

Original Article

Assessment of Nurses' Knowledge and Practices concerning Safety Measures throughout Intravenous Therapy Administration

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Abstract

Medication errors are globally identified placing the patients and healthcare providers at risk of blood born associated adverse events. However, unsafe intravenous (IV) injection practices had spread all over the world; signifying the nurses' responsibilities in safe and effective Intravenous (IV) therapy administration; in order to prevent its serious errors hazards and complications. **Aim of the study:** Assess nurses' knowledge and practices related to safety measures during administration of intravenous therapy. **Setting:** This study was carried out in Damanhour Hospital in medical units. **Subject:** All staff nurses involved in direct patient care and responsible for giving IV therapy and work in medical units (65) nurses. **Tools:** Tool 1: Nurses' knowledge related to safety measures during administration of intravenous therapy; through a structured interview schedule. Tool 2: Nurses' practices observational checklist related to safety measures during administration of IV therapy. **Result:** All nurses were female, majority of them in age group of > 35 years. Where, 70.8% and 67.7% of the nurses; respectively had poor total practices and knowledge scores related to their safety nursing measures during IV therapy administration. Additionally, a positive statistical correlation was found between total nurses' knowledge scores and total nurses practice scores. **Conclusion:** The present study nurses' practices as well as their knowledge levels as regards to safety measures during the administration of IV therapy were poor. On the other hand, a positive statistically correlation was observed between total nurses' knowledge and practice scores reflecting that their performance is mainly based on their acquired knowledge. **Recommendation:** Nurses should be encouraged to attend regular scientific meetings, conferences and training programs to keep pace with the rapidly growing knowledge and practical in nursing science.

Key words: Intravenous therapy, IV Therapy Administration, Nurses' Knowledge and practice, Safety measures.

Introduction

Safe care is a rudimentary need of all patients regardless of the setting. Safety has a positive association with health promotion and illness prevention. Safe practices diminish the risk of accidents, subsequent modifications in health, lifestyle, and the charge of health care services. ⁽¹⁻³⁾ Where; safe, competent and ethical medication administration involves elementary nursing knowledge, skill and judgment. It comprises also knowledge of medication safety, human factors that may influence medication safety systems and best practices to diminish medication errors. Injection safety includes practices intended to avoid transmission of infectious diseases from one patient to another, or from a patient to health care providers. Intravenous injection (IV) safety practices are a set of actions taken to achieve injections in an optimally safe manner for patients, healthcare personnel, and others. ⁽⁴⁻⁶⁾

Unsafe injection procedures have been stated universal causing the transmission of a wide variety of blood born pathogens involving: viruses, bacteria, fungi and parasites. ⁽⁷⁾ Patients can also predispose to non-infectious adverse events

such as abscess and poisonous reactions; while the reuse of syringes or needles, in low financial countries, can expose patients to pathogens either directly via dirty equipment or indirectly via contaminated medication vials.^(8,9) Egypt chief concern is preserving safe injections; where the estimated average number of injections for each person/year is 4.2 versus 1.5 in other countries.⁽⁷⁾ Nevertheless, insecure injections practices have been meaningfully recognized as a contributing crucial risk factors in the transmission of HBV and HCV; where of nearly 280 million administered injections, an estimated 8% (23 million) were risky.⁽¹⁰⁻¹²⁾

Intravenous therapy is broadly used so long as fast and precise therapeutic management; medication errors frequency is improved universally. Researches acknowledged that just about one-third of medical complications are owed to nursing medication errors. Nevertheless, worldwide IV medication preparation and administration errors were estimated to be 9.4% to 97.7%.⁽¹³⁾ Probable complications can be very serious; they may be local and systemic. Local complications include phlebitis, infiltration, extravasation, thrombophlebitis, infection and hematoma. Systemic complications are septicemia, fluid overload, shock, air embolism and catheter embolism. As these complications are potentially life threatening; hence, the IV therapy safety practices are well thought-out a skilled nursing health related mission which entails both theoretical and practical competences.^(14, 15)

Consistent with the important nursing role in the health care delivery system, and as nurses have close interaction with patients; they should well-informed and skillful in relation to initiation, preparation and administration of IV therapy. Correspondingly, in medications' patient monitoring, over and above evaluating, documenting the response in relation to medication administration and improving patient care.^(16, 17)

Nonetheless, nurses have close connection with the patient. They are exclusively placed to integrate preventive and promote strategies in day to day care they provide. Therefore, they should have knowledge, good attitude and skills regarding safe IV therapy medication administration.

Aim of the study:

The present study aimed to assess nurses' knowledge and practices related to safety measures throughout administration of intravenous therapy.

Research question

What are nurses' knowledge and practices related to safety measures throughout administration of intravenous therapy?

Operational definition:

Safety measures throughout IV administration: Are the performed nurses' practices related to safety measures throughout intravenous therapy administration.⁽⁴⁾

Materials and Methods:

Research design: A descriptive research design was operated.

Setting: The study was conducted in all medical and surgical units in Damanhour University Hospital, El-Beheira. The hospital contains two medical departments and two surgical departments, each department is alienated into eight rooms and each room contains almost from 3 to 6 Patients.

Subject: All staff nurses work in medical units (65) nurses who were involved in direct patient care and responsible for giving IV therapy.

Tools: Two tools were developed and used for the purpose of data collection.

Tool 1: Nurses' knowledge related to safety measures throughout administration of intravenous therapy; structured Questionnaire.

the structured questionnaire was developed by the researchers after reviewing the current national and international related literatures^(1- 3, 16- 18). It aimed to assess nurses' knowledge as regard to safety measures during intravenous therapy administration. It comprised the following four parts:

Part 1: This part included (2) items which was constructed to assess nurses 'knowledge in relation to definitions of intravenous injection and safe IV therapy administration.

Part 2: It included (20) items intended to assess nurses 'knowledge in relation to IV therapy advantages and disadvantages, calculation of infusion rate, safe IV injection practice, associated IV infection and risks and how to prevent IV risks.

Part IV: This part included (3) items to assess nurses 'knowledge in relation to medication rights, local and systemic complications of infusion therapy.

In addition to the Nurses' socio demographic data that comprised: gender, age, qualification, years of experience, previous attendance of training programs related to medication administration and patient safety .

Scoring System: Nurses knowledge regarding safety measures throughout administration of intravenous therapy was schemed under three main categories:

- Correct and complete answer = 2
- Correct and incomplete answer = 1

- Wrong answer or don't know = 0

Where, a total score of 75% and above of nurses' knowledge was considered good nurses' knowledge, scores of 50% to less than 75% was considered satisfactory nurses' knowledge. While less than 50% score was considered poor nurses' knowledge.

Tool 2: Nurses' practices observational checklist related to safety measures during administration of IV therapy.

This tool was developed by the researchers after reviewing the current national and international related literatures^(1-3, 16-18), in order to observe the nurses' practices regarding safety measures during intravenous therapy administration. It comprised three parts as follows:

Part 1: It was comprised of items related to IV therapy preparations as:

Nurses' preparations which included (4) items, equipment and IV medication's preparations, involved (5) items, patient preparations embraced (5) items, and environment preparations included (6) items.

Part 2: It was embraced (4) items related to drug administration as medication administration rights, handling, observing and discarding medication safety during IV drug administration.

Part 3: It was comprised of items related to recording and reporting of IV medication administration.

Scoring system: Each nursing practices included sub practices which were translated into items. Nurses' practices tasks responses were scored on 3 points Likert scale as the following:

- Done correctly = 2
- Done incorrectly = 1
- Not done = 0

A total score of 75% and above for nurse' practices was considered good nursing practices and scores of 50% and less than 75% was considered satisfactory nursing practices. While less than 50% score was considered poor nursing practices.

Methods

1. **Official approval** was obtained from Research Ethics Committee hospital administrators and heads of the departments to demeanor the study after explanation of its purpose.
2. **The two study tools** were developed by the researchers after reviewing the related literatures. The tools were revised by a jury of five experts in the medical-surgical nursing field, to test its content validity. Hence, all compulsory modifications were done.
3. **The tools** were tested for their **reliability** using Cronbach- alpha coefficient statistical test. Results z that, the reliability of the tool I was 0.776 and for tool II it was 0.856.
4. **Pilot study** was performed on 10% (seven) nurses to test the tools' clarity, feasibility and applicability. Those nurses were excluded from the study.
5. **Data collection process**

Data collection was accomplished through assessing the nurses` safety practices required for patients receiving IV directly, through infusion, and also during cannulation. It included the following steps:

- All nurses were requested to fulfill knowledge assessment questionnaire regarding safety measures during intravenous therapy administration (tool I), through individualized face-to-face meetings at the previously declared setting during morning shifts. Each structured questionnaire took from 20-30 minutes for each nurse. Statements explanation or instructions were provided to all nurses throughout the process of filling up the questionnaire; if needed.
- Nurses' practices assessments were observed individually of each nurse via direct concealed observation during IV therapy procedures.
- Observation of nurses' practices was performed first then followed by their knowledge assessment. Where, they were directly observed at 3 sequential times during the morning and afternoon shifts; for one hour each during each shift; to assess their safety practices throughout IV therapy administration using (tool 2). The average mean of the three observations was calculated and obtained.
- Written witness consent was gained from the head nurse and the administrative authorities in the identified setting to get their approval for conducting the study after explanation of its research wise purpose.

6. Ethical considerations

- Written informed consent of the nurse participants was obtained post explaining the aim of the study. The researchers introduced themselves to the nurses and explained the purpose of the study, then assured them that the study was for research purpose only.
- Nurses were treated anonymously. Nurses' privacy and data confidentially were assured.
- The right to withdraw from the study was confirmed with no penalties.

7. Statistical analysis:

Once data were gathered it was revised, coded, and fed to statistical software IBM SPSS version 20. The presented graphs were structured via Microsoft excel software. All statistical analysis was executed utilizing two tailed tests and alpha error of 0.05. P value was considered statistically significant if ≤ 0.05 . Frequencies and percent were operated to portray the qualitative data. Analysis of categorical data was achieved using Pearson's chi square test; Mont Carlo exact test and Fishers exact test.

Results

Table (1): Revealed that, all the studied nurses were female; nearly half of them (52.3 %) were working in the surgical wards whereas (47.7%) were in medical wards. Also, two thirds of the nurses (60%) were in the age group of <35 years, and the highest proportions (69.2 %) had diploma degrees. Finally, more than two third of the nurses (69.2 %) didn't attend training programs related to safety practices during IV therapy administration.

Table (1): Distribution of the studied nurses, along with socio-demographic characteristics

Socio-demographic data	No	%
Department		
▪ Medical	31	47.7
▪ Surgical	34	52.3
Age (years)		
▪ <35	39	60.0
▪ 35+	26	40.0
Gender		
▪ Female	65	100.0
Qualifications		
▪ Diploma	45	69.2
▪ Technical	20	30.8
Years of experience		
▪ <10	19	29.2
▪ 10+	46	70.8
Training in relation to IV therapy administration		
▪ Yes	20	30.8
▪ No	45	69.2

Table (2): Declared that, the more than two thirds of the nurses (67.7%) had poor total knowledge score, while (20.0%) had satisfactory total knowledge score, and only (12.3%) had a good total knowledge score related to safety nursing measures during IV therapy administration.

Table (2): Distribution of total nurses' knowledge score related to safety nursing measures throughout IV therapy administration

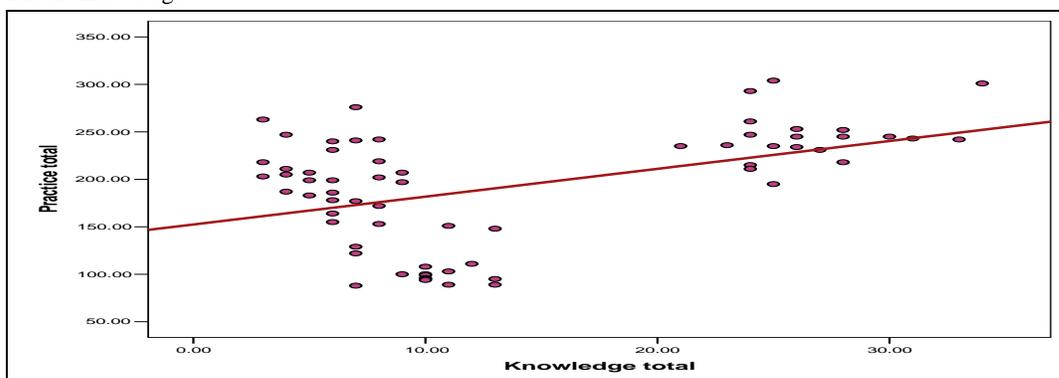
Nurses' total knowledge score	No	%
Poor	44	67.7
Satisfactory	13	20.0
Good	8	12.3
Mean \pm SD	13.7 \pm 9.4	

Table (3): Illustrates that, the majority of the nurses (70.8%) had poor total practices score, while slightly less than a quarter of them (21.5%) had satisfactory total practices score, and only (7.7%) had a good total practices score related to safety measures during IV therapy administration.

Table (3): Distribution of total nurses' practice score related to safety nursing measures throughout IV therapy administration

Nurses' total practices Score	No	%
Poor	44	70.8
Satisfactory	13	21.5
Good	8	7.7
Mean ± SD	64.25 ± 20.35	

Figure 1: Emphasized that, there was a positive statistical correlation between total nurses' knowledge scores and their total practice's scores; where $p = 0.001^*$. This indicates that, the nurses' practices were increased with the increasing nurses' knowledge.



$r = 0.45$

$P = 0.001^*$

Figure 1: Correlation between total nurses' knowledge and practices scores

Discussion

Medication safety is a global therapeutic concern that is linked with excellence and safe patient care. Nevertheless, medication administration procedure is error-labile for the reasons of the environmental and workload problems facing the nurses at workplace. ^(18, 19) **Tariq et al. (2023)** ⁽²⁰⁾ pointed out that, more than half of life-threatening medical errors were associated with IV medications. Therefore, it is extremely important for nurses to be knowledgeable about medication action, uses, side effect, possible complications and safety precautions. These knowledges are absolutely essential for a professional and skillful monitoring of the therapy. For that, this study was carried out to assess nurses' knowledge and practices related to safety measures during IV therapy administration.

Though, in the current study, all of the studied nurses were **female**; which may be ascribed to the greater portion of nurses in Egypt, who are females, also this may be related to legislations of studying nursing science in Egyptian Universities and schools which were solely only for females till eight years ago where male are introduced. This finding is in agreement with that of **Al-Faouri et al. (2021)** ⁽²¹⁾; **Ahmed et al. (2021)** ⁽²²⁾, and **Amin et al. (2021)** ⁽²³⁾, who revealed the dominance of females among most of their studied samples. Additionally, the majority of the studied nurses **didn't attend training programs** related to safety measures during IV therapy administration. Nevertheless, this finding is consistent with **Aderaw studies in Alghalban (2020)** ⁽²⁴⁾ who found that more than two third of their diploma nurses didn't receive training on IV injection safety.

The findings also revealed that, nurses' **knowledge was poor**; where the studied nurses were lacking knowledge related to different aspects of safety nursing measures during IV therapy administration. This low knowledge level may be related to lacking basic knowledge, inaccessibility of pre-service and in-service training programs, absent of continuous supervision and evaluation. On the same line with this finding, **Faris and Abed (2022)** ⁽²⁵⁾ reported in their

pre-test prior their educational program implementation that; all nurses had an unsatisfactory knowledge level concerning parenteral (IV) medication administration. However, contradicting findings were revealed by **Ibrahim, et al. (2013)** ⁽²⁶⁾ who declared in their study that, nurses at Mansoura University experienced high knowledge about IV injection safety.

Moreover, the majority of the studied nurses had **poor practices** related to safety measures during intravenous therapy administration. This incompetent level of practices may be associated with the elevated patients' number compared with nurses' ration, and workload which has a negative effect on nurse's performance and their quality of care. Additionally, may be refrained to; some nurses worked by replication, imitation and experience without the base of safety knowledge. Therefore, this research highlights the importance of unifying multidisciplinary efforts to correct the unsatisfactory nurses' performance. On the same line, **Anwar et al., (2019)** ⁽²⁷⁾ study conducted among nursing staff in an Egyptian and a Saudi hospital found that; the majority of nurses' practices were unsatisfactory when they administer medications via IV access devices. On the contrary, **Mhana et al., (2022)** ⁽²⁸⁾ in Egypt reported that, about two thirds of nurses had satisfactory practices when refrained to safe IV administration.

Regarding **correlation between nurses' knowledge and practices scores**, a statistically significant positive correlation between nurses' knowledge and practice was noticed; which reflects that nurses' performance is mainly based on their knowledge. In agreement with the current study finding **Mhana et al., (2022)** ⁽²⁸⁾ and **Elrefaey, et al. (2021)** ⁽²⁹⁾ noticed that; nurses' practices are precisely affected by their base of knowledge which is crucial to reach competent nursing practices in diverse clinical settings. Moreover, **Enterprise in association with CIRA (2023)** ⁽³⁰⁾ declared that, not merely knowledge is the foundation stone in nursing practice; but also deficient of educating combined with their shortage, being the accountable staff supplying a major part of healthcare.

Conclusion:

It can be concluded that; poor knowledge level of the majority of nurses participated in this study concerning safety measures during the administration of IV therapy are key alarm pointing out the subsequent hazardous practices. As well, the poor practices level in nearly two thirds of nurses which is considered unacceptable infection control practices. Additionally, when comparing knowledge level to their practices level; evidently both can predispose to serious medication errors.

Recommendations:

Based on the results, the following recommendations are suggested:

1. Training programs for recently employed nurses besides in-service training program for expert nurses should be developed to update their knowledge about safety measures throughout IV therapy administration.
2. Nurses should continually be encouraged to join scientific discussions and conferences to remain pace with the rapidly mounting wealth of knowledge and practicals necessary for proper nursing service.
3. The current study replication with a larger probability sampling is required to validate the results.

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Conflicts of interest

There is no conflict of interest to disclose

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