Development and Validation of a New Tool to Measure Performance Knowledge and Communication Skill of Multidisciplinary Health Science Learners on Radiation Emergency Preparedness and Response Management

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Keywords: instrument development and validation; item assessment tool; radiological incidents and accidents; readiness for shared learning; surveys and questionnaires

Abstract

Objective: The purpose of the study was to design, develop, and validate a newer tool on radiation emergency preparedness responses (RadEM-PREM IPE tool) to measure communication, knowledge, performance skills in multidisciplinary health science learners.

Methods: The study design is a prospective, single centric, pilot study. Five subject experts designed, analyzed, and selected items of the instrument for relevant content and domain. Psychometrics that the tool assessed were content validity, internal consistency, test-retest reliability, and intraclass correlation coefficient. Twenty-eight participants completed test-retest reliability for validation of 21 sorted out items calculated percentage of agreement >70% I-CVI/UA (item content validity index with universal acceptability) and S-CVI/UA (scale content validity index with universal agreement method).

Results: Items with percentage agreement >70% and I-CVI over 0.80 were kept, ranged from 0.70 to 0.78 were revised, and below 0.70 were rejected. Items with kappa values ranging from 0.04 to 0.59 were revised and ≥0.74 were retained. Internal consistency assessed using Cronbach’s alpha was 0.449. Positive correlation between attitude and communication (r = 0.448), between performance and communication (r = 0.443) were statistically significant at 0.01 level. Overall, intraclass correlation coefficient for all the measures is 0.646, which is statistically significant at 0.05 level (P < 0.05).

Conclusions: Study concludes that the RadEM-PREM IPE tool would be a new measuring tool to assess knowledge, performance, and communication skills of interprofessional radiation emergency response team learner’s evaluation.

Emergency preparedness and response (EPR) to handle radioactive materials is concerned with occupational health and safety at the work place. Enriching the high standard, quality work culture by adopting good radiation safety practices in a nuclear medicine setup is a vital step in minimizing hazards and protecting the health of people. Lack of knowledge, behavior (attitude), and practice process for handling the various awkward radiation emergency situations is alarming among all the stakeholders and creates panic situations and consequences that are hazardous to professional, public, patients, and environments. To assess and evaluate learners’ pre-existing level of learning, the learning acquired in course of time, continuous improvement in the delivery of content, and modes of training administration as per the Kirkpatrick level 2 evaluation,1,2 there is a need for an appropriate assessment tool, which is lacking at present for radiation emergency response team evaluation. Assessment of learners for psychometric parameters analysis, the close-ended questionnaires design, formatting, validating, and reliability are the systematic process and vital to analyze educational deliverable programs. In the same line, developing an evidence-based radiation emergency response assessment in the hospital setup is vital to design and develop a reliable and valid assessment tool.

Aims and Objectives

The aim of this present study is to develop a valid and reliable tool on radiation emergency preparedness and response management (RadEM-PREM) also to explore the
psychometric measures of the instrument. Once this instrument is ready for intervention, it will help to evaluate the net learning and the learning gap in future-ready multidisciplinary health science graduate students. Objective of the study is to design, develop, validate, and check the reliability of the items for “Radiation emergency preparedness response management (RadEM-PREM) Inter professional evaluation (IPE) assessment tool,” which is lacking at present.

This RadEM-PREM IPE evaluation tool would be significantly helpful to assess the readiness of health science interprofessional learners in team building for radiation emergency preparedness and response.

The process adopted in this work is designing the items’ content, content validation, face validation, analyzing test-retest of the items to check for their reliability for ready to use as assessment tool recommended by Considine et al. in 2005, Tsang et al. in 2017, Calonge-Pascual et al. in 2020.3,5

This work in the long-run will be very effective and productive to assess and evaluate the pre-existing learning level, net learning attributes and learning lag to bridge the continuous improvements in future training to check the interprofessional learner’s readiness for building multidisciplinary radiation emergency response team.

Methods

Ethical Committee Approval

This work is duly approved from KMC and KH Institutional Ethics Committee vide IEC :1017 /2019 in December 2019.

Study Design

Study design is prospective, cross-sectional, single centric, pilot study conducted in India.

Participants

Items were generated by 5 subject experts for instrument design for relevant content, and domain specifications followed the stages of questionnaire design and development systematic good practice process. The tool is hypothesized for initiating team work capacity building in radiation emergency preparedness and response area in a hospital setup. Psychometrics of the tool was assessed in terms of content validity, internal consistency, and test-retest reliability.

Of the 3 domains of knowledge, performance skill, and communication skill, items were sorted out based on the high percentage relevance of the content-domain compatibility. In the next step of validation, the 5 subject experts validated the contents of items, substituting to remove ambiguity in the item contents, modification–remodification, screened for the levels of learning in the radiation emergency response area. Content validity was assessed to review the scale by a panel of 5 content experts with professional expertise in radiation protection. These 5 content experts were experienced either teaching faculty, a professional member of Nuclear Medicine Physicists Association of India (NMPAI)/Association of Medical Physicist India (AMPI), or having at least more than 10 y of professional practicing experience in radiation safety and the protection relevant field of medical radioisotope applications handling. All the item content experts and validators have at least a postgraduate degree in science holding with postgraduate degree/diploma in medical physics or nuclear medicine relevant professional qualifications and training in radiation protection.

Twenty-eight radiation safety expert professionals completed test re-test reliability of items for validation of RadEM preparedness management 21-item questionnaire Tool (RadEM-PREM tool) designed and developed for multidisciplinary interprofessional education (IPE) health science learners.

Study Size

In the present study, 92 items were screened out to 42 items in the first stage. In next stage, a further 21 items were sorted out for 3 domains such as knowledge learning attributes (KS), performance (PS), and communication (CS) skills based on the content validity index and high relevance in their respective domains. A total of 21 items were sorted out having percentage of agreement more than 70%, and each item’s content validity index with universal acceptability (I-CVI/UA) and scale content validity index with universal acceptability (S-CVI/ UA) is calculated. Of 21 items, 7 belong to the knowledge domain, 7 were from the performance domain, and another 7 were from the communication domain.

The inclusion criterion for the present study was working radiation professional experts in India. Entry-level future ready radiation professional were excluded.

Measurement Tool Used

Measurement tool includes close-ended questionnaires having 5 options which was curated and sent to the subject experts. The experts were then asked to rate each item based on relevance, clarity, grammatical /spelling, ambiguity, and structure of the sentences. Substituting content body, editing, correcting is adopted for domain-wise relevance of the items. Item-level content Validity index (I-CVI), Scale-Content Validity index (S-CVI)/Universal agreement (UA), Cronbach alpha coefficient, Pearson’s correlation coefficient (PC), intraclass correlation coefficient, percentage relevance of the tools are either discussed or tabulated.

Results

The high percentage relevance of the content-domain compatibility on the 4 rater scale initiated for instrument design process by 5 validators is shown in Table 1. In this table, validators’ percentage agreement for relevancy of the 21 items is tabulated in percentage relevance. The I-CVI, S-CVI, and modified kappa were analyzed for all the questions using Microsoft Excel (Microsoft Corp., Redmond, WA) (Table 2).

1 Lynn et al.6 recommended that I-CVIs should be no lower than 0.78 to accept that item content valid. Researcher used I-CVI information in revising, deleting, or substituting items. The items that had a CVI over 0.80 were kept, and those ranged from 0.70 to 0.78 were revised. Items with CVI score of less than 0.70 were

<table>
<thead>
<tr>
<th>Validators</th>
<th>Knowledge (%)</th>
<th>Performance (%)</th>
<th>Communication (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>82</td>
<td>25</td>
<td>100</td>
</tr>
<tr>
<td>IVU</td>
<td>64</td>
<td>100</td>
<td>96.4</td>
</tr>
<tr>
<td>SYB</td>
<td>78</td>
<td>92.8</td>
<td>57.1</td>
</tr>
<tr>
<td>SGC</td>
<td>100</td>
<td>100</td>
<td>78.5</td>
</tr>
<tr>
<td>RND</td>
<td>100</td>
<td>100</td>
<td>89.2</td>
</tr>
</tbody>
</table>

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rejected and not considered for further inclusion or revision. The S-CVI calculated using universal agreement (UA) was calculated by adding all items with an I-CVI equal to 1 divided by the total number of items. The S-CVI/UA of 21 items ranged between ≥0.8 and ≥1.0, considering that the items had excellent content validity.

The modified kappa was calculated using the formula: \( \kappa = \frac{(I-CVI-Pc)}{(1-Pc)} \), where \( Pc = \frac{N!}{A!(N-A)!} \times 0.5N \). In this formula, \( P_c \) is the probability of chance agreement; \( N \) is the number of experts; and \( A \) is the number of experts that agree the item is relevant.

Reliability testing was done, and items with a kappa value ≥0.74 were retained and those with values ranging from 0.04 to 0.59 were revised.

Reliability of the developed tool done by doing test-retest of these questionnaire items measured Cronbach’s alpha coefficient. The test-retest reliability of all 21 items were administered on-line through MS form to 28 radiation safety professionals working in India within a 4-week interval. The internal consistency of the subscale was assessed using IBM SPSS-16 software in which Cronbach’s alpha was reported to be 0.449.

Pearson’s product-moment correlation was used to assess the correlation between the subscales of the questionnaire for item discrimination analysis as advocated by Haladyna 1999.7 A highly positive correlation was observed between communication and knowledge \( (r = 0.728) \). Moderate correlation was observed between performance and knowledge \( (r = 0.544) \) and also between performance and communication \( (r = 0.443) \). All 3 correlations among knowledge, communication, and performance were statistically significant at the 0.01 level (Table 3).

Overall, intraclass correlation coefficient for all the measures was 0.646, which was statistically significant at 0.05 level \( (P < 0.05) \).

**Limitations**

This tool has been developed and validated in consultation with content experts and peers of radiation protection. Furthermore, the

Table 2. Item-wise 21 item I-CVI, SCVI-average, and SCVI /UA

<table>
<thead>
<tr>
<th>ITEMS serial number</th>
<th>ITEMS</th>
<th>Knowledge (KS)</th>
<th>Performance (PS)</th>
<th>Communication (CS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEM 01</td>
<td>Which of the following should be included in a radiation emergency kit except?</td>
<td>0.8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 02</td>
<td>The radioactive waste collected during decontamination of an area should be treated as</td>
<td>0.8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 03</td>
<td>The radioactive waste collected during decontamination of an area should be disposed as per</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 04</td>
<td>Decontamination kit contain all except:</td>
<td>0.8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 05</td>
<td>What does RSO stand for?</td>
<td>0.8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 06</td>
<td>Which of the following material is highly effective for radiation shielding?</td>
<td>0.8</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 07</td>
<td>ALARA Stands for:</td>
<td>1</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 08</td>
<td>Contaminated area of the body should be</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 09</td>
<td>After decontamination of radioactive spillage, the area can be</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 10</td>
<td>Which is the method used to check the contamination on the surface of a damaged 99mTc generator consignment</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 11</td>
<td>If the monitoring staff finds high radioactive contamination levels entrapped in the hair</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 12</td>
<td>If a small amount of radioactive material gets accidentally spilled on your skin, you should immediately?</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 13</td>
<td>How can you reduce the exposure to radiation from radioactive materials?</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 14</td>
<td>During the decontamination procedure, which movements should you follow to decontaminate the surface;</td>
<td>–</td>
<td>0.8</td>
<td>–</td>
</tr>
<tr>
<td>ITEM 15</td>
<td>In case, your assistant has walked over a radioactive spill, inadvertently, you will</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>ITEM 16</td>
<td>In case radioactivity spilled in the radio pharmacy at work and your supervisor enters to carry a source, you will</td>
<td>–</td>
<td>–</td>
<td>1</td>
</tr>
<tr>
<td>ITEM 17</td>
<td>Incidence reporting about radiation emergency indicates</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>ITEM 18</td>
<td>If you have a doubt of pregnancy status of a female patient, you will enquire about her</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>ITEM 19</td>
<td>In case you have realized that staff on duty have administered 99mTc DMSA radiopharmaceuticals to a dynamic renal case for glomerular filtration rate study</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>ITEM 20</td>
<td>Main causes of misadministration</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>ITEM 21</td>
<td>How to prevent loss of shipment of radionuclides?</td>
<td>–</td>
<td>–</td>
<td>0.8</td>
</tr>
<tr>
<td>S-CVI/AVG</td>
<td>0.86 0.8 0.838571429</td>
<td>0.8</td>
<td>0.8</td>
<td>0.838571429</td>
</tr>
<tr>
<td>S-CVI/UA</td>
<td>0.285714 0.0 0.142857143</td>
<td>0.285714</td>
<td>0.0</td>
<td>0.142857143</td>
</tr>
</tbody>
</table>

Table 3. Pearson correlation coefficient for the questionnaire

<table>
<thead>
<tr>
<th></th>
<th>Performance</th>
<th>Communication</th>
<th>Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance</td>
<td>1</td>
<td>0.443**</td>
<td>0.544**</td>
</tr>
<tr>
<td>Communication</td>
<td>1</td>
<td>0.728**</td>
<td>1</td>
</tr>
</tbody>
</table>

**Correlation is significant at 0.01 level (2-tailed).
tool is checked for reliability and internal consistency on another group of radiation safety professionals working in India. However, this tool is not tested among the interprofessional learner sample group from multidisciplinary health sciences including medical students.

**Discussion**

The present study describes a newer tool to assess the knowledge along with performance and communication skills of interprofessional radiation emergency team learners, with 5 subject experts as recommended by Lynn 1986. In this tool design and development, all the steps have been taken into account (Polit and Beck 2006, Polit et al. 2007) to obtain content validity evidence. The example provided was taken from a construction process instead of an adaptation process. Thorndike 1994 advocates that both reliability coefficients and alternative form correlation be reported, so it is followed in this study too. Low reliability coefficients may indicate that the test done on 28 professionals are small. Another possible reason of less coefficient, as Rattray and Jones in 2007 reported, may be close-ended questions, which mainly restrict the depth of participants response and, hence, diminish or render incomplete the quality of the data. Another possible reason of low reliability coefficient may be that the professional who participated in the re-test either did not pay required attention on the items, were disinterested, or got distracted. A solution to this could be item discrimination analysis to conduct on a larger group of panel experts. To overcome, in this study, an alternative form of correlation has also been calculated following the guidelines and it is greater than the reliability coefficient (r = 0.66). Peer review practices using guidelines led to improved psychometric characteristics of items. This instrument has been constructed it has undergone the testing by limited experts as pilot data collection, and their results are very promising; need to check test-retest reliability in either a larger panel expert group or multidisciplinary health science learners group after the sufficient span of time.

The new "RadEM-PREM IPE assessment tool" would be very useful for assessment of multidisciplinary team-building in the area of radiation emergency preparedness and response in entry-level and intermediate-level emergency response team members.

**Conclusions**

This study concludes that the 21-item “RadEM-PREM IPE assessment tool” is a valid and reliable new measuring tool. “RadEM-PREM IPE assessment tool” is to assess knowledge, performance, and communication skills of interprofessional radiation emergency response team learners in hospital settings.

**Acknowledgments.** This project was done as a part of the Fellowship Program at MAHE-FAIMER International Institute for Leadership in Intermultiprofessional Education (M-FIILIPE), Manipal Academy of Higher Education, (MAHE) Manipal, India. We thank Dr. Ciraj Ali Mohammed, Course Director M-FIILIPE and CCEID MAHE Manipal, all MAHE FAIMER faculty and MCHP Manipal for support and guidance.


**Funding.** None.

**Competing interests.** None.

**References**

Radiation emergency preparedness response management interprofessional evaluation assessment tool (RadEM-PREM IPE) assessment tool for multidisciplinary health science learners

Preamble:
This 21-item tool going to use for survey on assessing the awareness and readiness on radiation emergency preparedness and response management to be handled in case of any mishap experienced by the future ready interprofessional learners (IPL) because among eligible participants who all are going to coordinate radiation work during your delivery of profession at work place sometime in future in hospital setting. Therefore, this questionnaire tool is for assessment of 3 main domain of knowledge (KS), communication skill (CS), and performance skill (PS) among the multidisciplinary health science students from medical undergraduate course, nursing midwifery courses, nursing graduate courses, dental graduation, allied health professional graduation courses, etc. The allied health science graduate students will be from nuclear medicine technology, medical imaging technology, emergency medical technology, and postgraduate allied health science will be from nuclear medicine and medical radiation physics students. This tool will be used on IPE learner groups both pre- and post-delivery of interprofessional educational awareness teaching learning materials in sufficient time interval. After collecting responses through on-line/off-line will be get analyzed the data for assessing the change in readiness for learning together and to bring it up in collaborative practice in hospital. This developed tool is part of the M-FIIPE FAIMER-USA project study titled - Capacity Building Initiative for Radiation Emergency Preparedness and Response in Nuclear Medicine: An Interprofessional Education Approach.

<table>
<thead>
<tr>
<th>ITEMS serial number</th>
<th>ITEM STEM</th>
<th>FIVE DISTRACTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>ITEM 01</td>
<td>KS1 Which of the following should be included in a radiation emergency kit except?</td>
<td>Option 1 Protective clothing like overshoes, gloves Option 2 Decontamination materials for the affected areas including absorbent materials for wiping up spills Option 3 Decontamination materials for persons Option 4 Portable monitoring equipment Option 5 Instrument maintenance manual</td>
</tr>
<tr>
<td>ITEM 02</td>
<td>KS2 The radioactive waste collected during decontamination of an area should be treated as</td>
<td>Option 1 Normal waste Option 2 Harmless Option 3 Radioactive waste Option 4 Biomedical waste Option 5 Non-hazardous waste</td>
</tr>
<tr>
<td>ITEM 03</td>
<td>KS3 The radioactive waste collected during decontamination of an area should be disposed as per</td>
<td>Option 1 Hospital safety guidelines Option 2 Radiation safety regulatory guidelines Option 3 As the person in charge sees fit Option 4 USP guidelines Option 5 Local administration guidelines</td>
</tr>
<tr>
<td>ITEM 04</td>
<td>KS4 Decontamination kit contains all except:</td>
<td>Option 1 Shoe covers Option 2 Forceps Option 3 Brush Option 4 Polythene Bags Option 5 Radioactive solution</td>
</tr>
<tr>
<td>ITEM 05</td>
<td>KS5 What does RSO stand for?</td>
<td>Option 1 Radiation Service Officer Option 2 Roentgen Safety Office Option 3 Radiation Safety Officer Option 4 Radiation Safety Organization Option 5 Radiation Surveillance Officer</td>
</tr>
<tr>
<td>ITEM 06</td>
<td>KS6 Which of the following material is highly effective for radiation shielding?</td>
<td>Option 1 Wood Option 2 Paper Option 3 Lead Option 4 Plastic Option 5 Concrete</td>
</tr>
<tr>
<td>ITEM 07</td>
<td>KS7 ALARA stands for:</td>
<td>Option 1 As low As responsibly acceptable Option 2 As low as radiationally activated Option 3 As low as reasonably achievable Option 4 As low as reasonably attenuated Option 5 As low as responsibly achievable</td>
</tr>
<tr>
<td>ITEM 08</td>
<td>PS1 Contaminated area of the body should be</td>
<td>Option 1 Washed with soap and water Option 2 Washed with water only Option 3 Washed with ethanol Option 4 Exposed to UV rays Option 5 Covered to protect from sunlight</td>
</tr>
<tr>
<td>ITEM 09</td>
<td>PS2 After decontamination of radioactive spillage, the area can be</td>
<td>Option 1 Used as normal Option 2 Again decontaminate Option 3 Take a wipe test and measure to ensure contamination level Option 4 Mark the area Option 5 Leave the area and avoid its use</td>
</tr>
<tr>
<td>ITEM 10</td>
<td>PS3 Which is the method used to check the contamination on the surface of a damaged 99mTc generator consignment</td>
<td>Option 1 Swipe sampling method Option 2 Area monitoring method Option 3 Survey meter monitoring method Option 4 Zonal monitoring Option 5 Drop test</td>
</tr>
<tr>
<td>ITEMS serial number</td>
<td>ITEM STEM</td>
<td>FIVE DISTRACTORS</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------</td>
<td>-----------------</td>
</tr>
</tbody>
</table>
| ITEM 11 | PS4 If the monitoring staff finds high radioactive contamination levels entrapped in the hair | Option 1 Wash the hair  
Option 2 Do nothing  
Option 3 Shave the concerned area with razor  
Option 4 Head shower and bath  
Option 5 Scrub the concerned area with hard brush |
| ITEM 12 | PS5 If small amount of radioactive material gets accidently spilled on your skin, you should immediately | Option 1 Inform physician  
Option 2 Go to nearest primary health center  
Option 3 Wash the skin with cloth  
Option 4 Wash skin gently with soap and water  
Option 5 Scrub the skin with brush |
| ITEM 13 | PS6 How can you reduce the exposure to radiation from radioactive materials? | Option 1 Providing shielding between you and the source  
Option 2 Increasing the time spent near the source  
Option 3 Decreasing your distance from source  
Option 4 Options 1, 2, and 3  
Option 5 Not possible at all |
| ITEM 14 | PS7 During decontamination procedure, which movements should you follow to decontaminate the surface? | Option 1 Wipe the area in single outward movements or circular motion with absorbent sheet or cotton using tongs or forceps.  
Option 2 Wipe the area in single inward movements or circular motion with absorbent sheet or cotton using tongs or forceps.  
Option 3 Wipe the area in single inward movements or circular motion with hands.  
Option 4 Wipe the area in single outward movements or zigzag motion with absorbent sheet or cotton using tongs or forceps.  
Option 5 Wipe zigzag only |
| ITEM 15 | CS1 In case your assistant has walked over a radioactive spill, inadvertently, you will | Option 1 Shout at the the assistant, for not having observed  
Option 2 Tell the assistant to clean the place first  
Option 3 Make him aware of the possibility of spread  
Option 4 Stop him from going further and arrange for his decontamination  
Option 5 Options 3 and 4 |
| ITEM 16 | CS2 In case radioactivity spilled in the radio pharmacy at work and your supervisor enters to carry a source, you will | Option 1 Hide the radioactive spill from his vision  
Option 2 Inform him that you will carry the source  
Option 3 Inform him about the radioactive spill  
Option 4 Confine the spillage with tissue paper immediately  
Option 5 Options 3 and 4 |
| ITEM 17 | CS3 Incidence reporting about radiation emergency indicates | Option 1 Careless work conditions  
Option 2 Acceptance of poor safety conditions  
Option 3 Weakness of an organization  
Option 4 Documented information to communicate mishaps and the management for future reference  
Option 5 Identification of inefficient personnel in the organization |
| ITEM 18 | CS4 If you have a doubt of pregnancy status of a female patient, you will enquire about her | Option 1 Age  
Option 2 Marital status  
Option 3 Last menstrual period (LMP)  
Option 4 Members in the family  
Option 5 Previous investigations |
| ITEM 19 | CS5 In case you have realized that staff on duty have administered 99mTc DMSA radiopharmaceuticals to a dynamic renal case for glomerular filtration rate study | Option 1 Keep silent  
Option 2 Inform about the technical error, to the nuclear medicine physician, who has to interpret the scan  
Option 3 Inform your colleague  
Option 4 Leave the place for coffee  
Option 5 Inform the patient attender |
| ITEM 20 | CS6 Main causes of misadministration | Option 1 No training in emergency situation  
Option 2 Distraction  
Option 3 Communication gaps  
Option 4 Unplanned work  
Option 5 All and everything as above |
| ITEM 21 | CS7 How to prevent loss of shipment of radionuclides? | Option 1 Should have good communication between the shipment authorities and the hospital  
Option 2 Make queries about the shipment daily  
Option 3 Security cameras should be fixed at all of the areas  
Option 4 Stock keeping should be done every day  
Option 5 Options 1 and 2 |

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