Disaster Medicine and Public Health Preparedness

www.cambridge.org/dmp

Original Research

Cite this article: Bhushan S, Malapure SS, D'Souza NR, *et al*. 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. *Disaster Med Public Health Prep*. **17**(e425), 1–6. doi: https://doi.org/10.1017/dmp.2023.80.

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

Corresponding author:
Shivanand Bhushan,
Emails: shivanand.b@manipal.edu; drshivanandbhushan@gmail.com.

SOCIETY FOR DISASTER MEDICINE & PUBLIC HEALTH

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

Shivanand Bhushan MSc, DMRIT, PhD[1], Sumeet Suresh Malapure MD[2], Nisha Rachel D'Souza MSc[1], Pankaj Tandon MSc, Dip RP, PhD[3], Sibi Oommen MSc[1], Srinidhi G. MSc, Dip RP[2], Ashwani Kumar Verma MPH[4], Akhilesh K. Pandey MSc, PhD[2], William Wilson MD[2] and Muralidhar M. Kulkarni MD[2]

[1]Manipal College of Health Profession (MCHP) MAHE Manipal-Karnataka, India; [2]KMC, MAHE Manipal-Karnataka, India; [3]Head TSS, Radiological Safety Division AERB Mumbai, India and [4]School of Pharmaceutical and Populations Health Informatics, DIT University, Uttarakhand, India

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 response 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 ambiguousness 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.

Table 1. Initial validators percentage agreement domain-wise rater scale

	Percentage relevance of 21 items rated on domain wise scale		
Validators	Knowledge (%)	Performance (%)	Communication (%)
PT	82	25	100
IVU	64	100	96.4
SYB	78	92.8	57.1
SGC	100	100	78.5
RND	100	100	89.2

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).

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

https://doi.org/10.1017/dmp.2023.80 Published online by Cambridge University Press

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

ITEMS serial number	ITEMS	Knowledge (KS)	Performance (PS)	Communication (CS)
ITEM 01	Which of the following should be included in a radiation emergency kit except?	0.8	–	–
ITEM 02	The radioactive waste collected during decontamination of an area should be treated as	0.8	–	–
ITEM 03	The radioactive waste collected during decontamination of an area should be disposed as per	1	–	–
ITEM 04	Decontamination kit contain all except:	0.8	–	–
ITEM 05	What does RSO stand for?	0.8	–	–
ITEM 06	Which of the following material is highly effective for radiation shielding?	0.8	–	–
ITEM 07	ALARA Stands for:	1	–	–
ITEM 08	Contaminated area of the body should be	–	0.8	–
ITEM 09	After decontamination of radioactive spillage, the area can be	–	0.8	–
ITEM10	Which is the method used to check the contamination on the surface of a damaged 99mTc generator consignment	–	0.8	–
ITEM 11	If the monitoring staff finds high radioactive contamination levels entrapped in the hair	–	0.8	–
ITEM 12	If a small amount of radioactive material gets accidently spilled on your skin, you should immediately?	–	0.8	–
ITEM 13	How can you reduce the exposure to radiation from radioactive materials?	–	0.8	–
ITEM 14	During the decontamination procedure, which movements should you follow to decontaminate the surface;	–	0.8	–
ITEM 15	In case, your assistant has walked over a radioactive spill, inadvertently, you will	–	–	0.8
ITEM 16	In case radioactivity spilled in the radio pharmacy at work and your supervisor enters to carry a source, you will	–	–	1
ITEM 17	Incidence reporting about radiation emergency indicates	–	–	0.8
ITEM 18	If you have a doubt of pregnancy status of a female patient, you will enquire about her	–	–	0.8
ITEM 19	In case you have realized that staff on duty have administered 99mTc DMSA radiopharmaceuticals to a dynamic renal case for glomerular filtration rate study	–	–	0.8
ITEM 20	Main causes of misadministration	–	–	0.8
ITEM 21	How to prevent loss of shipment of radionuclides?	–	–	0.8
S-CVI/AVG		0.86	0.8	0.828571429
S-CVI/UA		0.285714	0	0.142857143

Table 3. Pearson correlation coefficient for the questionnaire

	Performance	Communication	Knowledge
Performance	1	0.443**	0.544**
Communication		1	0.728**
Knowledge			1

**Correlation is significant at 0.01 level (2-tailed).

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 = (I-CVI-Pc)/ (1-Pc), where Pc = [N!/A!(N-A)!]*0.5N. In this formula Pc = the probability of chance agreement; N = number of experts; and A = 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

https://doi.org/10.1017/dmp.2023.80 Published online by Cambridge University Press

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[6] followed. In this tool design and development, all the steps have been taken into account (Polit and Beck 2006,[8] Polit et al. 2007[9]) to obtain content validity evidence. The example provided was taken from a construction process instead of an adaptation process. Thorndike 1994[10] 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 coefficiency, as Rattray and Jones in 2007[11] 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.[12] 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 Interprofessional 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.

Author contribution. B.S., M.K., P.T., S.S.M., W.W. Data curation: B.S., P.T., A.V., S.G.C., N.R.D. Formal analysis: A.V., A.K., B.S. Methodology: Project administration: B.S., S.G.C., N.R.D. Visualization: B.S., S.G. N.R.D. Writing–original draft: B.S., M.K., S.O., A.K.P., A.V. Writing–review and editing: B.S., M.K. S.O., A.V.

Funding. None.

Competing interests. None.

References

1. **Kirkpatrick DL, Kirkpatrick JD.** *Evaluating Training Programs: The Four Levels*. Berrett-Koehler Publishers; 2006. Accessed May 24, 2023. https://bkconnection.com/static/Evaluating_Training_Programs_EXCERPT.pdf
2. **Kirkpatrick DL.** The four levels of evaluation. In: Brown SM, Seidner CJ, eds. *Evaluating Corporate Training: Models and Issues*. Springer Netherlands; 1998:95-112. Accessed May 24, 2023. https://doi.org/10.1007/978-94-011-4850-4_5
3. **Considine J, Botti M, Thomas S. Design**, format, validity and reliability of multiple choice questions for use in nursing research and education. *Collegian.* 2005;12(1):19-24.
4. **Tsang S, Royse CF, Terkawi AS.** Guidelines for developing, translating, and validating a questionnaire in perioperative and pain medicine. *Saudi J Anaesth.* 2017;11(Suppl 1):S80-S89.
5. **Calonge-Pascual S, Fuentes-Jiménez F, Casajús Mallén JA, *et al.*** Design and validity of a choice-modeling questionnaire to analyze the feasibility of implementing physical activity on prescription at primary health-care settings. *Int J Environ Res Public Health.* 2020;17(18):6627.
6. **Lynn MR.** Determination and quantification of content validity. *Nurs Res.* 1986;35(6):382-385.
7. **Haladyna TM.** *Developing and Validating Multiple-choice Test Items*. Routledge; 2004. Accessed May 24, 2023. https://www.taylorfrancis.com/books/mono/10.4324/9780203825945/developing-validating-multiple-choice-test-items-thomas-haladyna
8. **Polit DF, Beck CT.** The content validity index: are you sure you know what's being reported? Critique and recommendations. *Res Nurs Health.* 2006;29(5):489-497.
9. **Polit DF, Beck CT, Owen SV.** Is the CVI an acceptable indicator of content validity? Appraisal and recommendations. *Res Nurs Health.* 2007;30(4):459-467.
10. **Thorndike RM.** Book Review: Psychometric Theory (3rd ed.) by Jum Nunnally and Ira Bernstein New York: McGraw-Hill, 1994, xxiv + 752 pp. *Appl Psychol Meas [Internet].* 1995 Sep 1;19(3):303-5. https://doi.org/10.1177/014662169501900308
11. **Rattray J, Jones MC.** Essential elements of questionnaire design and development. *J Clin Nurs.* 2007;16(2):234-243.
12. **Abozaid H, Park YS, Tekian A.** Peer review improves psychometric characteristics of multiple choice questions. *Med Teach.* 2017;39(supp 1):S50-S54.

Appendix

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-FIILIPE FAIMER-USA project study titled - Capacity Building Initiative for Radiation Emergency Preparedness and Response in Nuclear Medicine: An Interprofessional Education Approach.

ITEMS serial number	ITEM STEM	FIVE DISTRACTORS
ITEM 01	KS1 Which of the following should be included in a radiation emergency kit except?	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
ITEM 02	KS2 The radioactive waste collected during decontamination of an area should be treated as	Option 1 Normal waste Option 2 Harmless Option 3 Radioactive waste Option 4 Biomedical waste Option 5 Non-hazardous waste
ITEM 03	KS3 The radioactive waste collected during decontamination of an area should be disposed as per	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
ITEM 04	KS4 Decontamination kit contains all except:	Option 1 Shoe covers Option 2 Forceps Option 3 Brush Option 4 Polythene Bags Option 5 Radioactive solution
ITEM 05	KS5 What does RSO stand for?	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
ITEM 06	KS6 Which of the following material is highly effective for radiation shielding?	Option 1 Wood Option 2 Paper Option 3 Lead Option 4 Plastic Option 5 Concrete
ITEM 07	KS7 ALARA stands for:	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
ITEM 08	PS1 Contaminated area of the body should be	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
ITEM 09	PS2 After decontamination of radioactive spillage, the area can be	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
ITEM10	PS3 Which is the method used to check the contamination on the surface of a damaged 99mTc generator consignment	Option 1 Swipe sampling method Option 2 Area monitoring method Option 3 Survey meter monitoring method Option 4 Zonal monitoring Option 5 Drop test

(*Continued*)

https://doi.org/10.1017/dmp.2023.80 Published online by Cambridge University Press

(*Continued*)

ITEMS serial number	ITEM STEM	FIVE DISTRACTORS
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
Footnote Claimer:	(copyright) (Permission required from author before using this tool for academic-research purpose)	

https://doi.org/10.1017/dmp.2023.80 Published online by Cambridge University Press