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Ammar Ahmed Hatem
*Academic Nurse, Ministry of Health/ Al-Diwaniya Health Directorate, Iraq*,
ammar.ahmed2202m@conursing.uobaghdad.edu.iq

Tahseen Rajab Muhammad
*Assist.Prof, Adult Nursing/ College of Nursing University of Baghdad, Iraq*, tahseenrm@yahoo.com



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ORIGINAL STUDY

# Impact of an Educational Program on Nurses' Knowledge of Poisoning Management: A Quasi-Experimental Study

**Ammar Ahmed Hatem** [a,*], **Tahseen Rajab Muhammad** [b]

[a] Academic Nurse, Ministry of Health/Al-Diwaniya Health Directorate, Iraq
[b] Assist. Prof, Adult Nursing/College of Nursing University of Baghdad, Iraq

## ABSTRACT

**Background**: Despite the critical role nurses play in managing poisoning cases, gaps in their knowledge can hinder patient outcomes. An educational program may address this deficit, but its effectiveness on nurses' knowledge in poisoning management remains to be systematically evaluated.

**Objectives**: This study aimed to examine the effect of an educational program on nurses' knowledge of poisoning management.

**Methods:** A quasi-experimental study with a pre- and post-test design was conducted on 80 nurses working in an emergency department (ED) in Al-Qādisiyyah Governorate, Iraq. The 80 nurses were randomly allocated into two groups of 40 to either receive the educational intervention or serve as a control group. Nurses in the intervention group received three sessions of educational lectures over three consecutive days while the control group received no training. A 20-item questionnaire was used to assess nurses' knowledge of poisoning management at baseline and two months after the end of the intervention. Descriptive statistics, chi-square, Fisher's exact test, t-test, paired t-test, and analysis of variance were used to analyze the data.

**Results:** At baseline, the intervention and control groups did not significantly differ in their mean knowledge scores ($1.36 \pm 0.13$ vs. $1.40 \pm 0.12$, $P = 0.172$). The intervention group's knowledge score increased to $1.91 \pm 0.05$ after the intervention ($P < 0.001$), while the control group's score did not change significantly ($P = 0.08$).

**Conclusion:** The educational program could significantly increase nurses' knowledge of poisoning management. Therefore, it is recommended that similar educational programs be held on a regular basis to improve emergency nurses' knowledge and update them on how to handle poisoning cases.

**Keywords:** Education, Nurses, Knowledge, Poisoning, Care

## 1. Introduction

In recent years, acute poisoning has become a more common problem worldwide, accounting for a significant portion of morbidity and mortality [1]. Emergency departments (ED) frequently encounter patients presenting to the hospital at any given time, regardless of the type or severity of poisoning. Based on data from the Poison Control Center data, it was projected in 2017 that 2.115.186 million Americans had poisoning incidents. In all age groups, unintentional exposure accounted for 77% of poisoning cases, while intentional exposure accounted for 18.9% and adverse reactions accounted for roughly 2.4% [2]. Some studies in Iraq have documented poisoning cases. For example, in early 1972, 650 Iraqi deaths were reported from inadvertently consuming poisoned grain treated with the fungicide methylmercury, which was consumed as food by rural residents [3]. Over the course of two years, more than 100

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* Corresponding author.
E-mail addresses: ammar.ahmed2202m@conursing.uobaghdad.edu.iq (A. A. Hatem), tahseenrm@yahoo.com (T. R. Muhammad).

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cases of kerosene poisoning among Iraqi youngsters were reported [4]. Two families also reported cases of thallium poisoning from tainted cakes in 2008, but it was unclear whether appropriate care was available [5].

The management of poisoning incidents is a critical component of emergency nursing, requiring a high level of knowledge and practice to ensure patient safety and effective treatment outcomes [6]. Some studies have assessed the nurses' knowledge and practice regarding the management of acute poisoning and almost all reported nurses' low knowledge and practice in this critical area. A study of 422 nurses in Northwest Ethiopia reported that 58.8% and 62.2% of them, respectively, had satisfactory knowledge and practice in the initial management of acute poisoning, while the rest had poor knowledge and practice in this area [7]. However, in a study in another region of Ethiopia, all nurses studied had poor knowledge and self-reported practice on initial management of poisoning [8]. A study of 30 Iraqi nurses also found that 73.3% of them had suboptimal practices toward children with chemical poisoning [9]. A study also examined 30 Egyptian nurses and found that all of them had insufficient knowledge and practice regarding the detection and management of acute drug poisoning [10]. To address this gap, some studies have developed and implemented educational programs to enhance nurses' knowledge and practice in poisoning management. However, the existing studies provide a conflicting body of evidence on the effectiveness and outcomes of these educational programs. Some studies suggest that educational programs can significantly improve nurses' knowledge, confidence, and practice in handling poisoning cases [9, 11, 12]. However, a study indicated only a marginal improvement in knowledge with an evident decline a few weeks after the intervention [13]. Furthermore, the aforementioned studies suffer from methodological issues such as a small sample size [12], lack of a control group [9, 11], and the use of non-randomized samples [9, 11, 12]. Therefore, the extent to which educational interventions can influence nurses' knowledge and skills in managing poisoning cases remains unclear. Thus, the question still remains: can an educational program improve nurses' knowledge of the management of poisoning cases?

### 1.1. Objectives

This study aimed to examine the effect of an educational program on nurses' knowledge of poisoning management.

## 2. Methods

### 2.1. The study design and participants

A quasi-experimental study with a pre- and post-test design was conducted on 80 nurses working in the ED of Al-Diwaniya Teaching Hospital, Al-Qādisiyyah Governorate, Iraq. The study was conducted from December 28, 2023, to February 29, 2024.

The sample size of eighty was calculated using the formula for comparing two means with a type 1 error of 0.05 and a power of 80%. Then using the sealed envelope technique, the 80 eligible nurses were randomly assigned into two groups of 40 to receive the educational intervention or to serve as a control group that did not take part in the educational program.

Inclusion criteria included working as an emergency nurse for at least six months and being willing to participate in the study. Nurses were excluded from the study if they decided to withdraw from the study or if they answered the study questionnaires incompletely.

### 2.2. Data collection instruments

A two-part, self-administered questionnaire was developed by the researcher to assess nurses' knowledge of poisoning and its management. The first part included questions regarding the nurses' sociodemographic characteristics, including age, gender, educational attainment, years of experience, years spent in the ED, and previous involvement in poisoning-related educational programs. The second part was the nurses' poisoning knowledge questionnaire (NPKQ). We developed the NPKQ through an extensive review of the relevant literature. The questionnaire includes 20 multiple-choice questions to assess the nurses' knowledge of the types, causes, signs and symptoms, and the management of patients who were intentionally or unintentionally exposed to toxic substances. All questions are scored as 1 or 2 for incorrect and correct answers, respectively. The total score can range between 20 and 40, with higher scores demonstrating a higher knowledge. The total score is divided by the number of questions to be standardized. Scores greater than 75%, 74–60%, and $<$ 60% of the total score is considered good, moderate, and poor knowledge, respectively. The content validity of the NPKQ was assessed by a panel of 13 experts, including 4 nursing faculty members, a physician, and eight nurses with more than ten years of professional experience in the ED. To assess the reliability of the NPKQ, we conducted a test-retest with a one-week

interval on eight nurses not included in the main study. The reliability correlation coefficient was 0.87.

### 2.3. Intervention

Nurses in the intervention group received three sessions of educational lectures held in the hospital conference room over three consecutive days. Each session lasted approximately 1 hour and consisted of PowerPoint-enhanced lectures, questions and answers, and group discussions on the types, causes, signs and symptoms, and the management of patients who were intentionally or unintentionally exposed to toxic substances. All lectures were presented by a nursing faculty member who was an expert in the field of toxicology and poisoning.

The content of the educational program was also assessed and approved by the aforementioned expert panel. All participants completed the pretest at baseline and the posttest two months after the intervention. The control group received no training but was assessed at similar times as the intervention group.

### 2.4. Ethical considerations

This study received approval from the Research Council and the Research Ethics Committee of the College of Nursing of Baghdad University. The researcher also received official permission to conduct the study from the Ministry of Planning (Central Statistical Organization), the Ministry of Health in Iraq (Department of Planning, Health Research Section), and the officials of Al-Diwaniya Teaching Hospital. The study participants were briefed on the study aims and signed a written consent form before participating in the study. All participants were also assured of the data confidentiality, their anonymity, and that they could withdraw from the study whenever they wanted.

### 2.5. Data analysis

Statistical analysis was performed using the Statistical Package for Social Sciences (SPSS) version 21. The chi-square, the Fisher's exact test and the t-test were used to compare the two study groups in terms of their sociodemographic characteristics. The normality of the quantitative data was checked using the Kolmogorov-Smirnov statistic, and the data demonstrated a normal distribution. Then, the t-test and analysis of variance were used to compare the mean knowledge scores between the two groups and also between the subgroups of the participants in the intervention group. Furthermore, the paired t-test was used to compare the mean knowledge scores within each group.

### 2.6. Results

The study groups did not differ significantly in their mean age ($P = 0.45$), gender ($P = 0.24$), education level ($P = 0.57$), years of experience in nursing ($P = 0.73$), years of experience in the ED ($P = 0.53$), participation in previous training courses on poisoning management ($P=0.56$), and self-study on poisoning ($P = 0.99$) [Table 1].

At baseline, the two groups did not differ significantly in their mean knowledge scores ($P = 0.172$). However, the mean knowledge score of the intervention group increased significantly after the intervention ($P < 0.001$) while this score did not change significantly in the control group ($P = 0.08$) [Table 2].

We also examined the association between the personal characteristics of the intervention group and their mean knowledge scores. As presented in Table 3, the participants' mean knowledge scores did not significantly affect by age, gender, and years of experience in the ED, either at baseline or after the intervention. Nevertheless, despite a significant difference in mean knowledge scores between nurses with different educational levels at baseline ($P = 0.014$), no significant difference was found between the mean knowledge scores of nurses with different educational levels at the end of the study ($P = 0.19$).

### 2.7. Discussion

This study evaluated the impact of an educational program on ED nurses' knowledge of poisoning management. Initial findings indicated that overall, nurses had a moderate level of baseline knowledge, indicating a basic foundation but revealing significant gaps, particularly for the complexity of atypical poisoning cases. A previous study at Cairo University Hospitals also reported that nurses had inadequate knowledge and skills regarding detection and management of acute drug poisoning [14]. A study in Dessie referral hospital in Ethiopia also reported that nurses had unsatisfactory knowledge about the initial management of acute poisoning [15]. Similar results have been reported in studies of Iraqi [9] and Egyptian nurses [10]. However, a study of medical students in Riyadh, Saudi Arabia, concluded that the majority of participants had sufficient knowledge on the initial management of acute poisoning [16]. The difference in the latter study can be attributed to the differences in the target population and the instrument used.

**Table 1.** Demographic characteristics of the nurses in the intervention and control groups.

| Characteristics | Group[a] | | P-value |
|---|---|---|---|
| | Intervention (n = 40) | Control (n = 40) | |
| Age, years, Mean ± SD | 29.35 ± 3.853 | 30.58 ± 6.733 | 0.455[b] |
| Gender | | | |
| Male | 22 (55) | 28 (70) | 0.248 |
| Female | 18 (45) | 12 (30) | |
| Education level | | | |
| Secondary school, nursing | 8 (20) | 8 (20) | 0.570 |
| Nursing institute | 17 (42.5) | 22 (55) | |
| Nursing bachelor's | 14 (35) | 8 (20) | |
| Postgraduate | 1 (2.5) | 2 (5) | |
| Years of experience in nursing profession | | | |
| 1–5 years | 12 (30) | 16 (40) | 0.732 |
| 6–10 years | 25 (62.5) | 18 (45) | |
| 11–15 years | 3 (7.5) | 6 (15) | |
| Years of experience in the emergency department | | | |
| 1–3 years | 20 (50) | 22 (55) | 0.531 |
| 4–6 years | 19 (47.5) | 13 (32.5) | |
| 7–9 years | 1 (2.5) | 3 (7.5) | |
| ≥ 10 years | 0 | 2 (5) | |
| Training courses on poisoning | | | |
| Yes | 6 (15) | 9 (22.5) | 0.568 |
| No | 34 (85) | 31 (77.5) | |
| Self-study on poisoning | | | |
| Yes | 40 (100) | 40 (100) | 0.99 |
| No | 0 | 0 | |

[a] Data presented as n (%) or Mean ± SD, [b] t-test, [c] Fisher's Exact test

**Table 2.** Comparisons of the mean knowledge scores between the intervention and control groups.

| Time | Group | | P-value[b] |
|---|---|---|---|
| | Intervention, Mean ± SD | Control, Mean ± SD | |
| Before the intervention | 1.36 ± 0.13 | 1.40 ± 0.12 | 0.172 |
| After the intervention | 1.91 ± 0.05 | 1.42±0.12 | < 0.001 |
| Pretest - Posttest | −0.542 ± 0.12 | −0.075 ± 0.26 | |
| P-value[c] | < 0.001 | 0.083 | |

[a] Data presented as n (%) or Mean ± SD, [b] t-test, [c] Paired t-test

The majority of our ED nurses were relatively young, with less than 10 years of nursing experience and less than 3 years of experience in the ED, and most lacked a bachelor's degree. Similarly, another study in Egypt reported that most of the ED nurses studied were under the age of 25, had diploma of nursing, and had less than six years of experience [11]. Some studies of nurses in Iraq [17–20] and Ethiopia [7] also reported demographics similar to our nurses. This demographic tends to have less exposure to specialized training in poisoning, which is often included in higher-level nursing education. Additionally, their limited experience might not provide the depth of knowledge required for the diverse poisoning cases encountered in the ED.

A key discovery was that the majority of the nurses had no formal training in poisoning management. Similarly, a study in Ethiopia found that the majority of nurses working in outpatient, medical, emergency, and intensive care units had no formal training on in poisoning management [7]. Due to the lack of formal training in poisoning management, our nurses relied mostly on self-directed learning in this critical issue. While this reliance on self-directed learning shows initiative, it may not be comprehensive or up to date with best practices. Therefore, it is crucial to incorporate integrate formal and systematic poisoning care training into nurses' professional development to enhance their skill set and preparedness in emergency situations, which can significantly influence patient outcomes.

The data from our study suggest that the educational intervention comprising three lecture sessions was effective in enhancing ED nurses' knowledge of poisoning management. The post-test scores being significantly higher not only than baseline but also

**Table 3.** Association between the intervention group nurses' knowledge with their age group, gender, education level, and years of experience in the emergency department.

| Age (Years) | Pretest Mean ± SD | Posttest Mean ± SD |
|---|---|---|
| < 25 | 1.40 ± 0.163 | 1.92 ± 0.045 |
| 26–30 | 1.40 ± 0.105 | 1.89 ± 0.057 |
| 31–35 | 1.31 ± 0.111 | 1.90 ± 0.054 |
| *P-value* | 0.106[b] | 0.267[b] |
| Gender | | |
| Male | 1.40 ± 0.155 | 1.90 ± 0.048 |
| Female | 1.32 ± 0.081 | 1.91 ± 0.060 |
| *P-value* | 0.061[c] | 0.723[c] |
| Education level | | |
| Secondary school, nursing | 1.28 ± 0.084 | 1.93 ± 0.053 |
| Nursing institute | 1.40 ± 0.132 | 1.91 ± 0.049 |
| Nursing bachelor's | 1.34 ± 0.118 | 1.88 ± 0.055 |
| Postgraduate | 1.65 ± 0.000 | 1.95 ± 0.000 |
| *P-value* | 0.014[b] | 0.191[b] |
| Years of experience in the emergency department | | |
| 1–3 years | 1.36 ± 0.139 | 1.91 ± 0.061 |
| 4–6 years | 1.37 ± 0.130 | 1.90 ± 0.046 |
| 7–9 years | 1.30 ± 0.000 | 1.90 ± 0.000 |
| *P-value* | 0.894[b] | 0.957[b] |

[a] Data presented as Mean ± SD, [b] analysis of variance, [c] t-test

compared with the control group, indicate that the educational program had a positive impact on the nurses' knowledge. These findings demonstrate that the lectures provided valuable information that the nurses were able to learn from and retain over the two-month period. The two-month span between the pre-test and post-test suggests that nurses not only absorbed the information, but also retained it for an extended period of time, which is essential for practical application in clinical settings. The comparison with a control group also adds validity to the study by demonstrating that the knowledge gained were likely due to the educational program rather than other external factors.

In light of these interpretations, the study strongly supports the notion that targeted educational programs can enhance nurses' competency. Hospitals and healthcare institutions may consider such data as justification for implementing regular, structured training programs to ensure that nurses remain informed about the latest practices in poisoning management, ultimately aiming to improve patient care outcomes. Previous studies of the effects of educational interventions on nurses' knowledge of poisoning management demonstrates variability in impact. A number of studies reported that educational programs improved nurses' knowledge and confidence in handling poisoning cases [9, 11, 12]. Another study in Egypt also found that designing job descriptions and training sessions for toxicology nurses could effectively raise nurses' levels of expertise in their job description and poisoning management [21]. Some others however, found only a limited improvement in knowledge that declined shortly after the intervention [13]. Our findings align with the broader literature that supports the notion that structured educational programs can lead to significant knowledge gains among healthcare professionals. Better-informed nurses are more likely to feel confident in their decisions and actions when managing poisoning cases, potentially leading to improved patient care outcomes. Our findings underscore the need for structured educational programs in poisoning management and advocate for ongoing educational programs in emergency settings to ensure the preparedness of nurses, particularly for complex intoxication scenarios. The fact that nurses' personal characteristics did not influence the effect of the intervention advocates that well-designed educational programs in poisoning management can improve the ED nurses' knowledge of poisoning management and will eventually improve their practice in managing such patients.

Using a randomized sample, having an adequate sample size, having a control group, and measuring the outcome two months after the intervention are among the strengths of the present study. However, due to the nature of the intervention, it was difficult to blind the study. It was also difficult to prevent information leakage between the two study groups, although the significant difference between the mean posttest scores shows that this issue did not significantly affect the outcome.

## 3. Conclusion

The educational program implemented in the current study could significantly improve nurses' knowledge of poisoning management. Therefore, it is recommended that similar educational programs be implemented on a regular basis to improve ED nurses' knowledge and keep them up-to-date in the management of poisoning cases. Our findings also have implications for authorities in clinical settings. First, most of the ED nurses were relatively young with moderate knowledge of poisoning management. In addition, none of the nurses had received formal training in poisoning management. These findings should serve as a warning to authorities to not only consider professional experience and educational level when assigning nurses to EDs, but also to design appropriate, regular educational programs to train ED nurses on critical issues such as poisoning. Additional research can also examine the long-term retention of knowledge and the direct impact on pa-

tient outcomes. Comparison of different educational methods can also reveal more effective strategies for knowledge transfer and retention.

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## Authors' contributions

All authors equally and substantially contributed to the work design, acquisition, analysis, and interpretation of the data, and drafting and revising the manuscript. All authors read and approved the final manuscript and take responsibility for the integrity of the data and the accuracy of the data analysis.

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## Role of the funding source

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## Availability of data and materials

The data used in this study will be available at reasonable request.

## Ethics approval and consent to participate

Scientific Research Ethical Committee, University of Baghdad/Nursing Faculty granted approval. Each participant in this study provided informed consent prior to enrolment.

## Consent for publication

By submitting this document, the authors declare their consent for the final accepted version of the manuscript to be considered for publication.

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