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The SCIEPR checklist: A tool for standardizing chest X-ray interpretation in resource-constrained settings – A pilot study

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ABSTRACT

Introduction: Checklists improve performance in specialized fields such as radiology. The SCIEPR (Standardization, Communication, Image Evaluation, and Pattern Recognition) checklist was developed to aid nonradiologists in interpreting chest radiographs in district hospitals with no radiologists onsite. This study aims to investigate the clinical utility of the SCIEPR checklist.
Methods: A descriptive cross-sectional pilot study included 103 participants, including 40 radiographers and 63 doctors from four district hospitals. Radiographers completed sections A and B regarding imaging protocols for chest radiographs, while doctors filled out section C for systematically searching for abnormalities. After four weeks of using the checklist, the participants completed a survey comprising 23 closed-ended and seven open-ended questions. Key measures included compliance in completing the checklist and evaluating the end-user's perceptions of the checklist.
Results: Seventy-four SCIEPR checklists were adequately completed. Sections A and B had 100 % compliance. Two items were omitted from Section C. Forty-one participants completed the survey tool (22 doctors and 19 radiographers). Participants had mixed opinions on the checklist's impact on time and workload. No item changes were suggested. Participants reported that the checklist enhanced patient care, improved service quality, reduced interpretation time, and reduced patient waiting time.
Conclusion: Following the pilot study, we refined section C of the SCIEPR checklist, improving content and face validity. The SCIEPR checklist promotes interprofessional collaboration and may reduce omission errors by standardizing imaging protocols.
Implications for practice: The SCIEPR checklist is designed to enhance collaboration between radiographers and medical doctors in chest imaging and interpretation. Its main goal is to improve the consistency and accuracy of chest X-ray interpretations, particularly in resource-limited settings with no radiologist onsite.

Introduction

Currently, there is a universal shortage of radiologists.[1] In 2024, there were an estimated 1072 registered radiologists in SA, with only one radiologist per 100,000 people,[2] in a population of 63 million,[3] which is little compared to Europe, where there are 13 radiologists per 100,000 people.[4] South Africa's healthcare system faces critical challenges in diagnostics. Medical doctors regularly use chest radiographs to diagnose and monitor treatment and predict outcomes for many diseases and abnormalities, including chest diseases. However, chest radiographs are challenging to interpret owing to overlapping clinical features and atypical presentations.[5] Although many hospitals in South Africa perform X-rays, there are few radiologists on-site to give structured X-ray reports, and medical doctors have no structured method for interpretation.[6]

A checklist is a structured tool that categorizes items in a list format, helping comprehension and retention of information.[7] Checklists enhance performance, prevent errors,[8] and improve task management.[9,10] Checklists should be developed using a systematic and comprehensive approach, particularly in specialized fields such as radiology.[11] Checklists may also address the existing shortage of radiologists.[12] A quantitative checklist for chest interpretation was developed by the research team and a panel of local experts, comprising radiographers, medical doctors and radiologists, using an exploratory sequential mixed method design spanning three phases. In phase 1, the researchers conducted an extensive literature review

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on checklists for interpreting chest X-rays.[13] The findings of the scoping review informed the construct and content domain of the checklist. The qualitative themes were used to formulate specific, measurable indicators or items, which contributed to the development of a preliminary quantitative checklist and an accompanying survey tool. The survey tool is part of the checklist to measure the end-user's perception and response rate.

In phase 2, the researchers collaborated with a panel of local experts to finalize the checklist using the Delphi technique. The team of local experts from South Africa and key informants participated in the item-writing process and provided feedback on the relevant items on the checklist. Their input helped eliminate confusion, ambiguity, or bias that could affect the responses and helped improve the preliminary checklist's relevance, clarity, and readability. The results from the Delphi technique were presented in a joint display to integrate the theory extracted from Phase 1 and the information provided by the local experts and key informants in Phase 2. The table of specifications had all the identified constructs and items generated during operationalization to formulate the SCIEPR (Standardization, Communication, Image Evaluation, and Pattern Recognition) checklist, as seen in Appendix A. The checklist aims to standardize imaging protocols, enhance interprofessional communication, and reduce omission errors when interpreting chest radiographs in hospitals without radiologists. Once the SCIEPR checklist had been developed and confirmed by a panel of experts, it was ready for pilot testing.[14]

This study represents the third phase of checklist development. We used a pilot-testing process to evaluate the suitability of each part of the SCIEPR checklist. Given the smaller sample sizes, the pilot study assesses clarity, aesthetics, relevance, tone, response time, and interpretation. The primary focus of this phase was to determine the clinical utility of the SCIEPR checklist.

Methods

This was a quantitative descriptive cross-sectional study. Each item of the SCIEPR checklist was accompanied by open-ended questions in a survey tool. This survey tool asked the field-testing participants to assess each item's quality and offer suggestions for improvement. The survey tool is shown in Appendix B. The study was reported following the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines.[15]

The checklist was piloted in four district hospitals in the city of Tshwane, Gauteng Province, South Africa (SA). Hospitals A, B, C and D serve rural and urban populations, with the total number of examinations done in October 2024 as shown in Table 1.

On average, each hospital performs 2500 examinations on a typical busy month. According to Table 1, chest examinations represented an average of 30–35 % of all diagnostic X-ray examinations. Interpretation was limited to new cases, primarily from emergency and outpatient departments. The X-ray departments in these hospitals are open 24 h a day with no dedicated radiologists. Only new cases were assessed using the SCIEPR checklist, while follow-up chest X-ray requests were excluded due to established diagnoses. The chest radiographs are interpreted by the referring doctors.

One hundred three participants, consisting of 40 qualified radiographers and 63 registered medical doctors involved in the imaging and interpreting chest radiographs, were selected via purposive sampling. Interested participants signed an informed consent form. A biostatistician recommended a sample size of 35 radiographers and 35 medical doctors with 80 % power, assuming a null proportion of 80 % or lower for the actual survey. The pilot study minimum sample size requirement based on the ideal effect sizes can be at least 15, 22, and 24 participants.[16]

Table 1
Number of general examinations done in October 2024.

Hospital	A	B	C	D
Diagnostic examinations, including chests	2844	2242	2465	2270
Total chest examinations only	886	809	823	677

Participant recruitment

Medical doctors were recruited after meeting with the heads of the departments or clinical managers at each of the four hospitals. The researchers met with the doctors to introduce the study and explain the background, problem statement, and aims. The importance of the study was discussed, and the inclusion and exclusion criteria were highlighted. The researcher demonstrated how to complete the checklist.

Radiographers were recruited after scheduling a meeting with the head of the X-ray department to introduce the study. The meetings were arranged on days when there was more staff. All explanations were done as with the medical doctors.

During the introductory meetings, all prospective participants received a packet of forms, including the three SCIEPR checklists, participant consent forms, instructions on completing the checklist, and the survey tool, all bound into a booklet. The different hospitals kept their booklets in different places. Hospitals A and B: Booklets were kept at the doctors' reporting station. Hospital C: The researchers provided each participant with a booklet. Hospital D: The booklets were kept in the X-ray department.

Data collection tools

SCIEPR checklist

The SCIEPR checklist (Appendix A), includes 35 measurable items and a back page with a chest line diagram for indicating abnormalities. The booklet included instructions on how to use the checklist. No patient demographics in terms of name, address, or date of birth were captured. Only the hospital number was captured to link the checklist to the chest radiograph.

Survey tool

We developed the survey tool with the help of a biostatistician, which was confirmed by a panel of experts who were involved in the Delphi technique during checklist development. The survey tool consisted of thirty questions, 23 closed-ended and seven open-ended (Appendix B).

Data collection

SCIEPR checklist

Data were collected over four weeks in each setting from August to December 2023. The process indicators on the checklist required a “Yes” or “No” for sections A and B and a “Normal” or “Abnormal” response for section C. In section A, the radiographer must confirm the information from the X-ray request form. “Yes” indicates that the information required to justify the examination is adequately presented, while “No” indicates a lack thereof. In section B, the radiographer indicates the position and projections performed during imaging according to the requested examination. “Yes” under image evaluation of the chest radiograph confirms adequate radiographic factor, while “No” indicates inadequacy. “N/A” means that the item did not apply to the patient, such as pregnancy status for male patients. In section C, “Normal” confirms that the

anatomical structure appeared normal regarding imaging shape, position, size, and tissue densities, and "Abnormal" was selected for structures that showed abnormal anatomy or radiographic density. Abnormal findings were not described as part of this study. Radiographers completed Sections A and B of the checklist, while medical doctors completed section C following the workflow of the radiology department. All the participants were advised to complete at least three checklists to gain experience before completing the survey. The completed SCIEPR checklists and survey tools were kept in the relevant departments and collected by the researcher.

Survey tool

All participants who used the SCIEPR checklist were invited to complete a self-administered baseline survey questionnaire to assess their perspective on the checklist's relevance, clarity, and time implications. The participants answered questions that involved the sections they completed on the SCIEPR checklist. The survey instrument included open-ended and closed-ended questions. Section A collected demographic data, including age, gender, and professional experience. Section B featured a 23-item question survey designed to evaluate the relevance, wording, clarity, and time needed to complete the checklist for chest interpretation via a 3-point Likert scale. The 3-point Likert Scale is used to gauge the intensity of opinions, attitudes, and perceptions within a given survey context.[17] It offered three choices, "positive," "neutral or not sure," and "negative," making it easy for participants to express their views. Section C included seven open-ended questions intended to elicit participants' feedback and offer suggestions for any modifications.

Data analysis

SCIEPR checklist

Data from the SCIEPR checklist were organized in an Excel spreadsheet with thirty-five items arranged in columns and participants' responses recorded in rows. The quantitative data were subsequently analyzed to verify compliance with the predefined checklist.

Survey tool

Participants' responses for each survey item were tabulated onto an Excel spreadsheet. The data were analyzed by an independent biostatistician, who suggested grouping items to reduce the frequency of "neutral or not sure" responses.[18] Scale reliability was improved when items were grouped into themes than when they were randomly arranged.[18] The items were grouped into eight constructs, namely, time, workload, length of the checklist, standardization, communication, training, image evaluation, and pattern recognition. The percentage agreements for each construct were calculated for relevance, clarity and length of time. Furthermore, the responses to the open-ended questions were analyzed using content analysis. We identified specific words, phrases, and concepts and determined the frequency of occurrence. The text was coded exactly as it appeared on the survey tool, ensuring that only words that clearly articulated the intended concepts were included. Coding was manually performed. The team was able to shed light on various factors that influenced the popularity of different checklist items, thereby enhancing the understanding of participant opinions and the overall effectiveness of the SCIEPR checklist.[19]

Several strategies were used to mitigate bias. Firstly, consistency in interpretations was ensured by involving multiple researchers. Two primary researchers conducted the content analysis with an assistant researcher. Additionally, certain participants were invited to review the findings to verify that the interpretations represented their beliefs. Finally, the study's conclusions were presented to peers for review, providing an opportunity to validate the results.

Results

SCIEPR checklist

Seventy-four SCIEPR checklists were collected, and sections A, B and C were adequately completed. Sections A and B, completed by radiographers, showed 100 % compliance. Section C, completed by medical doctors, revealed that a few participants did not evaluate abnormalities in the lung parenchyma and the diaphragm, as shown in Fig. 1.

Survey tool

Of the 103 participants recruited, only 41 (40 %) participated in the survey: 22 medical doctors and 19 radiographers (Table 2). Their ages ranged from 22 to 53 years. Work experience ranged from a few months (newly qualified interns and community service radiographers) to 22 years.

The results presented in Fig. 2 show that time and workload were not well perceived by all participants. Most participants viewed the checklist as a tool for training, image evaluations, pattern recognition, standardizing protocols, and enhancing communication.

In Section C of the survey tool, participants were asked about potential changes to the checklist items. None of the participants suggested any changes to the checklist items or format. The last question explored the perception of the participants on the use of the SCIEPR checklist; results from the open-ended questionnaire were coded and categorized into the following themes:

1. Reduce interpretation time: Less time for interpretation helps doctors work more efficiently.

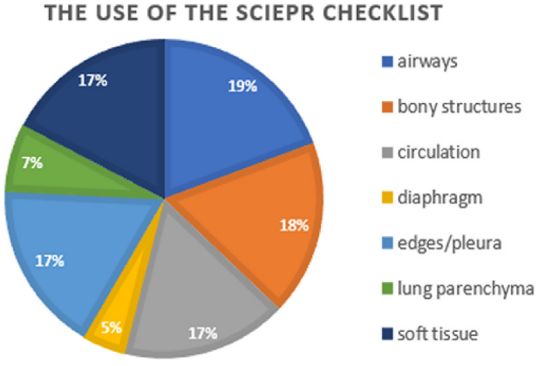

Figure 1. Results of the SCIEPR checklist for Section B compliance.

Table 2
Demographic data.

Age in years	**21–30**	**31–40**	**41–50**	**51 and above**
Radiographers	10	8	0	1
Medical doctors	11	5	3	1
Experience in years	**0 to 1**	**2 to 5**	**6 to 10**	**Above 10**
Radiographers	6	4	5	4
Medical doctors	10	6	4	2
Gender	**Male**	**Female**		
Radiographers	8	11		
Medical doctors	9	13		

2. Increase efficiency: Streamlining processes speed up doctors' workloads.
3. Identify abnormalities faster: Enhance methods for quickly identifying abnormalities.
4. Improve image quality: Checklists aid doctors in making better evaluations and more precise diagnoses.
5. Monitor patient wait times: Checklists also track waiting times in the X-ray department, improving hospital services.

These themes suggest that the SCIEPR checklist will enhance chest diagnosis and benefit doctors and patients.

Discussion

The study found that while compliance with the SCIEPR checklist was high among radiographers, some medical doctors overlooked specific areas, such as the lung parenchyma and diaphragm. Most participants viewed the checklist positively as a training tool that enhances efficiency, improves image quality, and reduces interpretation time. No participants suggested changes to the checklist items, indicating general satisfaction with its current format.

SCIEPR checklist

The SCIEPR checklist results showed that the diaphragm and lung parenchyma areas were not assessed for abnormalities by all participants, as shown in Fig. 1. These were the only items without subheadings, which could have explained the omission. These results were presented to the panel of experts to revise and refine the SCIEPR checklist. Section C was refined by adding subheadings to clarify the diaphragm (left hemidiaphragm and right hemidiaphragm) and the lung parenchyma (left lung parenchyma and right lung parenchyma). These results suggest that users should be trained to use a systematic approach during chest interpretation.[20] The sequence of search steps may be modified according to individual preferences. Doctors, in particular, should be encouraged to develop a consistent, systematic, and comprehensive routine for examining the images.[21] A familiarization period may be necessary for doctors and radiographers to get used to the added workload and time needed to complete the checklist. However, efficiency and speed will undoubtedly increase with experience[21,] and no essential items of the SCIEPR checklist should be omitted.

Interpretation is a strategy or process in which radiographers apply requisite knowledge and skills, and doctors apply perception, analysis, and synthesis skills. Radiographers need to have the requisite knowledge of anatomy and pathology, skills in radiological imaging, spatial abilities, and image manipulation skills, and be familiar with clinical information and context,[22] of which are represented in sections A and B of the checklist. Perception refers to identifying radiological findings using efficient search strategies, discriminating normal from abnormal findings and pattern recognition, which is represented in section C of the SCIEPR checklist. Analysis refers to examining radiological features and synthesising the radiological and clinical findings into a conclusion[22]; these two processes are not part of the checklist.

The SCIEPR checklist may improve communication and standardize imaging protocols and image evaluation criteria, representing a systematic approach to pattern recognition. Usually, the referring doctor will communicate with radiographers via an X-ray request form.[23] Section A of the SCIEPR checklist should be cross-checked against the information on the X-ray request form. Radiographers should ensure that the patient information on the request form matches that recorded on the SCIEPR checklist. If there is any missing information, the radiographer can get the information from the patient during history taking or contact the referring doctor.[24] Any missing information must be noted under communication in section B of the SCIEPR. Section B of the SCIEPR checklist includes another section for selecting projections and ensuring that patients are positioned according to the hospital imaging protocol for initial chest examinations. Standard projections for new patients are a posteroanterior (PA) and a lateral image in an erect position.[25,26] Two projections should be done due to the superimposition of structures in conventional radiography. The erect position is used to demonstrate any air-fluid levels below the hemidiaphragms. *Other projections can be done, depending on the patient's condition.* Section B also incorporated image evaluation criteria carried out by a radiographer. This follows a review of the image quality regarding proper positioning, breathing status, rotation, adequate radiographic exposure, and correct anatomical side markers. Any shortcomings in these aspects will impact the diagnosis.[27] Medical doctors are not trained to evaluate images but radiographers are.[28] The listed image quality factors guide all reporting doctors on the essential factors for accurate diagnosis.

Section C of the checklist listed all anatomical structures that should be evaluated for abnormal pattern recognition on a chest

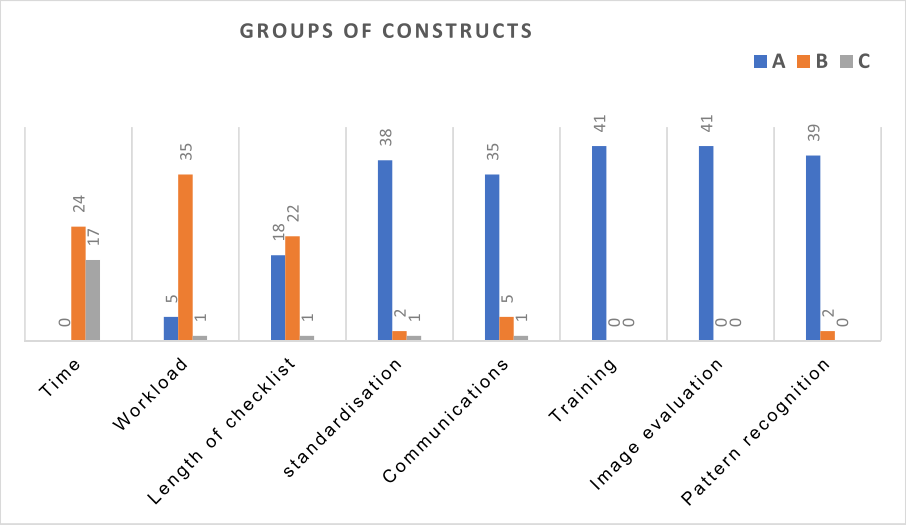

Figure 2. Item grouping response rates from the Likert scale survey (A for a positive response, B for an 'not sure', and C for a negative response).

image. The list guides the user to follow a systematic approach to search for chest abnormalities. All items listed should be evaluated to avoid omission errors.

Survey tool

Several small and medium-sized district hospitals exist in our metropolises and rural areas. These hospitals have emergency centers and outpatient departments, making them generalist facilities. In district hospitals, the clinical team consists of medical officers, clinical associates, and nurses. The extended team encompasses other allied health professionals. The approach to service delivery is collaborative and team-based, allowing for adaptation to local needs. Medical doctors are a key part of the public sector workforce, and family physicians may occasionally support the team.[29] District hospitals cater to most South Africans and face lower human-resourcing ratios, financial constraints, and aging infrastructure.[30] The lack of reporting of radiographic images can lead to ineffective patient diagnosis and mismanagement of patients.[1] There is thus an ethical obligation to find new practices to ensure patients receive quality healthcare.

Participants in our study were divided in their responses regarding the time taken to complete the checklist and the ensuing workload. A total of 15−20 minutes were needed to complete the 35-item checklist during chest interpretation. Most participants ($n = 35$) were neutral, and only a few ($n = 5$) agreed that checklists enhanced performance during high workloads and stressful conditions by freeing the mental capacity to perform essential tasks correctly and ensure a healthy approach to workload.[10]

Earlier studies have also reported that checklists led to longer interpretation times and lengths.[31] In the present study, the researchers assumed this perception came from participants who used the checklist only once. The themes from the open-ended questions highlighted that using the SCIEPR checklist reduced the interpretation time, and literature has shown that interpretation time improves with experience and confidence.[2] The checklist is envisaged to reduce patient waiting time, enhance patient care, and improve the quality of service. The checklist also encourages a systematic approach to finding abnormal patterns in chest radiographs, reducing the evaluation time and improving service delivery. South Africa has a national policy for managing patient waiting times in outpatient departments,[32] which states that the average patient waiting time for services per visit at a district hospital is estimated to be 2 h, and the total time spent by a patient per visit to a hospital, should be 3 h. Staff members at every service area must record the time of the commencement of service and exit in the respective areas as outlined in the SCIEPR checklist.[32]

The participants suggested that the checklist could be helpful for training purposes. Staff in district hospitals includes medical students, newly qualified medical doctors and community service radiographers. It is imperative that radiological training is improved at all levels, but especially at the undergraduate and intern levels.[2] We recommend that training institutions employ the SCIEPR checklist as an Objective Structured Clinical Examination (OSCE) to prepare final-year undergraduate medical and radiography students to be efficient and apply a systematic approach to chest interpretation. OSCEs are very helpful in medical education because they allow students to practice and demonstrate clinical skills in standardized medical scenarios. The recommendation aligns with Hales and Pronovost[33] and Marcovici and Taylor[34], who also recommended using checklists instead of lectures or instructional videos to teach students a systematic approach to chest interpretation.

There are several reasons for the lack of proficiency in radiographic interpretation. Firstly, there are no national standards for competency for nonspecialized doctors. Secondly, in most public facilities in South Africa, radiologists typically do not report on basic examinations. Lastly, university radiological programs vary widely, often leaving doctors to self-learn during training or afterwards.[35] The ongoing issue of shortage of radiologists has persisted for decades, with little hope for improvement.[2] Artificial intelligence learning solutions remain out of reach in low-resource settings.[36,37] Trainers are responsible for enhancing the skills of all personnel by integrating this training tool into medical curricula and extending it to district hospitals and clinics. Notably, recurring issues related to chest radiology interpretation lack systematic solutions. Introducing the new SCIEPR checklist seeks to address this persistent challenge.

This study had several limitations. Only three hospitals, instead of four, participated in the study. The checklist was stationed differently in all settings. Optimally, the checklist should be placed in the X-ray department, considering that radiographers are the first professionals to use it. According to the pilot study results, the SCIEPR checklist was revised and refined by the panel of experts; the SCIEPR checklist is ready for a more extensive field test with a large sample size to calculate an exploratory factor analysis. Future research should explore the ability of the SCIEPR checklist to improve the accuracy of chest interpretation.

Conclusion

The pilot study enhanced the content and face validity of the SCIEPR checklist. Participants approved the SCIEPR checklist, confirming its suitability for the intended users. The results showed that the SCIEPR checklist enhanced interprofessional collaboration and had the potential to reduce omission errors by standardizing imaging protocols and systematically searching for abnormalities.

Ethics approval and consent to participate

Ethical approval for this study was obtained from Faculty of Health Science research Ethics committee in the University of Pretoria, Reference number 84/2022, and the Tshwane Research committee with reference number GP_202204_001.

Written informed consent was obtained for anonymized participant information to be published in this article.

Availability of data

Data required for this study is available from: http://hdl.handle.net/2263/100780.

Author contributions

KMS: Conceptualisation, Methodology, Software.

KMS and NM: Data curation, Writing- Original Draft preparation.

KMS and NM: Visualisation, Investigation.

NM: Supervision.

KMS: Software, Validation.

KMS and NM: Writing- Reviewing and Editing.

Declaration of Generative AI and AI-assisted technologies in the writing process

Not applicable.

Conflict of interest statement

The authors declare that there are no conflicts of interest.

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APPENDIX A. SCIEPR checklist

Section A. check information in the request form to justify examination						
Arrival time:			Hospital or patient code:			
					yes	no
Age:						
Biological sex:						
Gender identity:						
Patient clinical history and findings:						
Last menstrual period:						
Indication(s) for examination:						
Requested examination:						
Date of previous X-rays and other related radiological examinations						
Section B. Completed by the radiographer						
Standard procedures *(tick projection and position)*	*Projection*	*Erect*	*Supine*	*Decubitus*		
	PA					
	Lateral					
	AP					
	Oblique					
	Other (specify)					
Communication	Write patient information discovered during imaging					
					yes	no
Image Evaluation of the chest	Anatomical side marker: Left /right visible on correct site					
	Area of interest: see from above lung apices to below diaphragms					
	Alignment					
	Artifacts (preventable)					
	Artifacts (non-preventable)					
	Exposures: see air filled lungs, bony structures and heart shadow					
	Inspiration: count 9-10 posterior ribs above diaphragms on erect PA					
	Position: scapulae out of lung fields					
	Rotation: sternoclavicular joints equidistant from spinous processes					
Departure time:						
Section C. completed by reporting medical doctor						
					Normal	Abnormal
Pattern recognition	Airways:	Position of trachea				
		Bifurcation of trachea				
		Right main bronchi				
		Left main bronchi				
	Bony structures:	clavicles				
		Scapula				
		ribs				
		Spine (check lateral)				
		Sternum (check lateral)				
		Other visible skeletal structures				
	Circulation and lymphatics:	Aortic knuckle				
		Heart size:				
		Mediastinal position				
		Mediastinal contours				
		Hila				
	Diaphragms:	left hemi-diphragm				
		right hemi-diaphragm				
	Pleura:	Costophrenic angle				
		Cardio phrenic angle				
	Lung parenchyma:	left lung parenchyma				
		right lung parenchyma				
	Soft tissue:	Around the chest				
		Breast tissue				
		neck				
Abnormal findings described (not part of this study)						

APPENDIX B. Survey tool

Section A. Demographic data collected			
	experience	gender	age
Medical doctor:			
Radiographer:			
Hospital: A, B, C, and D			
Section B. Survey questions for Phase 3 using three-point Likert scale: N=X			
1. How long did it take to complete the checklist?	≥30 min	15–20 min	≤15 min
2. Comment on the workload caused using the checklist	Increased	Right	Decreased
3. Comment on the number of items included in the checklist	many	Not sure	few
4. Comment on the items of the checklist	relevant	Not sure	irrelevant
5. Would you recommend the checklist to a colleague working in urban district hospital?	Yes	Not sure	No
6. Would you recommend the checklist to a colleague working in rural hospital?	Yes	Not sure	No
7. Would you recommend the checklist to a colleague working alone after hours?	Yes	Not sure	No
8. Would you recommend the checklist for training students and newly qualified doctors	Yes	Not sure	No
9. Would you recommend the checklist to a colleague working in hospital where there are no radiologists?	Yes	Not sure	No
10. Did the checklist improve the interprofessional communication?	Yes	Not sure	No
11. Did the checklist help you accomplish your goal of evaluating the quality of the image in terms of patient position on the chest radiograph?	Yes	Not sure	No
12. Did the checklist help you accomplish your goal of evaluating the quality of the image in terms of exposure factors on the chest radiograph?	Yes	Not sure	No
13. Did the checklist help you accomplish your goal of evaluating the quality of the image in terms of respiration phase as seen on the chest radiograph?	Yes	Not sure	No
14. Did the checklist help you accomplish your goal of evaluating the quality of the image in terms of rotation on the chest radiograph?	Yes	Not sure	No
15. Did the checklist help you accomplish your goal of evaluating the quality of the image in terms of projections done for chest interpretation PA and Lat?	Yes	Not sure	No
16. Did the checklist help you accomplish your goal of identifying abnormal patterns on the heart on the chest radiograph?	Yes	Not sure	No
17. Did the checklist help you accomplish your goal of identifying abnormal patterns on lung tissues on the chest radiograph?	Yes	Not sure	No
18. Did the checklist help you accomplish your goal of identifying abnormal patterns on diaphragms on the chest radiograph?	Yes	Not sure	No
19. Did the checklist help you accomplish your goal of identifying abnormal patterns on the pleura on the chest radiograph?	Yes	Not sure	No
20. Did the checklist help you accomplish your goal of identifying abnormal patterns on all soft tissue structures on the chest radiograph?	Yes	Not sure	No
21. Did the use of a lateral image enhance your goal of identifying abnormal patterns on the images?	Yes	Not sure	No
22. Would you recommend the use of checklist in all hospitals where radiologists are not on site?	Yes	Not sure	No
23. Did the checklist help you accomplish your goal of identifying abnormal patterns on all bony structures on the chest radiograph?	Yes	Not sure	No
Section C. Open ended questionnaire			
24. What would you remove to improve communication on the checklist?			
25. What would you add to improve image evaluation on the checklist?			
26. What would you remove to improve image evaluation on the checklist?			
27. What would you add to improve the system of searching for abnormal patterns on the checklist?			
28. What would you remove to improve the system of searching for abnormal patterns on the checklist?			
29. Overall, are you satisfied with your experience using the checklist?			
30. What is your perception in the use of the checklist in hospitals where radiologists are not on site?			

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