Effect of a forensic nursing virtual education course on knowledge and clinical decision-making of master's nursing students in Iran: a non-equivalent control group pre- and post-test study

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Editor: Sun Huh, Hallym University, Korea
Purpose: Forensic nursing is a specialty in the nursing profession based on legal procedures. This study aimed to assess the effect of a forensic nursing virtual education course on knowledge and clinical decision-making among master’s nursing students.

Methods: In a quasi-experimental study with a pre- and post-test, 106 master’s nursing students at Guilan (n=65) and Mazandaran (n=41) Universities of Medical Sciences, Iran were enrolled. Data were collected using census sampling from March to April 2021. Participants in the intervention group received a forensic nursing virtual education course in three 90-minute sessions for 2 days.

Results: A total of 88 out of 106 master’s nursing students were enrolled in this study. The mean post-education score for knowledge in the intervention group was significantly higher than in the control group (12.52 vs. 7.67, P<0.001). The mean post-education score for clinical decision-making in the intervention group was significantly higher than in the control group (16.96 vs. 13.64, P<0.001).

Conclusion: The level of knowledge and clinical decision-making of master’s nursing students regarding forensic evidence improved after the forensic nursing virtual education course in the intervention group compared to the control group. Nursing managers and policymakers can develop appropriate strategies to improve the knowledge and clinical decision-making of nursing students by using forensic nursing education courses in the curricula of nursing programs, especially in postgraduate education as an elective or mandatory course.

Keywords: Clinical competence; Clinical decision-making; Forensic nursing; Iran; Nursing students
Introduction

Background

Forensic nursing is a specialty in the nursing profession based on legal procedures. In fact, forensic nursing is defined as a nursing specialty with subspecialties that focus on nursing practice related to clinical legal issues of living or deceased victims and offenders [1]. Nurses are the first people who are in contact with patients and their families and have a direct relationship with medical records [2]. Nurses should also be aware of possible injuries while performing work, such as collecting, storing, and preserving evidence, and preventing damage to forensic records [3]. Therefore, forensic nurses can help resolve disputed cases through membership in the forensic team [2]. There is little evidence in the field of forensic nursing in nursing courses [1,2]. Hence, strengthening forensic nursing education will have positive results such as improving the quality of patient care, increasing access to services, reducing the burden on the health care system, increasing nurses’ confidence, and increasing patient satisfaction [4]. Conversely, if nurses do not receive adequate forensic education, forensic records may be overlooked, lost, or damaged during the collection, identification, and storage process. Finally, a lack of forensic education can make forensic examinations difficult and may lead to incomplete tests and incorrect clinical decision-making (CDM) [1]. Meanwhile, it is very important that nursing students, especially master’s nursing students, have the desired knowledge and CDM regarding forensic evidence. In addition, educational interventions can play an important role in increasing CDM. Hence, a systematic review showed that educational interventions can be effective in improving nurses’ judgment and CDM [5].

Therefore, due to the lack of sufficient knowledge of nursing students regarding forensic evidence, it is necessary to design interventions to improve their knowledge. In addition, nurses will have a weak CDM if they do not have sufficient knowledge of the problem [6]. However, previous studies in this area are limited. A study in Turkey showed that forensic nursing courses increased students’ knowledge of forensic evidence [1]. Obviously, educating nursing students has always been a major challenge for nursing managers and
policymakers. Meanwhile, virtual education is a simple, easy, and economical strategy that can have positive effects on the development of nursing competencies, critical thinking, and CDM of nursing students [7].

The knowledge and CDM of master’s nursing students regarding forensic evidence are crucial to the provision of high quality, safe and holistic nursing care. Furthermore, increasing the knowledge of master’s nursing students in forensics can improve their ability to understand patients’ clinical problems and engage in proper and timely CDM to meet the needs of forensic patients.

Objectives

This study aimed to assess the effect of forensic nursing virtual education courses on the knowledge and CDM of master’s nursing students regarding forensic evidence. Specifically, it assessed the effect of forensic nursing virtual education courses on the knowledge on and CDM of master’s nursing students.

It was hypothesized that the implementation of forensic nursing virtual education courses via lectures, PowerPoint presentations, pictures, short educational videos, and simulated scenarios in an educational webinar would enhance the knowledge and CDM of master’s nursing students regarding forensic evidence.

Methods

Ethics statement

This research was approved by the ethics committee of Guilan University of Medical Sciences (IR.GUMS.REC.1399.233). The objectives of the present study were explained to the participants, and they provided informed consent. Participants were reassured that they could withdraw at any stage of this research.

Study design

This is a quasi-experimental study, with a non-equivalent control group pre- and post-test design. It is described according to the Transparent Reporting of Evaluations with Nonrandomized Designs statement (https://www.cdc.gov/trendstatement/).
Setting

Data were collected using census sampling from March to April 2021: students of Guilan University of Medical Sciences and Mazandaran University of Medical Sciences.

Participants

All 1st- and 3rd-semester nursing students studying at Guilan and Mazandaran Universities of Medical Sciences were included. Students who participated in only 1 phase of the present study were excluded. In total, 106 master's students of nursing at Guilan (n=65) and Mazandaran (n=41) Universities of Medical Sciences, Iran were enrolled.

Intervention

Participants in the intervention group received a forensic nursing virtual education course in three 90-minute sessions for 2 days. The educational content is shown in Supplement 1. The educational content was presented to the students by a faculty member using lectures, PowerPoint presentations, pictures, short educational videos, and simulated scenarios in an educational webinar. Participants completed the questionnaires before the intervention and 2 weeks after the intervention.

Data sources/measurement

Data were collected using a researcher-made 3-part questionnaire including individual and occupational characteristics, nursing students' knowledge of forensic nursing, and simulated scenarios related to CDM in forensic nursing.

Individual and occupational characteristics

Individual and occupational characteristics such as age, sex, marital status, nursing experience in the clinical setting, work experience, bedside nursing experience in the emergency department, work experience in the emergency department, job position, history of forensic patient care, written instructions for caring for forensic patients, and history of participation in workshops related to forensic nursing.
**Nursing students’ knowledge of forensic evidence**

This researcher-made tool contained 17 items, which were designed to assess nursing students’ knowledge of forensic evidence. Participants responded to the items on a 3-point Likert scale (incorrect [score of 0], do not know [score of 0], and correct [score of 1]). One point was given for each correct answer. The overall scores of this tool were classified as insufficient (0–5), moderate (6–11), and sufficient (12–17). A 10-member panel consisting of forensic faculty members of Guilan University of Medical Sciences approved the tool, with a content validity ratio between 0.80 and 1 and a content validity index of 1. The internal stability of the items of this tool was evaluated using the Kuder-Richardson coefficient among 20 master’s nursing students. The internal reliability of this tool was 0.95 (Supplement 2).

**Simulated scenarios related to CDM in forensic evidence**

This researcher-made tool contained 25 items, which were designed to assess cases related to trauma, elderly abuse, suicide, child abuse, and the collection and documentation of evidence. The items in each case were related to data collection methods, nursing diagnoses, selection of the best care, and evaluation of care performed. One point was given for each correct answer. The overall scores of this tool are classified at 3 levels: weak (0–50), moderate (50–75), and desirable (75–100). A 10-member panel consisting of forensic faculty members of Guilan University of Medical Sciences approved the tool in private and collective sessions, with a content validity ratio of 0.92 and a content validity index of 0.97. The internal stability of the items of this tool was evaluated using the split-half method among 20 master’s nursing students. The Spearman correlation coefficient between the 2 halves and the internal reliability of the instrument were 0.484 and 0.66, respectively (Supplement 3).

**Bias**

None.

**Outcomes**
The outcomes of this study were as follows: first, an evaluation of master’s nursing students’ knowledge of forensic evidence before and after the forensic nursing virtual education course; and second, an evaluation of master’s nursing students’ CDM regarding forensic evidence before and after the forensic nursing virtual education course.

Sample size

There was no estimation of the sample size because all 1st- and 3rd-semester nursing students studying at Guilan and Mazandaran Universities of Medical Sciences were included. In this study, a total of 88 out of 106 master’s nursing students completed both a pre- and post-intervention encounter, in which they completed forensic nursing virtual education course.

Assignment method

Students of the Guilan University of Medical Sciences were allocated to the intervention; while students of Mazandaran University of Medical Sciences were selected as the control group.

Blinding (masking)

There was no blinding for participants.

Unit of analysis

The unit of analysis was the group (experimental or control).

Statistical analysis

SPSS ver. 16.0 (SPSS Inc., Chicago, IL, USA) was used to analyze the data. Quantitative and qualitative variables were presented as the mean (±standard deviation [SD]) and number (percentage), respectively. The normal distribution of data was evaluated by the Kolmogorov-Smirnov and Shapiro-Wilk tests. The data had a normal distribution. The independent t-test, chi-square, and Fisher exact tests were used to assess
knowledge and CDM and their relationship with individual and occupational characteristics of the participants. The significance level was considered $P<0.05$.

**Results**

**Participants**

In total, 88 out of 106 master's nursing students were enrolled in the present study (Fig. 1, Dataset 1). Out of 88 students, 52 were in the intervention group; while 36 were in the control group. Of the participants, 77.27% were female, 56.82% were married, 85.23% had nursing experience in clinical settings, and 52.27% had a history of forensic patient care. The mean age and work experience of the participants were 29.84 years (SD=6.36) and 7.02 years (SD=5.17), respectively. The details of the individual and occupational characteristics of the participants are presented in Table 1.

**Main results**

*Master's nursing students' knowledge of forensic evidence*

As shown in Table 2, the mean score of master's nursing students' knowledge of forensic evidence in the intervention group was significantly higher post-education than pre-education (12.52 versus 7.00, $P<0.001$). The control group showed a slight increase in the mean score for knowledge (7.67 versus 7.08, $P=0.039$). The mean post-education score of knowledge of students in the intervention group was significantly higher than that of students in the control group (12.52 versus 7.67, $P<0.001$). Furthermore, master's nursing students' knowledge of forensic evidence improved after the forensic nursing virtual education course in the intervention group compared to the control group ($P<0.001$).

*CDM of master's nursing students regarding forensic evidence*

As shown in Table 2, the mean score of master's nursing students' CDM regarding forensic evidence in the intervention group was significantly higher post-education than pre-education (16.96 versus 13.50, $P<0.001$). The mean post-education score of CDM in the control group was slightly lower than the pre-
education score (14.94 versus 13.64, P=0.008). The mean post-education score of CDM of students in the intervention group was significantly higher than that of students in the control group (16.96 versus 13.64, P<0.001). Furthermore, master’s nursing students’ level of CDM regarding forensic evidence improved after the forensic nursing virtual education course in the intervention group compared to the control group (P<0.001).

**Discussion**

**Key results**

This study assessed the effect of a forensic nursing virtual education course on the knowledge and CDM of master’s nursing students regarding forensic evidence. Based on the findings of the present study, the level of knowledge and CDM of master’s nursing students regarding forensic evidence improved after the forensic nursing virtual education course in the intervention group compared to the control group. Therefore, the hypothesis of this study was accepted.

**Interpretation**

As presented in this study, the level of knowledge and CDM of master’s nursing students regarding forensic evidence improved after the forensic nursing virtual education course in the intervention group compared to the control group. The difference between the score before and after the intervention in the present study showed that forensic nursing education for nursing students can improve their level of knowledge and CDM. This finding emphasizes the importance of adding forensic nursing virtual education courses to the curricula of nursing programs, especially postgraduate education. Obviously, nurses are important members of forensic medicine as the first health professionals to deal with cases involving legal issues at hospitals [6]. Therefore, the knowledge, CDM, and practice of nursing students should be improved through the use of forensic nursing education. However, one of the main barriers to forensic evidence is nursing students’ insufficient knowledge [1]. An insufficient level of knowledge of nursing students about forensic nursing can cause many legal problems for patients and institutions and prevent
the provision of high-quality health services. Therefore, it is suggested that nursing managers provide forensic nursing services at the desired level in clinical settings by providing education to nurses in the field of forensic nursing.

Nursing managers and policymakers can develop appropriate strategies to improve the knowledge and CDM of nursing students by using forensic nursing education courses in the curricula of nursing programs, especially in postgraduate education as an elective or mandatory course. Furthermore, holding group discussions for nursing students and nurses about forensic cases can improve their knowledge and CDM.

Comparison with previous studies

Consistent with the findings of this study, the results of a study in Turkey showed that a forensic nursing course increased students’ knowledge of forensic evidence [1]. Furthermore, no inconsistent study was found. It is essential that nurses be able to identify disputed cases well and, within the framework of their responsibilities, have sufficient knowledge in that area [8]. Based on previous evidence, nurses have insufficient knowledge about forensic nursing and inadequate status for evaluating forensic records [1,9]. A study in Turkey found that 73% of health professionals had no education in forensic nursing [10]. They also showed that 17.5% of the participants had received education related to forensic nursing and that this education was insufficient in raising the level of knowledge of nurses related to forensic nursing.

Regarding knowledge about forensic nursing, a study in Iran showed that 45.13% of emergency nurses had an insufficient level of knowledge and 54.36% of them had moderate knowledge of forensic nursing evidence [11]. In other studies, the level of knowledge of nursing students and nurses in different countries was different [12,13]. Meanwhile, in South Africa, a country where nurses do not receive any formal nursing education, there was insufficient knowledge about forensic nursing evidence [14]. In contrast, a study in the United States showed that academic education had a direct relationship with nurses’ knowledge of forensic nursing evidence [15]. The difference in nursing students’ level of knowledge about forensic nursing evidence between the present study and other studies can be attributed to differences in the educational programs of forensic nursing in different countries [12,13].

Limitations
The main limitation of the present study was the non-randomized allocation of the participants.

**Generalizability**

The results of this study may be useful for other nurses and nursing students in Iran.

**Suggestions**

Emergency nurses are the first to encounter forensic nursing cases. Hence, it is recommended that future studies investigate well-designed interventions to assess and compare the effect of virtual and in-person forensic nursing education courses on the knowledge and CDM of emergency nurses regarding forensic evidence.

**Conclusion**

It is suggested that a course on forensic nursing be added to the curricula of nursing programs, especially postgraduate education as an elective or mandatory course. It is also recommended that forensic nursing education courses be used as a simple, effective, and low-cost intervention to improve nurses’ knowledge and CDM in clinical settings.

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Conceptualization: ZF, MSS, FJ, HJ, EKL, SK, MJG. Data curation: ZF, MSS, FJ. Methodology/formal analysis/validation: EKL. Project administration: MSS, FJ. Funding acquisition: not applicable. Writing–original draft: ZF, SK, MJG. Writing–review & editing: ZF, MSS, FJ, HJ, EKL, SK, MJG.

Conflicts of interest

No potential conflicts of interest relevant to this article were reported.

Funding

None.

Data availability

Data files are available from Harvard Dataverse: 

Dataset 1. Raw response data of participants to the measurement tools.

Acknowledgments

None.

Supplementary materials

Data files are available from Harvard Dataverse:

Supplement 1. Educational content.

Supplement 2. Measurement tool for the knowledge of nursing students regarding forensic evidence.

Supplement 3. Measurement tool for the simulated scenarios related to clinical decision-making in forensic evidence.

Supplement 4. Audio recording of the abstract.
References

1. Ozden D, Ozveren H, Yilmaz I. The impact of forensic nursing course on students’ knowledge level on forensic evidence. J Forensic Leg Med 2019;66:86-90. https://doi.org/10.1016/j.jflm.2019.06.012

2. Ozsaker E, Kaya A, Okgun Alcan A, Yavuz van Giersbergen M, Aktas EO. Forensic cases in the operating room: knowledge and practices of physicians and nurses. J Perianesthes Nurs 2020;35:38-43. https://doi.org/10.1016/j.jpan.2019.06.010

3. Stevenson C, Taylor J. Nurses’ perspectives of factors that influence therapeutic relationships in secure inpatient forensic hospitals. J Forensic Nurs 2020;16:169-178. https://doi.org/10.1097/JFN.0000000000000274

4. Henshall C, Davey Z, Jackson D. The implementation and evaluation of a resilience enhancement programme for nurses working in the forensic setting. Int J Ment Health Nurs 2020;29:508-520. https://doi.org/10.1111/inm.12689

5. Thompson C, Stapley S. Do educational interventions improve nurses’ clinical decision making and judgement?: a systematic review. Int J Nurs Stud 2011;48:881-893. https://doi.org/10.1016/j.ijnurstu.2010.12.005

6. Nibbelink CW, Brewer BB. Decision-making in nursing practice: an integrative literature review. J Clin Nurs 2018;27:917-928. https://doi.org/10.1111/jocn.14151

7. Padilha JM, Machado PP, Ribeiro A, Ramos J, Costa P. Clinical virtual simulation in nursing education: randomized controlled trial. J Med Internet Res 2019;21:e11529. https://doi.org/10.2196/11529

8. Ribeiro GP, Dixe MD. Knowledge of forensic nursing practices: efficacy of an intervention for nursing students. J Forensic Nurs 2020;16:154-160. https://doi.org/10.1097/JFN.0000000000000289

9. Erkan I, Yesilyurt A, Kayserili A. Analysis of awareness for healthcare professionals in forensic nursing. Forensic Res Criminol Int J 2017;5:285-288. https://doi.org/10.15406/ffcij.2017.05.00153

10. Caliskan N, Ozden D. The knowledge levels of health personnel in Turkey regarding forensic evidence. J Forensic Sci 2012;57:1217-1221. https://doi.org/10.1111/j.1556-4029.2012.02148.x
11. Feizi Nazarloo L, Sedghi Sabet M, Jafaraghaee F, Kazemnezhad Leyli E, Rahbar Taromsari M, Jolly A. Emergency department nurses's knowledge about forensic nursing. J Holist Nurs Midwifery 2017;27:27-36.

12. Drake SA, Adams NL. Three forensic nursing science simulations. Clin Simul Nurs 2015;11:194-198. https://doi.org/10.1016/j.ecns.2014.11.004

13. Kalayci I, Yazici SO, Kupeli A. Assessement of the knowledge level of nursing students on forensic nursing. Procedia Soc Behav Sci 2014;131:130-134. https://doi.org/10.1016/j.sbspro.2014.04.091

14. Abdool NN, Brysiewicz P. A description of the forensic nursing role in emergency departments in Durban, South Africa. J Emerg Nurs 2009;35:16-21. https://doi.org/10.1016/j.jen.2008.02.003

15. Eldredge K. Assessment of trauma nurse knowledge related to forensic practice. J Forensic Nurs 2008;4:157-165. https://doi.org/10.1111/j.1939-3938.2008.00027.x
Table 1. Individual and occupational characteristics of the participants (n=88)

| Characteristic                                                      | Total (n=88) | Groups                          | P-value |
|-------------------------------------------------------------------|--------------|--------------------------------|---------|
|                                                                  |              | Intervention (n=52) | Control (n=36) |
| Individual characteristics                                        |              |                      |          |
| Age (yr)                                                          | 29.84±6.36  | 28.71±6.34           | 31.47±6.10   | 0.044<sup>a</sup> |
| <25                                                               | 22 (25.00)  | 19 (36.54)           | 3 (8.33)     | 0.020<sup>b</sup> |
| 26–30                                                             | 27 (30.68)  | 14 (26.92)           | 13 (36.11)   |
| 31–35                                                             | 17 (19.32)  | 7 (13.46)            | 10 (27.78)   |
| >35                                                               | 22 (25.00)  | 12 (23.08)           | 10 (27.78)   |
| Sex                                                               |              |                      |          |
| Male                                                              | 20 (22.73)  | 13 (25.00)           | 7 (19.44)    | 0.541<sup>b</sup> |
| Female                                                            | 68 (77.27)  | 39 (75.00)           | 29 (80.56)   |
| Marital status                                                    |              |                      |          |
| Single                                                            | 38 (43.18)  | 29 (55.77)           | 9 (25.00)    | 0.004<sup>b</sup> |
| Married                                                           | 50 (56.82)  | 23 (44.23)           | 27 (75.00)   |
| Occupational characteristics                                     |              |                      |          |
| Nursing experience in a clinical setting                         |              |                      |          |
| Yes                                                               | 75 (85.23)  | 41 (78.85)           | 34 (94.44)   | 0.043<sup>b</sup> |
| No                                                                | 13 (14.77)  | 11 (21.15)           | 2 (5.56)     |
| Years of work experience                                         | 7.02±5.17   | 6.18±5.15            | 8.03±5.10    | 0.125<sup>c</sup> |
| Bedside nursing experience in the emergency department            |              |                      |          |
| Yes                                                               | 41 (46.59)  | 22 (42.31)           | 19 (52.78)   | 0.333<sup>b</sup> |
| No                                                                | 47 (53.41)  | 30 (57.69)           | 17 (47.22)   |
| Years of work experience in the emergency department              | 3.65±3.80   | 2.75±2.88            | 4.68±4.51    | 0.106<sup>c</sup> |
| Job position (n=75)                                               |              |                      | 0.587<sup>c</sup> |
| Bedside nurse                                                     | 72 (96.00)  | 40 (97.56)           | 32 (94.12)   |
| Head nurse                                                        | 3 (4.00)    | 1 (2.44)             | 2 (5.88)     |
| History of forensic patient care                                 |              |                      |          |
| Yes                                                               | 46 (52.27)  | 17 (32.69)           | 29 (80.56)   | <0.001<sup>b</sup> |
| No                                                                | 42 (47.73)  | 35 (67.31)           | 7 (19.44)    |
| Are there written instructions on caring for a forensic patient in your ward? |          |                      |          |
| Yes                                                               | 17 (19.32)  | 9 (17.31)            | 8 (22.22)    | 0.628<sup>b</sup> |
| No                                                                | 71 (80.68)  | 43 (82.69)           | 28 (77.78)   |
| History of participation in workshops related to forensic nursing |              |                      |          |
|       | Values | Values | Values |       |
|-------|--------|--------|--------|-------|
| Yes   | 4 (4.55) | 3 (5.77) | 1 (2.78) | 0.642<sup>c</sup> |
| No    | 84 (95.45) | 49 (94.23) | 35 (97.22) |       |

Values are presented as mean±standard deviation or number (%).

<sup>a</sup>P-value was obtained with the independent t-test. <sup>b</sup>P-value was obtained with the chi-square test. <sup>c</sup>P-value was obtained with the Fisher exact test.
Table 2. Knowledge and CDM of master’s nursing students regarding forensic evidence in the intervention and control groups (n=88)

| Variable       | Groups                          | P-value |
|----------------|--------------------------------|---------|
|                | Intervention (n=52) | Control (n=36) |
| Knowledge      |                                |         |
| Pre-education  | 7.00±2.32                      | 7.08±2.80 | 0.879\(^a\) |
| Insufficient   | 14 (26.92)                     | 11 (30.56) |
| Moderate       | 37 (71.16)                     | 23 (63.89) | 0.603\(^b\) |
| Sufficient     | 1 (1.92)                       | 2 (5.55)  |
| Post-education | 12.52±1.80                     | 7.67±2.50  | <0.001\(^a\) |
| Insufficient   | 0                              | 6 (16.67) |
| Moderate       | 13 (25.00)                     | 29 (80.55) | <0.001\(^b\) |
| Sufficient     | 39 (75.00)                     | 1 (2.78)  |
| CDM            |                                |         |
| Pre-education  | 13.50±2.68                     | 14.94±2.57 | 0.013\(^a\) |
| Weak           | 16 (30.77)                     | 7 (19.45) |
| Moderate       | 34 (65.38)                     | 26 (72.22) | 0.361\(^b\) |
| Desirable      | 2 (3.85)                       | 3 (8.33)  |
| Post-education | 16.96±3.07                     | 13.64±3.41 | <0.001\(^a\) |
| Weak           | 3 (5.77)                       | 14 (38.89) |
| Moderate       | 32 (61.54)                     | 20 (55.56) | <0.001\(^c\) |
| Desirable      | 17 (32.69)                     | 2 (5.55)  |

Values are presented as mean± standard deviation or number (%).

CDM, clinical decision-making.

\(^a\) P-value was obtained with the independent t-test. \(^b\) P-value was obtained with the Fisher exact test. \(^c\) P-value was obtained with the chi-square test.
Fig. 1. Flowchart of the study.
## Supplement 1. Educational content

| Sessions | Days | Content | Time (min) |
|----------|------|---------|------------|
| 1        | 1    | - Definition of forensic nursing  
- Theoretical foundations of forensic nursing  
- Violence and its types | 90 |
|          |      | **Assignments:** presentation of simulated scenarios | |
| 2        | 1    | - Vulnerable populations  
- Forensic nursing education | 90 |
|          |      | **Assignments:** presentation of simulated scenarios | |
| 2        | 1    | - Types of evidence and gathering forensic evidence | 90 |
|          |      | **Assignments:** presentation of simulated scenarios | |
| 2        | 1    | - Protection of forensic evidence | 90 |
|          |      | **Assignments:** presentation of simulated scenarios | |
| 3        | 1    | - Death investigation | 90 |
|          |      | **Assignments:** presentation of simulated scenarios | |
| 2        | 1    | - Document forensic evidence | 90 |
|          |      | **Assignments:** presentation of simulated scenarios | |
**Supplement 2. Measurement tool for the knowledge of nursing students regarding forensic evidence**

| Items                                                                 | True | False | I do not know |
|----------------------------------------------------------------------|------|-------|---------------|
| 1 The testimony of a forensic nurse is reliable in all legal cases in court. |      |       |               |
| 2 The presence of multiple knife wounds on the hands and feet can indicate a person’s self-defense against violence. |      |       |               |
| 3 Sexual assault refers only to injuries caused in the sexual area. |      |       |               |
| 4 The presence of bruises and redness around the genital area in children can indicate sexual abuse. |      |       |               |
| 5 In patients considered to be the victims of poisoning, collecting body secretions (sweat or eye fluids, etc.) has legal value. |      |       |               |
| 6 In order to protect a sample of semen obtained from the vagina, a wet swab is sent to the laboratory in a plastic bag. |      |       |               |
| 7 In rape victims, even in the case of taking a bath, semen can be sampled by taking a swab from inside the vagina. |      |       |               |
| 8 In rapes, semen spilled on clothes has legal value without a time limit. |      |       |               |
| 9 In order to document the exact size of an active stab wound, a forensic nurse is required to photograph it while placing a ruler next to the wound. |      |       |               |
| 10 If active nonbleeding wounds are suspected, a nurse should photograph the wound to document the exact size of the wound by placing a ruler next to the wound. |      |       |               |
| 11 A contusion caused by the pressure of a car wheel in a driving accident presents as a bruise on the spine area when entering the emergency room. |      |       |               |
| 12 The best environment for protecting DNA in the collected samples is formalin. |      |       |               |
| 13 DNA can be extracted from the hair separated from the body of the aggressor only up to 72 hours. |      |       |               |
| 14 A nurse should pack the bloody clothes of a shooting victim into a plastic bag as evidence. |      |       |               |
| 15 All patients referred to the emergency room are considered legal patients unless proven otherwise. |      |       |               |
| 16 In the care of forensic patients, help can also be obtained from the patient’s companion. |      |       |               |
| 17 The first step for a nurse when dealing with the victims of driving accidents is to make a detailed chart of the location of the injuries on the body chart. |      |       |               |
Supplement 3. Measurement tool for the simulated scenarios related to clinical decision-making in forensic evidence

| Scenario 1 | Statement                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Answers |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
|            | Neda is a 10-year-old girl who lives with her parents in Rasht. She goes to school at 7:30 AM every day and returns at 2:00 PM. On Sunday, Neda asked her mother for permission to go to her friend Fatima’s birthday and return home by 5:00 PM, but she did not return until 6:00 PM and her mother was very worried. She called Fatemeh’s house and a young boy who introduced himself as Fatemeh’s brother replied that the party was over and there was no news of Neda. Finally, at 8:00 PM, Neda entered the house with slow and limping steps while her clothes were dirty and soiled and some of the buttons on her clothes were loose. The mother asked what happened to her and why she was late. The mother asked her a question, but she replied while her voice was shaking that: she fell on the way back home. And she quickly went to her room. While she was changing her clothes, her mother entered the room and noticed redness and bruises around her neck and back, which she mentioned. When her mother asked why she was confused, she said that she hit something. Neda’s mother was very worried. Neda’s mother insistently brings her to the hospital’s emergency room while Neda cries and resists. Neda’s mother will explain the story to you. By building trust in Neda and by telling her not to worry about anything and that you intend to help her, you get her to agree to the examination, and you also obtain permission from Neda’s mother for the examination. You notice that Neda’s face is scrunched up while walking and she walks slowly and limply. You ask Neda to take off her clothes while you make Neda’s surroundings quiet and communicate with Neda with your communication skills. Meanwhile, you notice bruises on her arms and red-brown spots on her neck and shoulders, as well as numerous bruises on her inner thighs. As a nurse, answer the following questions: |
| 1          | Based on the available evidence, what kind of damage has occurred?                                                                                                                                                                                                                                                                                                                                                   |         |
|            | a. Child abuse                                                                                                                                                                                                                                                                                                                                            |         |
|            | b. Trauma                                                                                                                                                                                                                                                                                                                                                 |         |
|            | c. Domestic violence                                                                                                                                                                                                                                                                                                                                   |         |
|            | d. Elder abuse                                                                                                                                                                                                                                                                                                                                           |         |
| 2          | What is the most important finding of this scenario?                                                                                                                                                                                                                                                                                                      |         |
|            | a. Anxiety and worry in the behavior of the patient’s mother                                                                                                                                                                                                                                                                                              |         |
|            | b. Bruises on the thigh and pubis of the patient                                                                                                                                                                                                                                                                                                          |         |
|            | c. Discomfort while walking and sitting                                                                                                                                                                                                                                                                                                                  |         |
d. Patient anxiety and worry

3 What is your action to preserve forensic evidence?
   a. You ask the mother to bring the patient's old clothes.
   b. Pay attention to the location of the bruises, their intensity, extent, and color, and record the information.
   c. Check the clothes for the presence of liquid and send them to the laboratory.
   d. All items

4 In the above scenario, what is the most important nursing diagnosis?
   a. The risk of social isolation related to fear of others
   b. The risk of various infections in the genitourinary system related to sexual assault
   c. The risk of sexual dysfunction in adulthood related to psychological reactions
   d. The risk of sleep disorders related to anxiety

5 As a nurse, which of the following measures do you agree with to prevent this type of accident?
   a. Inform parents and children
   b. More supervision in children's socializing
   c. Report suspicious cases to judicial authorities
   d. Report suspicious cases to the emergency manager

Scenario 2

At 8 o'clock in the morning on Sunday, emergency colleagues delivered a 16-year-old boy with a body covered in blood whose wrists were tied with a cloth to the emergency department of the hospital. The teenager is sleepy and pale and opens his eyes in response to sound. The patient's father is a middle-aged man who anxiously and worriedly asks the emergency personnel to save his child's life and repeats under his breath, I was worried that something bad would happen and we should not have left him alone. In the initial examination, the emergency nurse estimates the level of consciousness of the patient according to the Glasgow Coma Scale as 11. As a nurse, answer the following questions:

6 Based on the available evidence, what damage has this teenager suffered?
   a. Trauma
   b. Physical abuse
   c. Suicide
Which action do you consider most necessary in the initial examination of this patient?

- a. Checking the intensity of bleeding
- b. Examination of the patient’s level of consciousness
- c. Examination of the neurovascular damage of the injured hand
- d. Checking the amount of blood lost by the patient

Based on the above scenario, what is your most important action?

- a. Patient monitoring and pulse pressure control
- b. Control the patient’s bleeding and inform the doctor
- c. Establishing 2 suitable intravenous lines and starting serum therapy
- d. All of the above

In the scenario above, which is the most important nursing diagnosis?

- a. The risk of loss of body fluids related to bleeding
- b. The risk of injury and trauma related to weakness caused by anemia
- c. The risk of decreased level of consciousness related to hypovolemic shock
- d. The risk of sleep pattern disturbance related to the pain of the cut site

As a nurse, what action do you consider necessary after saving the patient’s life and improving the general condition of the patient before discharge?

- a. Asking for psychological counseling for the patient
- b. Education for parents in connection with follow-up and referral to adolescent neuropsychological counseling centers
- c. Teaching teenage parents to take care of their children
- d. Teaching teenagers about self-care

Scenario 3

67-year-old Mrs. Hashemi goes to the emergency department of the hospital with a young man and a young woman while suffering from severe weakness on a cold winter day. Mrs. and Mr. Javan state that Mrs. Hashemi is their neighbor and lives with her only son who has a severe drug addiction. Today, they encountered her while she was completely unconscious in the street and asked for help. Due to her unwell condition, she was taken to the hospital. Mrs. Hashemi looks very anxious and worried and keeps repeating under her breath that
she sees everything as blurry and has abdominal pain with nausea and is very thirsty. At first glance, the nurse notices bruises on Mrs. Hashemi’s hands and face. In further investigations, the nurse notices that the patient is barefoot and had multiple wounds on the toes of both feet. At this moment, the patient states that her toes have been hurting for some time for no reason and also that she has run out of insulin for 3 days and has not been able to get insulin again. By paying closer attention to the patient’s symptoms, the nurse smells the smell of acetone on her breath. As a nurse, answer the following questions:

11. Which of the following types of injuries has this patient been subjected to?
   a. Elder abuse
   b. Physical abuse
   c. Neglect of the elderly
   d. All of the above

12. All the following options in the above scenario are signs of elder abuse except...
   a. Neglecting to provide insulin for a diabetic person
   b. Untreated toe ulcers
   c. Visibility of bruises on the patient’s hands
   d. An elderly person being left home alone

13. What is the nurse’s first action when facing this patient?
   a. Blood sugar control
   b. Monitoring vital signs
   c. Washing and dressing the wounds of the toes
   d. Informing the doctor

14. What is the most important nursing diagnosis in this scenario?
   a. The risk of blood sugar imbalance related to not taking medicine
   b. The risk of falling related to dizziness and imbalance
   c. The risk of decreased level of consciousness related to acid-base disorders caused by diabetic ketoacidosis
   d. The risk of fluid volume deficiency related to hyperuria

15. What is your most important action to prevent such an event?
Scenario 4
During the visit of a car driver to the emergency department of the hospital, a pregnant young woman is admitted to the emergency department. This lady had an accident with a moving car and the assailant’s car fled from the scene of the accident the injured person was taken to the hospital by the people present on the scene while his clothes were wet with blood. In the initial examination conducted by the emergency nurse, the patient was fully conscious at first and had placed her hands on her stomach and was writhing in pain, and said that her baby was not moving. She desperately begged the nurse to save her child. After a few minutes, she loses consciousness and passes out. According to the above scenario, answer the following questions:

16 In such a situation, what is the first decision you make as a nurse?
   a. I will immediately inform the emergency doctor.
   b. I ask my colleagues for help.
   c. I will announce a code.
   d. I will inform the legal authorities immediately.

17 In this situation, what is the most reliable way to measure the patient’s vital signs?
   a. Checking vital signs through the monitor and checking the level of consciousness according to the Glasgow Coma Scale
   b. Checking the radial pulse by hand
   c. Checking the patient’s blood pressure with a manual sphygmomanometer
   d. Checking the femoral pulse by hand.

18 What is the first step until the doctor arrives at the patient’s bedside?
   a. Imaging of the affected areas of the patient
   b. Controlling the patient’s bleeding with a local dressing
   c. Placing the head in the proper position to prevent aspiration
   d. Collecting and packing the patient’s bloody clothes

19 Based on the symptoms of a pregnant mother, which of the symptoms needs to be treated more quickly?
a. Vaginal bleeding
b. Open ankle fracture and bleeding from the fracture site
c. Decreased mother’s level of consciousness
d. Severe abdominal pain

20 What is the most important possible nursing diagnosis in this scenario?
   a. The risk of hypovolemic shock in the mother related to severe bleeding
   b. The possibility of pain caused by bone fractures
   c. The risk of long-term gait impairment related to an acute ankle fracture
   d. The risk of maternal depression related to the possibility of fetal loss

Scenario 5

A 25-year-old woman was taken to the hospital and finally to the operating room, after asking for help from her neighbors, while several wounds were seen on the backs of her hands, arms, neck, and chest, and her clothes were soaked with blood. Due to the urgency of the patient’s condition, the nurses took off the patient’s clothes without using gloves and cut parts of the clothes for easy changing and threw them on the floor on the infected nylon in a corner, and prepared the patient for the operation. After that, they folded the clothes and put them in a nylon bag. According to the above scenario, answer the following questions:

21 In the above situation, what do you do with the patient’s clothes?
   a. I put all her clothes in a nylon bag after changing.
   b. I throw away the patient’s clothes.
   c. I leave the clothes to the service to deliver to the patient’s caregivers.
   d. I put the clothes separately in paper boxes.

22 Due to the urgency of the patient’s condition, what do you do to change the patient’s clothes?
   a. The tears in the clothes are expanded by hand to make them easier to change.
   b. I cut the middle of the dress with a scalpel or scissors.
   c. I open the dress from the seams.
   d. I undress the patient according to her comfort level.

23 In such a situation, which of the following actions would you take?
   a. I do the work related to the patient and finally, register my name on the items collected from the patient.
b. I request my colleagues to help me expedite patient care.

c. I only prepare the patient for the operating room quickly and do not waste time talking to the patient.

d. I leave the evidence collected from the patient in the same room where I prepared the patient.

24 What do you do if you encounter this patient?

a. In the nursing report, I mention the presence of a wound due to a knife and explain the rest of the details verbally.

b. I write down the wounds and the type of cuts, their location, size, depth, and other features of the cut.

c. It is not necessary to report to the supervisor about the presence of this patient immediately.

d. I do all of the above.

25 Which of the following options is incorrect?

a. The forensic nurse should document the exact size of the wound by placing a ruler next to it.

b. In caring for a legal patient, one should not always ask for help from the patient’s caregivers.

c. Multiple stab wounds on the backs of hands and arms can indicate a person’s self-defense against violence.

d. The testimony of a forensic nurse is reliable in court.