledge was made for this assessment to shed light and give more insight about the current nurses' knowledge deficit, as it's based on the results obtained from questionnaire, as well as, literature review.

Guidelines were developed by the researcher; detected needs, requirement, deficiencies were translated to aim and objectives of the program. Moreover, teaching materials were prepared (e.g. lecture, discussion, PowerPoint presentation and booklet that helped in covering theoretical information [8-13].

2-Content Validity of the Tool:

Content validity (or logical validity) was performed to measure the extent to which the tools represent all facets of the social psychometrics construction. The method of measuring content validity was performed by gauging agreement among raters/judges regarding how essential of

a particular item of the tools is. Each of the subject matter expert raters (SMEs) on the judging panel respond to the following question for each item: "Is the knowledge or practice measured by this item 'essential,' 'useful, but not essential,' or 'not necessary' to the performance of the construct?" If more than half the panelists indicate that an item is essential, that item has content validity. Greater levels of content validity exist as larger numbers of panelists agree that a particular item is essential

Tool of data collection was already tested for its content validity with a content validity index (0.8) [7]. Comprehensiveness and applicability by 9 expertise from the Medical, Surgical Department at Faculty of Nursing in Port Said University, and Cardiology, Nephrology and Anesthesiology Departments at faculty of medicine in Suez Canal University. This in addition to lecturers from National Institute of Cardiology to determine whether the included items are comprehensive, understandable, applicable, clear and suitable to achieve the aim of the study.

3-Reliability:

It was done using Cronbach alpha coefficient to assess the internal consistency of the tool and its value was (0.82) for knowledge tool.

4- Pilot study

Tools of data collection were tested on ten percent of subjects (6 nurses) and they were excluded from the entire sample of research study. The purpose of the pilot study is to test the applicability of study tools and to estimate the time needed to fill it. The results of the data obtained from the pilot study helped the researcher to modify the tools: items were corrected or added as needed. Accordingly, modifications were done and the final form was developed.

5-Field work:

Data collection of this study was carried out over eight month period that started from 1st of June 2018 to end of March 2019. Data collection was conducted through four phases (assessment, planning, implementation and evaluation phase).

Assessment phase:-

Assessment of critical care nurses' knowledge about inotropic medications (pre, immediate post and follow up test) was performed.

B. Planning phase:

Based on the work completed in phase one, the researcher designed the guidelines based on the actual need assessment of studied nurses through reviewing the literature and based on recent evidence based guidelines for administered inotropic medications. Guidelines were covering the theoretical related inotropic medications administration in critical care units. Booklet containing the content of the guidelines was designed by the researcher and it was written in simple Arabic language supplemented by photos and illustrations to help nurses understand the content.

General aim of the guidelines:

Guidelines aimed to improve nurses' knowledge regarding administration of inotropic medications in critical care units.

Specific objectives of the guidelines:

At the end of the guidelines implementations, each nurse was able to:-

1. Define inotropic medications

2. Mention types of inotropic medications
3. Recognize the general concepts regarding inotropic medications
4. Identify the basic key terms needed for recognizing inotropic medications.
5. Identify adrenaline medication
6. Identify noradrenaline medication
7. Identify dopamine medication
8. Identify dobutamine medication
9. Identify digoxin medication
10. Recognize equipment needed for inotropic infusion
11. Prevent complications of inotropic medications
12. Recognize alarms occurring during inotropic infusion therapy

C. implementation phase:

Data of current study were collected from June 2018 to March 2019. Once objectives were developed, the guidelines for nurses were designed. Structurally planned guidelines of this study were implemented in the form of session motivation and reinforcement during session in order to enhance motivation for the sharing in this study.

The total numbers of session were (2) sessions.

The total number of groups was 10 groups. The teaching lecture started from 9 am to 12 p.m., which was modified sometimes according to the nurses' free time. The teaching hours were 3 hours/day for three days/ week. 2 months were spent to conduct pre-test, 8 weeks for guidelines implementation, 2 months for immediate post-test and 2 months for follow up.

Teaching session was conducted, the number of session were 2 for each group (6 nurses) to acquire the related information. Each nurse was supplemented with the knowledge booklet. Communication channel was kept open between the researcher and the study group. Then, immediate posttest and follow up knowledge test was carried out.

C-ADMINISTRATIVE DESIGN:

An official permission for data collection in Suez Canal University Hospital was obtained from the hospital administrative board by submission of a formal letter from The Dean of The Faculty of Nursing.

Meeting and discussion was held between the researcher and the nursing administrative personnel to make them aware about the aim of the study and objectives of the research, as well as to get better cooperation during the implementation phase of the research.

Ethical Considerations:

The ethical research considerations in this study included the following:

The researcher clarified the aim of the study and the objectives to the studied nurses included in the study prior starting.

Nurses were informed that they were able to participate or not in the study, they have the right to withdraw from the study at any time, confidentiality and anonymity will be assured and protection of the nurse from hazards. Oral and written consent was obtained from each nurse prior to participation in the study after simple explanation of the aim and expected outcomes of the study. Also, each nurse was familiar with the importance of his/her participation, they had the right to withdraw from the study at any time and their withdrawal from the study was available at any

time. Ensuring the confidentiality of the information collected and anonymity was guaranteed

D-STATISTICAL ANALYSIS:

Data collected through the questionnaire and observation checklist were coded, entered and analyzed using Statistical Package for the Social Sciences (SPSS version 20). P value was set at <0.05 for significant results.

The following statistical techniques were used:

- Percentage.
- Mean score degree \bar{X} .
- Standard deviation SD.
- Paired T test
- Repeated measured ANOVA test
- Proportion probability of error (P- value) and confidence interval.

Significance of results:

- When $P < 0.05$, there is a statistically significant difference.
- When $P < 0.01$, there is a highly statistically significant difference.

5. Results

Table 1 shows that 80.7% of studied nurses' age was from 20 to less than 30 with mean age 26.13 ± 3.35 . As regard the level of education, the technical institute was the highest percent with 63.9% followed by diploma 21.3%. Also, 37.7% of studied nurses had from 3 to less than 6 years of experience. The majority of studied nurses (90. %) didn't attend courses regarding inotropic medications ago.

Table 2 clarifies that there was statistically significant difference between the pre-knowledge of studied nurses, post- knowledge and follow up-nurses knowledge regarding inotropic medication with P value = <.001 with significant increase in their mean scores with mean of nurses knowledge regarding inotropic medications before teaching guidelines implementation was 18.10 with SD 5.44 and the higher mean (3.36) was about knowledge

regarding noradrenaline. On the other side, the total mean post teaching guidelines implementation was 29.33 and SD 4.06 and the higher mean was knowledge about general concepts with mean 3.70 followed by knowledge about digoxin with mean 5.33 and total mean in follow-up was 29.40 and SD 3.79 and the higher mean (5.46) was knowledge regarding general concepts with mean 3.60 followed by knowledge regarding noradrenaline with mean 5.46.

Table 3 reveals that there was statistically significant difference between the pre-knowledge of studied nurses and post-nurses knowledge regarding inotropic medication with $t=12.308$ and P value = <.001. Also, the mean difference between the pre- knowledge versus post-knowledge was 7.06 with SD 11.23 with significant increase in their mean scores.

Table 1. Percentage distribution of the studied nurses according to their demographic characteristics (n=60)

Demographics	Total Sample(n=60)	
	N	%
Age (Years)		
20: < 30 years	49	80.7
30: < 40 years	11	18.3
Mean(SD) Range(Min-Max)	26.13(3.35) 21-35	
Education		
Bachelor degree	8	13.1
Technical Institute of nursing	39	63.9
Diploma	13	21.3
Experience		
<3	20	33.3
3:<6	23	38.3
6:<9	7	11.7
>9	10	16.7
Attending courses regarding inotropes before		
Yes	6	10
No	54	90

N: sample size; n: frequency; %: percent; SD: standard deviation; Min: minimum value; Max: maximum value.

Table 2. Total mean scores of nurses' knowledge (pre-post-follow up) teaching guidelines regarding inotropic medications (n=60)

Knowledge item	Pre	Post	Follow up	F test	P value
	Mean±SD	Mean±SD	Mean±SD		
General concepts	2.50 ±.911	3.70 ±.59	3.60 ±.66	54.619	<.001
Adrenaline	2.95 ±1.29	5.20 ±.97	5.20 ±.77	138.65	<.001
Noradrenaline	3.36 ±2.17	5.71 ±.64	5.46 ±.62	55.259	<.001
Dopamine	3.10 ±1.45	4.95 ±1.04	5.06 ±1.02	56.730	<.001
Dobutamine	3.18 ±1.09	4.43 ±1.47	4.83 ±1.19	39.016	<.001
Digoxin	3.00 ±1.23	5.33 ±.89	5.23 ±.81	123.43	<.001
Total Score	18.10 ±5.44	29.33 ±4.06	29.40 ±3.79	154.92	<.001

n: sample size; SD: standard deviation; F repeated measures anova P value is significant ≤.05.

Table 3. Relationship between nurses' knowledge (pre and post) teaching guidelines regarding inotropic medications (n=60)

Item	Pre mean ±SD	Post mean ±SD	Confidence interval(CI)		t test	P value
			lower	Upper		
Value	18.10± 5.44	29.33±4.06	9.40	13.05	12.308	<.001
(Effectiveness)	11.23±7.06					

t test is paired sample t test , P value is significant <.05.

Table 4. Relationship between nurses' knowledge (pre and follow up) teaching guidelines regarding inotropic medications (n=60)

Item	Pre mean ±SD	follow up mean ±SD	Confidence interval(CI)		t test	P value
			lower	Upper		
Value	18.10± 5.44	29.40±3.79	9.57	13.02	13.094	<.001
(Effectiveness)	11.30±6.68					

t test is paired sample t test , P value is significant <.05.

Table 4 reveals that there was statistically significant difference between the pre-knowledge of studied nurses and follow up-nurses knowledge regarding inotropic medication with t=13.094 and P value <.001. Also, the mean difference between the pre- knowledge versus follow-up knowledge was 11.30 with SD 6.68 with

significant increase in their mean scores.

As shown by Figure 1, the satisfactory level of knowledge before teaching guidelines implementation was 8.3%. on the other hand the satisfactory level of knowledge post and follow up teaching guidelines implementation was 86.7 % and 85.2% for each of them.

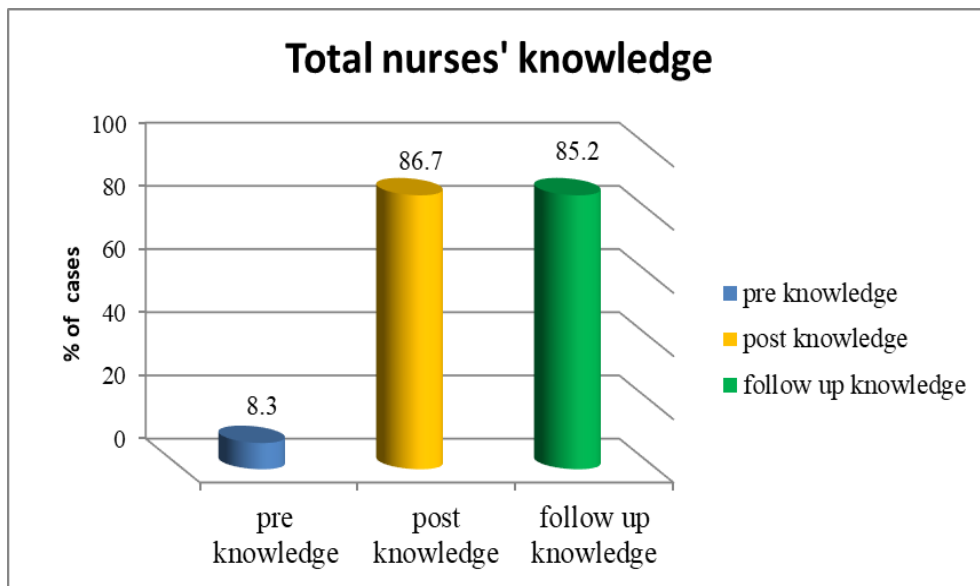


Figure 1. Percentage distribution of studied nurses according to (pre- post- follow up) teaching guidelines satisfactory level of knowledge (N= 60)

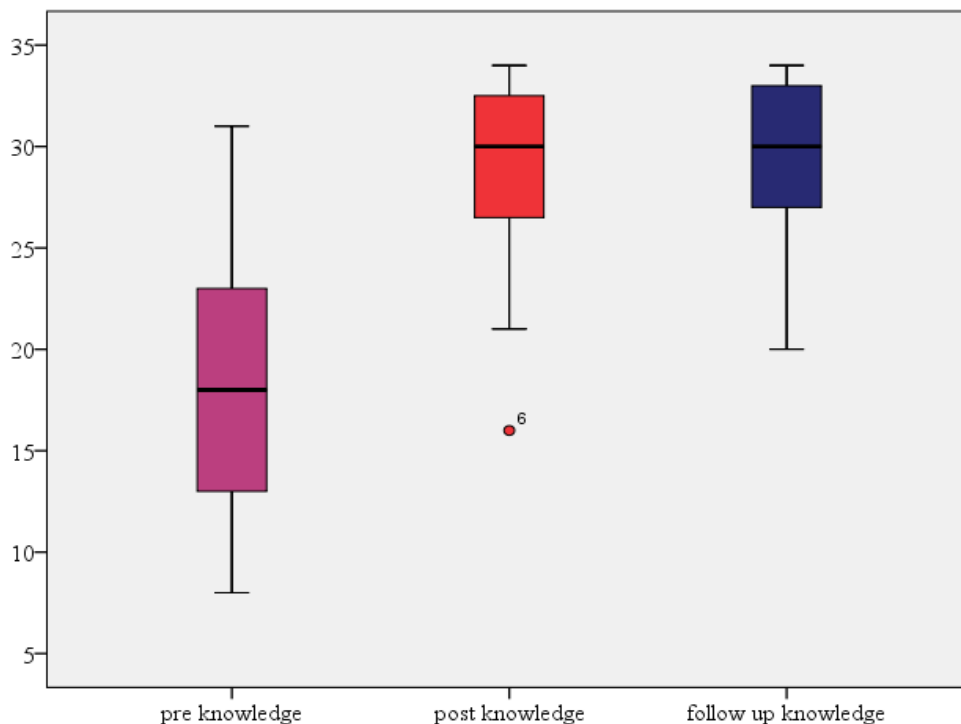


Figure 2. Distribution of total knowledge scores (pre-post-follow up) among the studied nurses represented by 25th, 50th (median), 75th percentiles, minimum, maximum and outlier values (N=60)

Figure 2 shows that the distribution of total knowledge scores among the studied nurses was significantly higher in post and follow-up post-teaching guidelines phases in comparison to pre-teaching guidelines phase (25th, 50th (median), 75th percentiles, minimum, maximum) ($p < 0.001$).

6. Discussion

A nurse is an integral part of the health care system. Process of medication administration is deliberated as daily component of nursing practice and core nursing action and which spend about 40% of their time in the hospital to administer medication. Also, the research results warn that more than half of life threatening errors are related to poor nurses' knowledge regarding inotropic medications. Nursing studies are limited in discussing nurses' competency regarding safe medication practices especially in critical care units as stated by [5].

Moreover, medication administration, which is core nursing role, if not performed according standards of care and practice can increase inessential risks among patients as noted by [14]. It often leads to adverse drug effects, rehospitalisation, and an increased hospital length of stay as depicted by [15]. Therefore, the current discussion aimed to assess the effect of implementing teaching guidelines regarding administering inotropic medications for critically ill patients on nurses' knowledge and practice.

Regarding age, the highest of the participants were in the twenty to less than thirty years age group with a mean age about twenty six and standard deviation three. As regards educational level, almost half of the studied nurses had technical degree. Concerning years of experience, more than two thirds of studied nurses ranged from 1-6 years of experience in the critical care unit. Also, the majority of studied nurses had not taken courses regarding inotropic medications administration.

These results were in accordance with [16], who illuminated that more than half of studied nurses aged between 26-30 years old and most of them had between one to five years of experience. Also these results were supported by a study done by [17], who illuminated that most of nurses had technical degree in nursing.

The current study revealed that most of nurses in critical care units had an unsatisfactory knowledge regarding inotropic medications. A possible interpretation of these results could be due to that nursing implications and role about pharmacological concepts were not explained clearly in the nursing curriculum. Also, lack of verification process in nursing pharmacology and reviewing the physician step by step medication administration process.

In the same context, the study findings were in agreement with [18] that depicted unsatisfactory nurses' knowledge regarding medication administration. Moreover, these results were in accordance with a study done by [19] who revealed lack of nurses' pharmacological knowledge. Consequently, there was an urgent need to implement intervention teaching guidelines regarding this critical group of medications, and this idea is emphasized by Alsulami et al., (2013) who delineated that countries of Middle East urgently need to introduce educational intervention teaching guidelines to improve the nurses' knowledge to improve their quality of medication administration practices.

As regards nurses' knowledge post and follow up intervention program, the results revealed that most of nurses have satisfactory level of knowledge regarding inotropic medications. This result was in correspondence with [19] who showed that their level of knowledge increase to moderate and high immediate after program and after one month.

Concerning the total mean score of nurses' knowledge regarding administering inotropic medication post and follow up intervention, the results revealed high mean scores in comparing with pre-intervention period with highly significant difference and increase the mean effectiveness score. These study results were consistent with a study done by [16,17] who revealed increase in the post mean score with increased effectiveness mean score.

The post test results can be explained in the light of the fact that the knowledge immediately increase in response to increase memory retention after training program. As regards the follow up knowledge, this could be interpreted in the light of the fact that practical knowledge differs from solid knowledge and adoption of health care institution a new policies and guidelines about this group of medication in response to education guidelines that the researcher applied in form of printed materials (booklets, handouts) and this point of view was supported by [20] that revealed that providing a flipped materials can overcome the forgetting curve theory which normally occurs after elapsing time.

Implications of the study results in clinical setting:

Clinical setting

1. Booklet can be used as reference for improving nurses' knowledge and practice in critically care units.
2. Designed teaching guidelines armed with evidence based knowledge and practices can be used for education purpose
3. Reduce medication errors associated with inotropic medication.

7. Recommendations for Application

1. Replication to a large study participants
2. There were no denoted teaching guidelines or education interventions about inotropic medication administration. In Egypt, nurses' knowledge about pharmacology especially high alert medications was not sufficient. The researcher tried to develop teaching guidelines for administrating this type of medications. The teaching guidelines were validated by group of experts in medical and nursing field. Also, it was translated into Arabic form for more beneficence for Egyptian nurses and can be used for upgrading nurses' knowledge regarding inotropes.

Declaration of Conflicting Interest

There is no conflict of interest.

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WSES guidelines for management of intra-abdominal infections. Massimo Sartelli. SSC guidelines have been regarded as the standard of care in patients with severe sepsis and septic shock in many hospitals worldwide [29]. However, the possibility to implement the SSC guidelines has been questioned in LMICs where simple and low-cost standardized laboratory testing should be emphasized to allow accurate diagnosis, prognosis, and monitoring of treatment response [30, 31]. Vasopressor agents should be administered to restore organ perfusion if fluid resuscitation fails optimizing blood flow and if hypotension persists following fluid loading. These agents should be globally available.