ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF EMERGENCY MEDICINE

Assessment on Competency in Interpretation of Emergency CXR among Emergency and Critical Care Medicine residents in Ethiopia: A cross-sectional study

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A research thesis submitted to the Department of Emergency and Critical Care Medicine, college of health sciences presented in partial fulfillment of the requirements for a specialty certificate in emergency and critical care

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ACRONYMS AND ABBREVIATIONS

AAU –Addis Ababa University

CHS –College Of Health Sciences

EMCC – Emergency Medicine and Critical Care

ED - Emergency Department

ETB - Ethiopian Birr

IRB - Institutional Review Board

CXR- Chest X-ray

SPHMMC -Saint Paul Hospital Millennium Medical College

TASH - Tikur Anbessa Specialized Hospital

JUSH- Jimma University Specialized Hospital

HFCSH- Hiwot Fana Comprehensive Specialized Hospital

IQ-interquartile range

OR- odds ratio

CI- confidence interval

Summary

Background: The chest X-ray (CXR) is an important diagnostic tool in diagnosing and monitoring a spectrum of diseases. It has a crucial role in the clinical decision-making process. The chest radiograph is the most commonly performed radiologic examination and can be one of the most complex and most difficult to interpret. Emergency physicians and residents are required to interpret CXR. Competence in interpreting Emergency CXR is essential for emergency and critical care residents to ensure timely and accurate diagnosis and treatment. However, there is a lack of comprehensive studies in developing countries assessing the competency levels of emergency and critical care medicine residents.

Objectives: To assess the competence of Emergency and critical care medicine (EMCC) residents in interpreting emergency chest X-rays and their associated factors to identify chest pathologies by using CXR in Tibur Anbessa Specialized Hospital (TASH), Saint Paul Hospital Millennium Medical College (SPHMMC), Jimma University specialized hospital and Haramaya University Hiwot Fana Comprehensive Specialized Hospital.

Methods: A cross-sectional study was conducted among EMCC residents on training in four university hospitals in Ethiopia from June to August 2024 G.C by using a Pretested and structured self-administered questionnaire. All 109 senior ECCM residents were included in this study. Participants was assessed using a standardized set of emergency Chest X-ray images representing a diverse range of pathologies encountered in an emergency setting. Data was gathered via web connection after being prepared by kobotools.org, coded, manually checked, and analyzed using the SPSS version 26 statistical program. The data was analysed using logistic regression, non-parametric tests, chi-square tests, and descriptive statistics.

Result: The overall competency in identifying chest X-ray (CXR) findings among residents was 39.8%, with a median of 2 (IQR 1-2) images correctly identified. No resident identified all CXR images, and the distribution showed that 6 residents (5.8%) recognized 9 findings, while 28 residents (27.1%) identified 7 findings. Most commonly, 99 residents (96.1%) identified normal CXRs, followed by pneumoperitonium (91 residents, 88.3%) and cannon ball lesions (90 residents, 87.4%). Only 14 residents (13.6%) correctly identified left upper lobe collapse, indicating significant gaps in competency across various pathologies. there is statistically significant association between age and competency in chest X-ray (CXR) interpretation, with older residents (36-40 years) were competent compared to younger residents (25-30 years). Additionally, third-year residents (PGY3) were significantly more likely to demonstrate competency than second-year residents (PGY2).

Conclusion and recommendation

In summary, the overall competency of ECCM residents in interpreting emergency CXR is low in four teaching hospitals in Ethiopia. The results of the current study found a statistical significant relationship with year of residency and age. We recommend to establish mentor ship practice with experienced clinicians and various teaching methods on improving CXR interpretation skills across different regions and hospitals in Ethiopia. More research will be needed to improve the study's limitations and long-term impacts of these training initiatives.

Introduction

X-rays are types of electromagnetic radiation probably most well-known for their ability to see through a person's skin and reveal images of the bones beneath it(1). W.C. Röntgen reported the discovery of X-rays in December 1895 after seven weeks of assiduous work during which he had studied the properties of this new type of radiation able to go through screens of notable thickness. He named them X-rays to underline the fact that their nature was unknown(2).

The chest X-ray (CXR) is an important diagnostic tool in diagnosing and monitoring a spectrum of diseases(3).it has a crucial role in the clinical decision-making process with widespread availability, low cost, and low radiation impact, It is still the principal imaging option for diagnosing and treating pulmonary and cardiac conditions(4). The chest radiograph is the most commonly performed radiologic examination and can be one of the most complex and most difficult to interpret(5).

Human-based reading of chest X-rays will be underscored by the development of recent innovations like Artificial intelligence (AI). Several studies show the potential benefit of artificial intelligence (AI) assistance in the detection of thoracic abnormalities(6). (7). (8).
The importance of diagnostic radiology becomes even more pronounced in emergency department (ED) settings, as these departments become increasingly crucial touch points for patient care across medical facilities(9). The treating physician in the emergency department does not always have the time or the opportunity to consult an on-call radiologist and therefore has to rely on personal experience and basic skills(10).

Previous international studies have shown that interpretation of chest radiographs is generally poor, but does improve with level of training and confidence in interpretation(11). Several studies from different centers compare emergency physician's and residents' CXR reading ability to the radiologist with discrepancies and disagreement with their interpretation(12). (10)

Statement of the problem

Emergency physicians and residents deal with a wide range of cases working day and night. It is the primary role of the emergency medicine residents and emergency physicians to identify normal and abnormal CXR. If residents have no adequate skill to interpret Emergency CXR treatment of chest conditions will be difficult. So it is possible to reduce errors made in the interpretation of radiographs in an emergency department(13).

In Ethiopia, medical students must finish a 3-week formal radiology course as part of their second clinical year training. However, emergency and critical care residents do not have a formal radiology attachment in their curriculum, so they must learn the skills through bedside rounds and their own initiative. As a result, ECCM residents are expected to be proficient in CXR interpretation.

ECCM is one of the most rapidly developing medical specialties in Africa. In Ethiopia One of the developing specialties, ECCM is only offered at seven teaching hospitals across the country(14).

There are currently no published studies in Ethiopia that discuss the CXR interpretation skills of emergency and critical care residents.

Significance of the study

The main objective of this study is to assess EMCC residents competency in CXR interpretation and the associated factors in identifying chest pathologies.

It assesses the adequacy of the curriculum of emergency medicine residents.

The study will also recommend how to improve residents' CXR interpretation skills.

The study will also have a huge infulence on improving the quality of care for patients and lead to more efficient use of healthcare resources.

Literature Review

Worldwide

A cross-sectional online questionnaire-based survey of 545 medical interns from several Saudi Arabian medical schools was carried out in July 2023. The lowest percentage of medical interns who accurately identify a case of pneumonia is 27% for left lower lobe pneumonia, whereas the highest percentage (60.9%) is for COVID-19 pneumonia. However, in the event of a pneumothorax or pneumoperitoneum, 13.1% and 23.8% of them, respectively, expressed a high degree of confidence in their diagnosis. Furthermore, 47.7% of participants answered "Normal Chest X-ray" inaccurately(15).

A similar cross-sectional study was carried out among 530 participants in all medical schools in Jordan between March and April 2020 to evaluate the accuracy and knowledge of undergraduate final-year medical students in detecting life-threatening emergency conditions on chest x-rays. A total of 285 participants (53.77%) properly answered at least six of the seven questions, and 139 individuals (26.2%) correctly answered every question. The case with the highest percentage of correct answers (93.8%) was pneumoperitoneum, whereas the case with the lowest percentage of correct answers (58.5%) was flail chest. 338 individuals (63.8%) reported having very high levels of general self-confidence. With 324 participants (61.1%), answers about tension pneumothorax received the highest degree of confidence(16).

A Similar study was conducted in Saudi Arabia in 2020, Including family medicine residents, general practitioners, diagnostic radiology residents, and medical interns A total of 600 physicians were enrolled, but only 205 physicians completed the survey (response rate: 34.2%). the overall diagnosis accuracy was 63.1% With a significant difference between family medicine and radiology residents (58.0% vs. 90.5%; $P < 0.001$),. The cases of COVID-19 pneumonia (85.4%) and pneumoperitoneum (80.5%) had the highest diagnostic accuracy scores. Being diagnostic radiology residents [OR]: 13.0; 95% [CI]: 2.5–67.7) and having higher diagnostic confidence (OR: 2.2; 95% CI: 1.3–3.8) were the only independent predictors of achieving high diagnostic accuracy(17).

In Another prospective, multicenter, controlled, cross-sectional study conducted in 2011 across four Danish hospitals in Denmark, 22 doctors undergoing Basic Clinical Education (BCE) participated and completed the survey in an overall manner, correctly establishing 51% of the diagnoses, all of which were normal and devoid of pathologic findings. The participants' overall confidence in the primary diagnoses was 57.5% on the Likert scale, which corresponded to 57.5% confidence in the proposed diagnoses. The sensitivity was calculated to 0.49 (95% confidence interval (CI): 0.41-0.57) and the specificity to 0.55 (95% CI: 0.41-0.68)(18).

A small retrospective comparative study involving 138 doctors including specialists, respiratory therapists, foundation year I and II doctors, and general practitioners in Manchester, United Kingdom was conducted in 2013 to evaluate the diagnostic accuracy and certainty in interpreting

chest X-rays in the medical division. Left lower lobe collapse was the CXR diagnosis with the lowest response rate (38%). On the other hand, right lower lobe pneumonia (83%), TB (84%), and left pleural effusion (98%), were the most accurately diagnosed conditions. Nonetheless, 35% of physicians could not distinguish between pneumonia and heart failure, and 18% could not identify a normal CXR. It's interesting to note that 18% of physicians could identify a unilateral apical pneumothorax but missed the opposite side's pneumothorax(3).

An additional study was carried out in 2015 and 2017 with 81 radiology residents at six different university hospitals in France. The purpose of the study was to determine the average competence level of the residents in reading chest X-rays and to look into any possible affecting factors. There were 51 (63.0%) PGY 3-5 residents and 30 (37.0%) PGY 1-2 residents. At least one CXR training session was attended by 12 out of 81 residents (14.8%) during their residency. Residents had an overall success rate of 92.6% when evaluating abnormal CXR and 79.6% when evaluating normal CXR. The detection CXR category showed a positive correlation between the number of years of residency and improved diagnostic performances (P=0.025). This shows that radiology trainees should take a systematic theoretical training course in CXR(19).

In the current world, a retrospective analysis of 563 emergency unit CXR was conducted in 2022 to evaluate a pre-commercial artificial intelligence (AI) system that attempts to replicate the performance of board-certified radiologists (BCRs) and can, thus, assist non-radiology residents (NRRs) in clinical settings that lack round-the-clock radiology coverage. For all illnesses under consideration, the diagnostic accuracy of the NRRs is surpassed by RRs with more sensitive BCRs' RFSs. With areas under ROC of 0.940/0.837 (pneumothorax), 0.953/0.823 (pleural effusion), and 0.883/0.747 (lung lesions), the AI system/NRRs' consensus matched the most sensitive BCRs' RFSs based on our external validation data set. This performance was significantly better than that of EU-experienced NRRs and comparable to experienced RRs(20).

Africa

From what I understand, Published related studies on EMCC resident’s competence in interpreting Emergency chest x-rays were scarce in Africa but a cross-sectional, prospective study was carried out in the Department of Internal Medicine in Johannesburg, South Africa in 2021, to assess and compare the interpretation of chest x-rays. 82 participants rotated through the Department of Internal Medicine, representing all ranks of physicians (interns, medical officers, registrars, and consultants). The years of experience divided the diagnostic accuracy into three categories: 0 - 5 years, 6 - 10 years, 43.0%, and >10 years, 47.9%. Accuracy for various designations was 50.5% for consultants, 40.9% for registrars, 36.4% for medical officers, and 19.5% for interns. Regarding to participants’ level of confidence in their ability to interpret chest radiographs 71.4% of consultants, 51.6% of registrars, 30.0% of medical officers, and 22.2% of interns were confident (p=0.012). Even though the interpretation of chest radiographs increased with seniority, overall interpretation was poor(21).

Ethiopia

Another related Cross-sectional study in Tikur Anbesa Specialized Hospital (TASH), Addis Ababa, Ethiopia was conducted among 79 Pediatric residents in 2018 to assess the skill level of pediatric residents in interpreting emergency radiographs. Ten radiographs (7 Chest X-rays, 2 abdominal, and one extremity X-ray) were selected. Only 32 (40.5 %) of the residents had a good skill level of interpretation with a 73% accuracy rate which was very low. The sensitivity of the residents in detecting abnormal radiographs was 72 (91.1 %) with a specificity of 34 (43 %). Most residents correctly identified intestinal obstruction on x-ray (92.4%), followed by pleural effusion (87.3%) and lobar pneumonia (84.8%). Pneumoperitoneum was missed by most (13.9%), followed by mediastinal mass (27.8%).A significant association was found with the year of residency(22).

As of now, there haven't been any published work in Ethiopia specifically addressing the Evaluation of competencies among Emergency Medicine and Critical Care (EMCC) residents in interpreting emergency chest X-rays (CXRs).

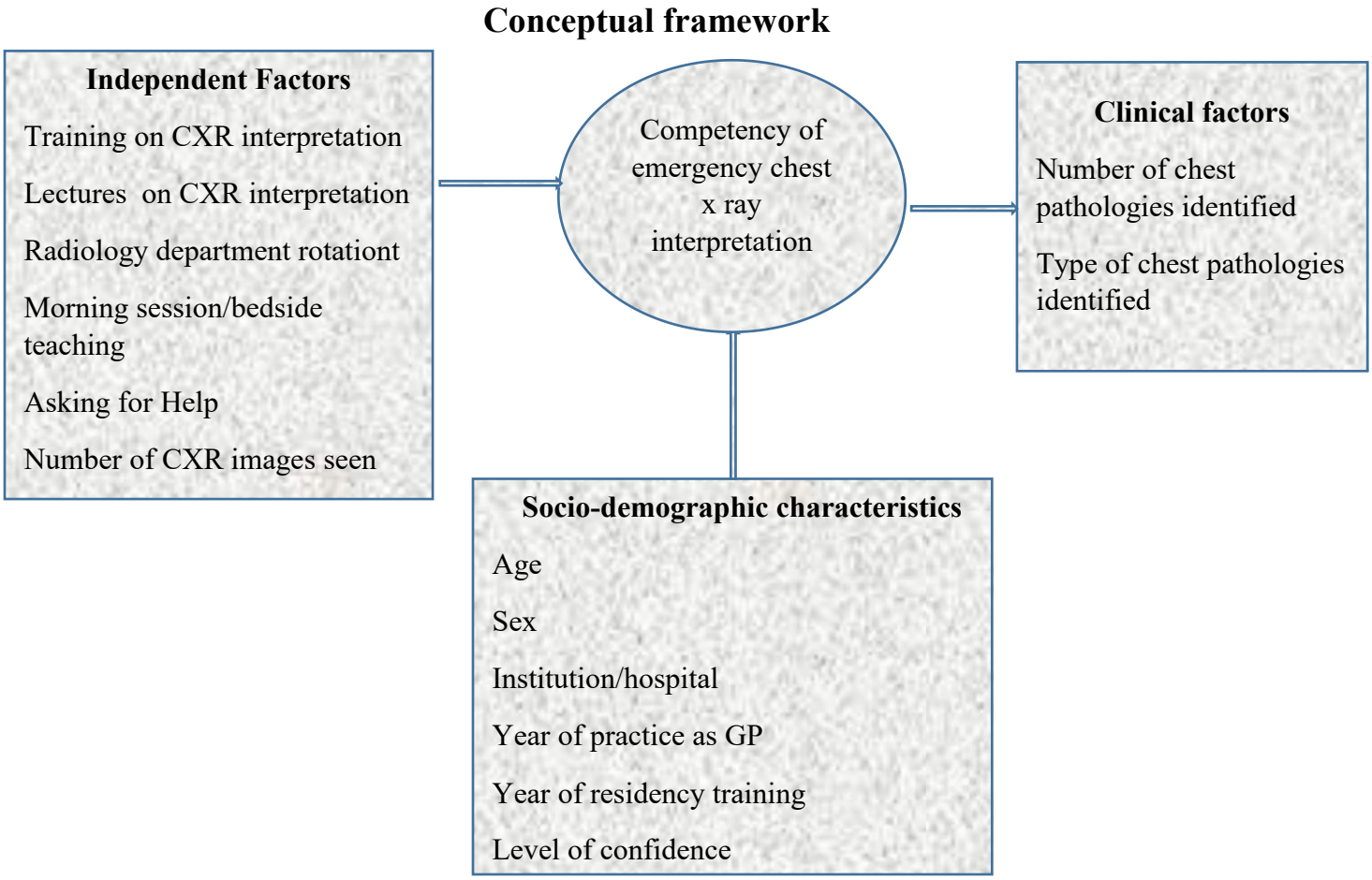


Figure 1: Conceptual framework illustrating competency in identifying chest pathologies and its associated factors.

Objectives

General objectives

The study aims to evaluate the competence of Emergency and critical care medicine (EMCC) residents in interpreting emergency chest X-rays and their associated factors to identify common chest pathologies by using CXR in TASH, SPHMMC, JUSH, and HFCSH.

Specific objectives

1) To assess the competency of Emergency and Critical Care Medicine (EMCC) residents in TASH, SPHMMC, JUSH, and HSCSH in interpreting emergency chest X-rays.

2) To identify associated factors with competency to identify chest pathologies by using CXR among EMCC residents in TASH, SPHMMC, JUSH, and HFCSH

Method and materials

Study setting, area, and period

The research was conducted at AAU (TASH), St. Paul's Hospital Millennium Medical College (SPHMMC), Jimma University Specialized Hospital (JUSH), and Hiwot Fana Comprehensive Specialized Hospital (HFCSH) in Ethiopia, during the months of June and August 2024. Addis Ababa University (AAU), founded in 1950, stands as one of the oldest, most prestigious, main referral and teaching hospital institutions in Ethiopia. It has a total of 600 physicians. In a collaborative effort with Addis Ababa University (AAU), the University of Wisconsin, and the University of Toronto, the Department of Emergency Medicine was established at Tikur Anbessa Specialized Hospital (TASH) in 2010 G.C.

Similarly, St. Paul's Hospital Millennium Medical College (SPHMMC) emerged as a prominent healthcare institution, established in 2010 to meet the evolving healthcare needs of the Ethiopian population. Governed by a board reporting to the federal minister of health. In 2011, emergency medicine and critical care departments were introduced. SPHMMC has a total of 562 physicians.

Jimma University Specialized Hospital (JUSH) is located in Ethiopia, Oromia region, Jimma zone, Jimma city 352 km (218.7 miles) southwest of Addis Ababa, the capital city of Ethiopia. Jimma University Medical Center is a teaching and tertiary-level hospital and is the only referral hospital for the southwestern sub-region of the country. It has a total of 350 physicians.

Hiwot Fana Comprehensive Specialized Hospital (HFCSH) is located in Harar, the capital city of Harari regional state, Eastern Ethiopia at a distance of 526 km from Addis Ababa. Hiwot Fana Comprehensive Specialized Hospital is the only tertiary hospital in Harar, Eastern Ethiopia. It has a total of 300 physicians.

All hospitals' emergency department has their own radiology unit functioning 24 hours at an approximate distance of 10-20 meters from the ED. The numbers are taken from a registry of payroll of each selected hospital’s human resource office.

Study design

Institutional based Cross-sectional study

Population

- ✓ **Target population**

All ECCM residents attending all institution providing Emergency medicine.

- ✓ **Source population**

All EMCC residents of TASH, SPHMMC, JUSH, and HFCSH.

- ✓ **Study population**

All senior EMCC residents of TASH, SPHMMC, JUSH and HFCSH

- ✓ **Sampling frame**

A List of senior EMCC residents who were accessible at the time of study participate in the respective teaching hospitals

Eligibility Criteria

- ✓ **Inclusion criteria**

All EMCC senior residents at all levels enrolled in their residency program at TASH, SPHMMC, JUSH, and HFCSH.

- ✓ **Exclusion criteria**

All First-year residents and 2nd-year EMCC residents who have not completed their first 6 months of training or residents who were not willing or unable to participate.

Principal investigator

Sample size determination

The single population proportion formula for cross-sectional study used to calculate sample size is

$$n= (Z\alpha 2/)2\ p(1-p)d2$$

Here n is the minimum required sample size, Zα/2 is the value under the standard normal table for a given confidence interval (1.96 for 95% CI), and p is the best estimate of prevalence since we don't have a previously done study in our country, we took 50% to increase the strength of the study, and d is the margin of error (0.05).

$$n= (1.96)20.5(1-0.5)0.052=384$$

Since our source population is 109, we used the correction formula where n is the sample size we calculated (384), N is our total population of 107 (excluding the pilot study)

$$\text{Corrected sample size} = n*N/\ n+N\ \approx 84$$

Adding 10% non-response the sample size calculated is 93. Because there is no discernible difference between the study population and the estimated sample size All available ECCM residents at the time of the study, as well as those presently undergoing training at AAU, SPMMC, JUSH, and HFCSH, were enrolled.

Sampling technique and procedures

Four university hospitals (TASH, SPHMMC, JUSH, and HFCSH) were selected by judgmental sampling. They were enrolled once the lists of all 109 residents from four teaching hospitals were obtained.

Table 1 Allocation of study participants

	TASH	SPHMMC	JUSH	HFCSH
R2	18	18	7	8
R3	25	20	10	3

Study Variables

Dependent variables

Primary outcome

Number of chest pathologies identified

Secondary outcome

Type of chest pathologies identified

Independent variables

- ✓ age
- ✓ Sex
- ✓ Institution
- ✓ Year of practice as GP
- ✓ Year of residencies
- ✓ Training on CXR reading
- ✓ Lectures on CXR reading
- ✓ Level of confidence
- ✓ Frequency of CXR images encountered per month

- ✓ Frequency of asking for help

Operational definitions

Emergency CXR- a chest X-ray performed on a patient in an emergency setting.

Competent – Residents who correctly interpret ≥70% of chest pathologies images (≥7).

Incompetent- Residents who correctly interpret <70% of chest pathologies images (<7).

CXR reading training – either online or in-person course on CXR reading from a known institution.

CXR interpretation- correctly interpreting a given CXR

Rotation- attaching at the Radiology department in a particular month.

Data collection tool and procedure

Chest radiograph images were sourced from Radiopaedia, an internationally recognized educational platform in radiology, (Radiopaedia.org) after obtaining permission and from previous literature reviews(22,17,15).. A set of common emergency conditions observed in the emergency department (ED) were chosen, and their diagnoses was validated by independent two radiologists who were not part of the image selection process, ensuring complete agreement on all case diagnoses.
The questionnaire is created and structured and has some open-ended and closed-ended questions including basic background questions about residents, training, and common chest pathology CXR images was given to the study population. A questionnaire was developed and piloted by sending it to 2% of physicians. The questionnaire is modified according to the replies received to make it more efficient.
Prior to data collection, signed informed consent was acquired, and the questionnaire is developed in English. Each resident receive the questionnaire using links to internet resources in the same sequence. The survey was distributed via telegram and whats app messages to 109 residents with daily reminder SMS text for each participant. Each invitation had a different link that could not be used more than once. Participants were able to access the survey on their computers, tablets and mobile phones and was open for 12 days.
The survey includes a series of 10 cases that started with a brief clinical vignette and a chest X-ray image followed by a multiple-choice question asking for the most likely diagnosis. For each case participants were also asked to rate their degree of confidence.

The 10 CXR diagnoses that were shown were: congestive heart failure, normal, cannonball lesions/lung metastases, pneumothorax, left upper lobe collapse, right main bronchus intubation, pulmonary edema, Pneumoperitoneum, left lower lobe pneumonia, and right side hemothorax.

Data quality control

The primary investigator was responsible for collecting data, and before entering the information into the SPSS program, the responses were reviewed daily for completeness of the data. There was 1 data collector and the data collector had routine monitoring during the data collection period to ensure the overall quality of the data being gathered, monitor compliance with the study protocol, and address any issues that arose.

Data processing and analysis

For tidying and analysis by the primary investigator, the completed questionnaires which are downloaded from Kobo tools were coded, manually reviewed, entered into Microsoft Excel, and exported to SPSS version 27. Descriptive statistics, proportion, mean, standard deviation, and median were produced using tables and charts to characterize the sociodemographic and background features of the study population. Whereas continuous variables are presented as the median and interquartile range (IQR). Frequency tables and cross-tabulations were employed to visually represent the results of categorical data, which were then subjected to testing using either the Chi-Square Test or Fisher's Exact Test. Binary logistic regression was utilized for the analysis of binary-dependent categorical and continuous variables. Variables with a p value of less than 0.2 in bi-variable analysis were included in multivariable analysis. Multivariable logistic regression analysis was conducted to identify factors associated with competency of identifying chest pathologies using CXR images. Interpreting ≥7 of chest pathology images was considered the outcome variable. Hosmer-Lemeshow goodness-of-fit test was used to check the model fitness and a p-value of >0.05 was taken as fit. All analyses were consider a p-value of <0.05 and a 95% confidence interval as statistically significant.

Ethical consideration

Before implementation of the study, ethical approval was obtained from the respective ethical review boards of the Department of EMCC at TASH, SPHMMC, JUSH and HFCSH. Participants were recruited voluntarily and provided written informed consent upon filling the questionnaire. To protect participants privacy, data was anonymized and stored securely. We adhered to the ethical guidelines of each institution, ensuring that the research was conducted responsibly and ethically.

5. RESULTS

Responses

Total of 109 invitations were sent via online web with link provided from kobotoolbox to all senior ECCM residents of TASH, SPHMMC, JUSH and HFCSH. 103 residents responded making Response rate 96% excluding pretest (2) participants

Characteristics of study participants

Total of 103 residents (Male: n= 78, 75.7%, Female n= 25, 24.3%) with mean age of 30.74 (95% CI : 30.26 - 31.19) years participated.

Forty three(41.7%) of residents were from TASH, 36(35%) were from SPHMMC, 15(14.6%) were from JUSH and 9(8.7) were from HFCSH. 55.3% of participants were 3rd year and the remaining were 2nd year ECCM residents. 63 (61.2%) of residents worked as general practitioner for less than 3 years and 40 (38.8%) of residents worked for more than 3 years as general practitioner. Most of residents 87(84.5%) have no CXR reading training during their residency program, While 16 (15.5%) of residents has training during their residency program. Of those who took the training with median of estimated hours for training being 3hrs (IQR 2.75 - 12) in their residency program.

Forty five(43.7%) residents had radiology department attachment with median number of rotation being 1 (IQR 0). Most of residents 77(74.8%) did not attend lecture and only 26 (25.2%) of residents attended lectures on CXR reading topic. Out of 26 residents only 24 (92.3%) of them said the lecture was not enough. And 20 (76.9%) of residents took the lecture in 1st year of their residency program, 5 (19.2%) residents in 2nd year and 1(3.8%) in 3rd year of their residency program.

Sixty two residents (60.2%) had bed side/morning session teaching with EMCC consultants forty eight(46.6%) and senior residents 14 (13.6%) were mentioned to give the teaching for the

participants but large number of residents 30 (29.1%) rated it adequate but some changes are needed. Only 4 (3.9%) of them rated these activities as excellent, twenty two(21.4%) rated it as substantial is needed, and 6(5.8%) adequate but no major change needed.
Majority of residents 62 (60.2%) claims CXR reading is difficult. 82(79.6%) of residents sometimes ask for help for interpretation of CXR. 12(11.7%) of residents rarely and 9(8.7%) of residents always ask for help. Radiologists were cited as a source of help during their difficulty in Ninety (87.4%) of the participants. 41 (39.8%) of participants mentioned emergency physicians, emergency senior residents and their peers as source of help in CXR reading. 30 (29.1%) and 3 (2.9%) of participants mentioned references and other as source of help.
92(89.3%) of residents saw CXR more than 10 times per month. Most of residents 68 (66%) rated their confidence level of CXR interpretation as somehow confident, 22 (21.4%) of residents rated as neutral and only 9 (8.7%) residents rated as very confident.

Table 2 Background characters of study participants (n=103)

Variables		Frequency	Percentage
Age	25-30	66	64.1
	30-35	32	31.1
	35-40	5	4.9
Sex	Male	78	75.7
	Female	25	24.3
Year of residency	Year 2	46	44.7
	Year 3	57	55.3
Teaching hospital	AAU	43	41.7
	SPHMMC	36	35.0
	JUSH	15	14.6
	HFCSH	9	8.7
Year of experience as	<3	63	61.2
General practitioner	>3	40	38.8

Trained on CXR reading	No	87	84.5
	Yes	16	15.5
attended all lectures	No	77	74.8
	Yes	26	25.2
Bed side/ morning session	No	41	39.8
	Yes	62	60.2
Radiology department attachment	No	58	56.3
	Yes	45	43.7
Source of help during difficulty in reading CXR	Radiologists	90	36.6
	Emergency physicians	41	16.7
	Emergency senior residents	41	16.7
	Peers	41	16.7
	References	30	12.2
	Others	3	1.2

Competency of Identifying CXR pathologies using CXR images

The overall CXR interpretation competency of the participants was found to be 39.8%(≥70% of CXR images). A median of 2 (IQR 1-2) CXR images were correctly identified. Distribution of residents according to the number of correctly identified CXR pathology was: 6 residents (5.8%) identified 9 different types of CXR images, 7 residents (6.8%) identified 8 CXR findings,28 residents (27.1%) identified 7 CXR findings, 24 residents (23.3%) identified 6 CXR findings, 14 residents (13.4%) identified 5 CXR image findings, 15 residents (14.6%) identified Correctly 4 CXR findings, 6 residents (5.8%) identified correctly 3 CXR images, 3 residents (2.9%) identified correctly 2 CXR images and Most concerning was the fact that no residents did identify all CXR images. Distribution of residents according to the type of CXR pathology identified showed that 99 residents (96.1%) identified normal CXR, 91 residents (88.3%) identified pneumoperitonium, 90 residents (87.4%) identified cannon ball lesion, 76 residents (73.8%) identified left lower lobe pneumonia, 67 residents (65%) identified right main stem intubation, 57 residents (55.3%) identified right hemothorax, 45 residents (43.7%) identified

pneumothorax, 44 residents (42.7%) identified pulmonary edema, 22 residents (21.4%) identified congestive heart failure, and only14 residents (13.6%) identified left upper lobe collapse.

Table 3 CXR findings and interpretation by participants

CXR Findings	**Correctly answered**		**Incorrectly answered**	
	frequency	percent	frequency	percent
Normal CXR	99	96.1	4	3.9
Pneumoperitonium	91	88.3	12	11.7
Cannon ball lesion	90	87.4	13	12.6
Left lower lobe pneumonia	76	73.8	27	26.2
Right main stem intubation	67	65	36	35
Right hemothorax	57	55.3	46	44.7
Pneumothorax	45	43.7	58	56.3
Pulmonary edema	44	42.7	59	57.3
Congestive heart failure	22	21.4	81	78.6
Left upper lobe collapse	14	13.6	86	14

Table 4 Number of CXR findings correctly identified

Number of CXR findings detected correctly	Frequency	Percentage
2	3	2.9
3	6	5.8
4	15	14.6
5	14	13.4
6	24	23.3
7	28	27.1
8	7	6.8
9	6	5.8
10	0	0

Factors associated with competence of identifying ≥7 CXR pathologies

Bi-variate logistic regression was performed to assess the association of each independent variable with the outcome variable and analysis revealed that age, sex, institution, year of residency, year of experience as general practitioner, CXR reading lectures, bedside/morning session teaching on CXR and from whom was those activities showed a p value of <0.2. In multivariate logistic regression older residents(36-40 years) and higher year of residency(PGY-3) showed statistically significant association with competency of identifying **≥7** CXR pathologies, even after controlling for other factors.

Among the characteristics examined, the study revealed a statistically significant association between age and CXR interpretation competency. Older residents (36-40 years) were approximately 14 times higher odds of being competent compared to younger residents (25-30 years) (OR: 14.30, 95% CI: 1.58-131.86, p=0.019). While no significant gender-based difference was observed.

Third-year residents (PGY3) were significantly more likely to be competent in CXR interpretation compared to second-year residents (PGY2). This was statistically significant with a p-value of 0.006 and approximately 4 times higher odds of being competent than second-year residents (OR: 4.11, 95% CI: 1.49-11.34). This suggests that with additional training and experience, residents' CXR interpretation skills improve.

No significant association between CXR interpretation competency and the institution of training, years of experience as a general practitioner, Bed side/morning session teaching in CXR reading or attendance of CXR reading lectures. While these factors were not found to be significant predictors of competency in this study.

The following table presents the results of a study investigating the association between various characteristics of residents and their competency of identifying CXR pathologies.

Factors associated with identifying CXR pathologies among Emergency and critical care residents

Characteristics		Score of CXR images Questions				
		Competent	Incompetent	COR95%CI	AOR 95%CI	P-Value
Sex	Male	29(28.2%)	49(47.6%)	Reference	Reference	
	Female	12(11.7%)	13(12.6%)	1.560(0.628-3.87)	1.132(0.392-3.269)	0.819
Age	25-30	31(30.1%)	35(34%)	Reference	Reference	
	31-35	7(6.8%)	25(24.3%)	3.163(1.202-8.324)	2.361(0.216-25.806)	0.481
	36-40	**3(2.9%)**	**2(1.9%)**	**0.590(0.093-3.768)**	**14.330(1.558-131.836)**	**0.019**
Institution	AAU	17(16.5%)	26(25.2%)	Reference	Reference	
	SPHMMC	16(15.5%)	20(19.4%)	0.817(0.333-2.026)	1.093(0.248-4.817)	0.907
	JUSH	6(5.8%)	9(8.7%)	0.981(0.295-3.257)	2.827(0.454-17.602)	0.265
	HFCSH	2(1.9%)	7(6.8%)	2.288(0.424-12.365)	1.712(0.600-4.885)	0.315
Year of residency	**PGY 3**	**30 (29.1%)**	**27(26.2%)**	Reference	Reference	
	PGY 2	**11(10.7%)**	**35(34%)**	**3.535(1.505-8.305)**	**4.114.(1.492-11.341)**	**0.006**
Year of experience as general practitioner	> 3	14(13.6%)	26(25.2%)	Reference	Reference	
	< 3	27(26.2%)	36(35%)	1.393(0.614-3.160)	2.058(0.516-8.199)	0.306
CXR reading lectures	Yes	5(4.9%)	11(10.7%)	Reference	Reference	
	No	36(35%)	51(49.5%)	1.687(0.654-20.124)	1.385(0.448-4.283)	0.571
Bed side/morning session teaching in CXR reading	Yes	28(27.1%)	34(33%)	Reference	Reference	
	No	13(12.6%)	28(27.2%)	1.774(0.776-4.053)	1.211(0.259-5.659)	0.808

6. **Discussion**

Our findings revealed poor competency in interpreting CXR. The current study found a significant association between age and competency in interpreting chest X-rays among Emergency and Critical Care Medicine residents in Ethiopia, with older residents (aged 36-40 years) being approximately 14 times more likely to demonstrate competency compared to their younger peers (aged 25-30 years). Age related differences in competency have been documented in various studies. For instance, a study evaluating CXR interpretation across different training levels indicated that increased years of training correlate with improved diagnostic accuracy, particularly when participants had exposure to formal radiology education(23)(11). The ability of family medicine residents to interpret CXRs for emergency conditions was evaluated in another study published in 2021; although it did not directly link age to competency, it did show that proper training, not just years of experience, had an impact on diagnostic accuracy. The findings suggest that while age may play a role, structured training and exposure to clinical scenarios are critical for developing interpretation skills(17). The current study's findings indicated a strong correlation between year of residency and the ability to recognize CXR abnoralities. The results of this study indicate that third-year residents (PGY3) are significantly more likely to demonstrate competency in interpreting chest X-rays (CXR) compared to second-year residents (PGY2), with an odds ratio of 4.11 and a p-value of 0.006 which aligns with existing literature that consistently shows an improvement in diagnostic skills as medical trainees progress through their residency programs. A research involving internal medicine residents showed that those who had recived more training demonstrated superior performance on CXR tests, with mean scores of around 70% for residents, 50% for interns, and 45% for medical students. These differences were statistically significant ($p < 0.01$)(11).

Additionally, they demonstrated that formal training programs resulted in better performance, with those who received structured teaching averaging 80% against 60% for those who did not receive such training. These findings imply that while residency year and age have an impact on competency, training quality and clinical experience are just as important. A statistically significant difference was observed ($p < 0.01$).

Acording to a study, more clinical exposure improved participants' performance on CXR interpretation exams.Those with extensive clinical exposure had a mean score of 75%, while those with limited exposure scored around 55%. these difference was statistically significant ($p < 0.05$)(18). Our results that PGY3 residents are significantly more skilled than PGY2 residents are corroborated by more general patterns in medical education that highlight the importance of experience, clinical exposure, and organised training in improving diagnostic abilities across the board for medical professionals. This is the first study which investigated the competency of emergency and critical care residents in Ethiopia in interpreting emergency chest X-rays. A number of residents accepted the offer and valued the opportunity to obtain the right responses following the completion of the study. A unique invitation link that could not be used more than once demonstrated that the study did not contain duplicate responses, and daily reminder SMS texts helped to obtain a decent response rate. The study also done in four teaching hospitals in Ethiopia making a multi-center study.Another strength of our study is providing clinical information in the study enhances test interpretation as demonstrated in systematic review of 16 articles(24).

Our study includes a number of limitations first, Residents were assessed by using an online survey with increased rate of guessing factor and unrestricted time to answer it might affect the results. Second there is no certainty about whether the residents used extra resources or discuss questions among themselves to answer the questions. The test questionnaire featured multiple choice questions(MCQ) so it might create the potential for answer guessing.The other limitation of this study is it doesn't include ECCM consultants, medical interns, internal medicine residents and radiology residents.

8. CONCLUSION

In summary, the overall competency of ECCM residents in interpreting emergency CXR is low in four teaching hospitals in Ethiopia. The results of the current study found a statistical significant relationship between year of residency and age.

9. RECOMMENDATION

We recommend that medical education institutions enhance organized training programs focused on practical experience in chest X-ray (CXR) interpretation, particularly for junior residents. This should include the incorporate of clinical histories and case-based learning to improve diagnostic accuracy. Since this is the first study in our nation and Africa among ECCM residents, more research will be needed to improve the study's limitations and long-term impacts of these training initiatives and the effectiveness of various teaching methods on improving CXR interpretation skills across different regions and hospitals in Ethiopia.

10. REFERENCE

1. published JL. livescience.com. 2018 [cited 2024 May 9]. What Are X-Rays? Available from: https://www.livescience.com/32344-what-are-x-rays.html

2. Tubiana M. [Wilhelm Conrad Röntgen and the discovery of X-rays]. Bull Acad Natl Med. 1996 Jan;180(1):97–108.

3. Satia I, Bashagha S, Bibi A, Ahmed R, Mellor S, Zaman F. Assessing the accuracy and certainty in interpreting chest X-rays in the medical division. Clin Med Lond Engl. 2013 Aug;13(4):349–52.

4. Speets AM, van der Graaf Y, Hoes AW, Kalmijn S, Sachs AP, Rutten MJ, et al. Chest radiography in general practice: indications, diagnostic yield and consequences for patient management. Br J Gen Pract J R Coll Gen Pract. 2006 Aug;56(529):574–8.

5. Kanne JP, Thoongsuwan N, Stern EJ. Common Errors and Pitfalls in Interpretation of the Adult Chest Radiograph. Clin Pulm Med. 2005 Mar;12(2):97.

6. Bennani S, Regnard NE, Ventre J, Lassalle L, Nguyen T, Ducarouge A, et al. Using AI to Improve Radiologist Performance in Detection of Abnormalities on Chest Radiographs. Radiology. 2023 Dec;309(3):e230860.

7. Lind Plesner L, Müller FC, Brejnebøl MW, Laustrup LC, Rasmussen F, Nielsen OW, et al. Commercially Available Chest Radiograph AI Tools for Detecting Airspace Disease, Pneumothorax, and Pleural Effusion. Radiology. 2023 Sep;308(3):e231236.

8. Ahn JS, Ebrahimian S, McDermott S, Lee S, Naccarato L, Di Capua JF, et al. Association of Artificial Intelligence-Aided Chest Radiograph Interpretation With Reader Performance and Efficiency. JAMA Netw Open. 2022 Aug 1;5(8):e2229289.

9. Brunswick JE, Ilkhanipour K, Seaberg DC, McGill L. Radiographic interpretation in the emergency department. Am J Emerg Med. 1996 Jul;14(4):346–8.

10. Gatt M, Spectre G, Paltiel O, Hiller N, Stalnikowicz R. Chest radiographs in the emergency department: is the radiologist really necessary? Postgrad Med J. 2003 Apr;79(930):214–7.

11. Eisen LA, Berger JS, Hegde A, Schneider RF. Competency in chest radiography. A comparison of medical students, residents, and fellows. J Gen Intern Med. 2006 May;21(5):460–5.

12. Al Aseri Z. Accuracy of chest radiograph interpretation by emergency physicians. Emerg Radiol. 2008 Oct 1;16:111–4.

13. Espinosa JA, Nolan TW. Reducing errors made by emergency physicians in interpreting radiographs: longitudinal study. BMJ. 2000 Mar 18;320(7237):737–40.

14. Mohammed MS, Finot Debebe Y, Tumebo AA. The status of emergency medicine in Ethiopia, challenges and opportunities. Ethiop Med J Online. 2018;119–24.

15. Medical Interns' Skill Levels in Emergency Chest X-ray Interpretation | Saudi Journal of Radiology. 2024 Mar 25 [cited 2024 May 1]; Available from: https://saudiradiology.com/index.php/home/article/view/163

16. Samara O, AlRyalat SA, Malkawi L, Ali MB, Kilani A, Alkhalaileh Z, et al. Assessment of final-year medical students' performance in diagnosing critical findings on chest X-ray. Emerg Radiol. 2021 Apr;28(2):333–8.

17. Al Shammari M, Hassan A, AlShamlan N, Alotaibi S, Bamashmoos M, Hakami A, et al. Family medicine residents' skill levels in emergency chest X-ray interpretation. BMC Fam Pract. 2021 Feb 17;22(1):39.

18. Christiansen JM, Gerke O, Karstoft J, Andersen PE. Poor interpretation of chest X-rays by junior doctors. Dan Med J. 2014 Jul;61(7):A4875.

19. Fabre C, Proisy M, Chapuis C, Jouneau S, Lentz PA, Meunier C, et al. Radiology residents' skill level in chest x-ray reading. Diagn Interv Imaging. 2018 Jun;99(6):361–70.

20. Rudolph J, Huemmer C, Ghesu FC, Mansoor A, Preuhs A, Fieselmann A, et al. Artificial Intelligence in Chest Radiography Reporting Accuracy: Added Clinical Value in the Emergency Unit Setting Without 24/7 Radiology Coverage. Invest Radiol. 2022 Feb 1;57(2):90–8.

21. Dreyer RG, van der MCM, Nicolaou MA, Richards GA. Assessing and comparing chest radiograph interpretation in the Department of Internal Medicine at the University of the Witwatersrand medical school, according to seniority. Afr J Thorac Crit Care Med. 2023 Apr;29(1):12–7.

22. View of Assessment of the skill of pediatric residents in interpreting emergency pediatric radigraphs | Ethiopian Medical Journal [Internet]. [cited 2024 May 8]. Available from: https://emjema.org/index.php/EMJ/article/view/1634/708

23. Jimah BB, Appiah AB, Sarkodie BD, Anim D. Competency in Chest Radiography Interpretation by Junior Doctors and Final Year Medical Students at a Teaching Hospital. Radiol Res Pract. 2020 Nov 6;2020:8861206.

24. Loy CT, Irwig L. Accuracy of diagnostic tests read with and without clinical information: a systematic review. JAMA. 2004 Oct 6;292(13):1602-9. doi: 10.1001/jama.292.13.1602. PMID: 15467063.

11. ANNEXES

Annex 1: Information and consent form

I, Dr. Misiker W/kidan, am a third-year resident specializing in Emergency & Critical Care Medicine. At present, I am engaged in a research endeavor titled "Competency in interpreting emergency CXR among Emergency & Critical Care Residents in Ethiopia." The primary aim of this study is to meticulously evaluate the competency in the interpretation of CXR within our esteemed field.

The goal of the questionnaire is solely academic and is designed to gather information about your experience with CXR interpretation. The information gathered will only be utilised for this research. Your answers won't have any bearing on you, and confidentiality will be rigorously maintained. The success and progress of this study depend on your valued participation. But it's all voluntary. If you decide not to participate in the study, you can do so at any time. I extend my sincere gratitude in advance for your invaluable cooperation. Should you require any clarification or wish to communicate further, please do not hesitate to reach out using the provided contact details.

Respectfully

Dr. Misiker W/kidan

Tel: +251922769225

Email: Supermisker@gmail.com

Contact information for complaint: If you have any concern that the research team is conducting their activities unethically or inappropriately, please contact Addis Ababa University, College of Health Sciences, Department of Emergency and Critical Care Medicine, at the following address:

Email: emergencymedicine.som@aau.edu.et

If you agree to participate in this study, I appreciate your truthfulness.

Are you willing to participate in this study? Yes [] No []

Annex 2: Questionnaires(17, 21)

Part – I

Directions: Please place a mark on the given spaces, encircle choices, and write comments accordingly. You can skip any questions that you feel do not apply to you. Thank you!

1. Age…….

2. Sex: A. Male B. Female

3. Where are you doing your postgraduate training?

A. AAU C. JUSH

B.SPHMMC D.HFCSH

4. Year of a residency training program?

A. PGY2 B. PGY3

5. Year of experience as a General practitioner?

A. <5 B. >5

6. Did you have any CXR reading training in post graduate program?

A. Yes

B. No

If your answer is yes for Q. No 6, can you mention the estimated number of hrs? Allocated for training? ……

7. Did you have any CXR reading lectures in your residency program?

A. Yes B. No

If your answer is yes in Q. No. 6, when did you take the lecture?

If your answer is yes in Q.No.6, did you attend all classes?

A. yes B. No

Do you think the CXR class was enough?

A. Yes B. No

8. Do you have any radiology department attachments in your residency?

A. Yes B. No

If your answer is Yes in Q. No.7, can you mention the number of rotations? (in a month)……

9. Have you ever had bedside teaching/morning sessions in CXR reading?

A. Yes B. No

If your answer is yes in q.9. With whom do you have these activities frequently?

A) From senior resident
B) From EMCC consultant

If your answer is yes to Q 9 how do you rate these activities?

A. Excellent

B. adequate but some changes are needed

C. adequate but no major change needed

D. substantial change is needed

10. Do you think CXR reading is difficult?

A. Yes B. No

11. Where do you go to get help with the difficulty of CXR readings? (More than one answer possible)

A. radiologist
B. Emergency physician
C. Emergency senior residents
D. my peers.
E. references
F. other……

12. How frequently CXR do you see per month?

A. <5 B. 5-10 C. > 10 times D. Not at all

13. How confident you are in the interpretation of CXR?

A. Very confident
B. Not confident
C. Neutral

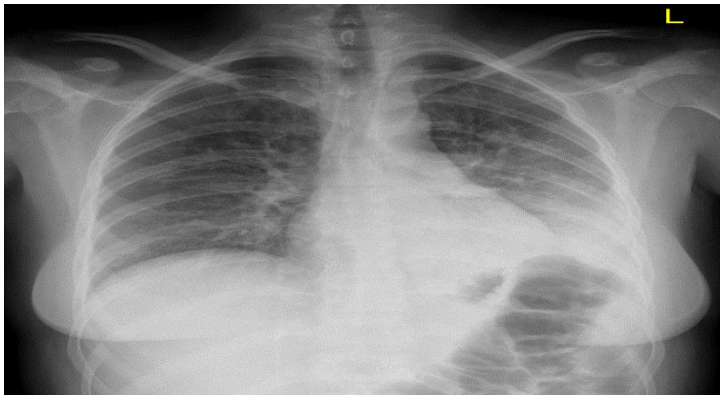
14. How frequently did you ask for help with the interpretation of CXR?

A. Rarely B. Sometimes C. Always D. Not at all

Part Two: CXR image test(21,17)

The survey included a series of 10 cases that started with a brief clinical scenario and a chest X-ray image followed by a multiple-choice question asking for the most likely diagnosis. Choose one that applies.

1. A 50 year old female patient presented to ED with a complaint of productive cough and pleuritic chest pain of 3 days duration. He has tachycardia of 110 and a fever of 380C. His CXR is shown below.
   What is the most likely diagnosis?



A. Normal CXR
B. Left lower lobe collapse
C. Left lower lobe pneumonia
D. Left pleural effusion

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident

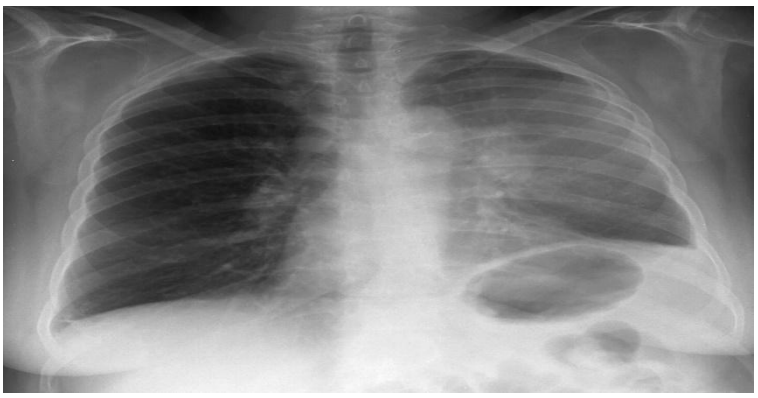
B. Somehow confident

C. Neutral

D. Very unconfident

E. Somehow unconfident

2. A 60 year old female known asthmatic presented to ED with a complaint of increased wheezing and dyspnea. On examination, her saturation is 84$ off O2. She has scattered wheeze all over the chest with reduced air entry bilaterally. Her CXR is shown below. What is the most likely diagnosis?



A. Pleural effusion
B. Left upper lobe collapse
C. Pneumothorax
D. Pneumonia

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident

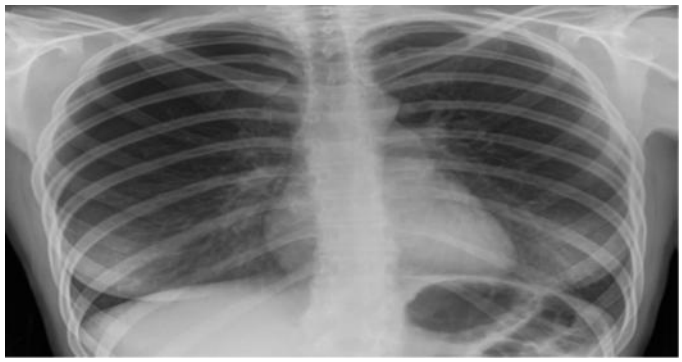
B. Somehow confident

C. Neutral

D. Somehow unconfident

E. Very unconfident

3. A 22 year old male patient presented to ED after he sustained a Motor vehicle accident 30 min back. He has a history of shortness of breath. He has tachypnea. Saturation is 80% off O2. CXR is shown below. What is the most likely diagnosis?

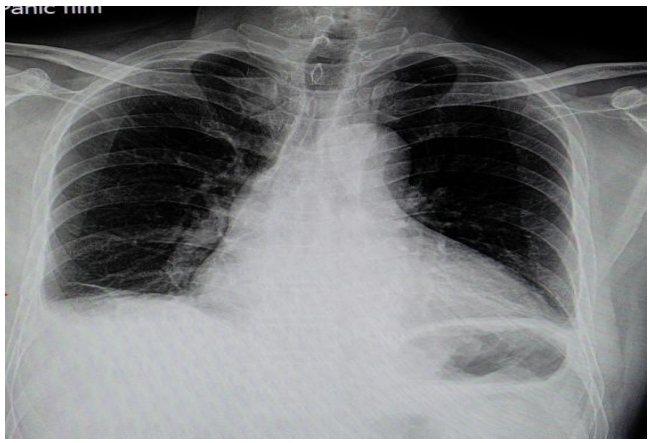


A. Normal CXR
B. Pneumothorax
C. Hemothorax
D. Flail chest

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. Somehow unconfident
E. Very unconfident

4. A 30 year old male patient presented after sustaining a Road traffic accident 20 minutes before the presentation. On examination he is agitated, has Tachypnea to a level of 28 and desaturates to a level of 88%. Chest auscultation is difficult to appreciate. CXR is shown below. What is the most likely diagnosis?



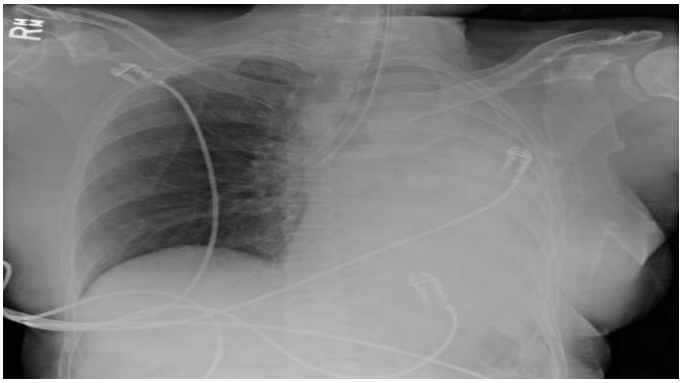
A. Normal CXR
B. Pneumothorax

C. Right Hemothorax
D. Left pneumothorax

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. Somehow unconfident
E. Very unconfident

5. A 30 year old male patient was intubated for airway protection to undergo the elective surgical procedure. Post-intubation CXR was taken and shown below. What is the most likely diagnosis?

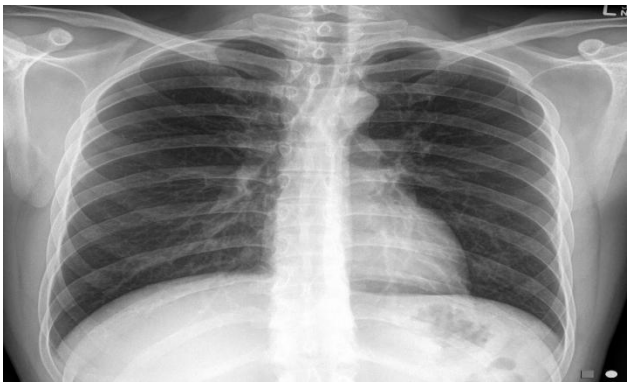


A. Left side massive effusion
B. Left side chest mass
C. Right main stem intubation
D. Left pneumothorax

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. Somehow unconfident
E. Very unconfident

6,A 50 year old female patient presented to ED with a complaint of productive cough and low-grade fever of 2 days duration. He has tachycardia of 100 and a fever of 36.50C. His CXR is shown below. What is the most likely diagnosis?

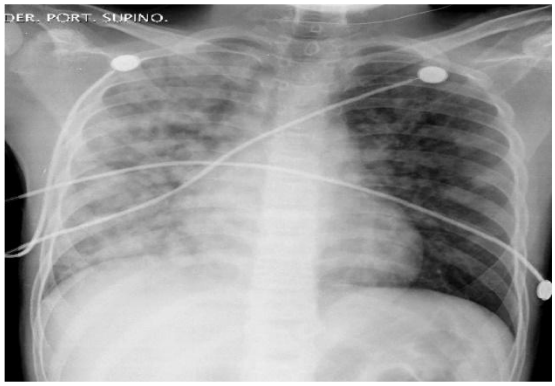


A. Normal CXR
B. Left lower lobe collapse
C. Left lower lobe pneumonia
D. Left pleural effusion

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. Somehow unconfident
E. Very unconfident

7. A 45 year old male patient presented with 1 day history of shortness of breath and productive cough of whitish sputum. On examination, he has a respiratory rate is 34. Saturation is 75% in room air. Chest examination is full of crepitation over the bilateral chest. CXR is shown below. What is the most likely diagnosis?



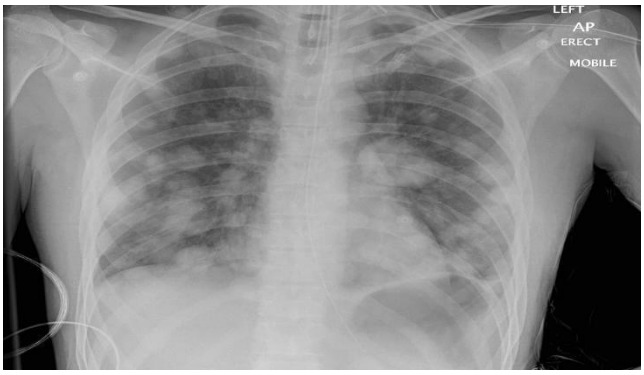
A. Pulmonary edema

B. Lung metastasis
C. Right side pneumonia
D. Pulmonary TB

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. somehow unconfident
E. Very unconfident

8. A 26 year-old male, with no previous history of seizures, was brought in by ambulance in status epilepticus. He was intubated for seizure management with propofol and clonazepam infusions. chest XR was performed:
What is the most likely diagnosis?

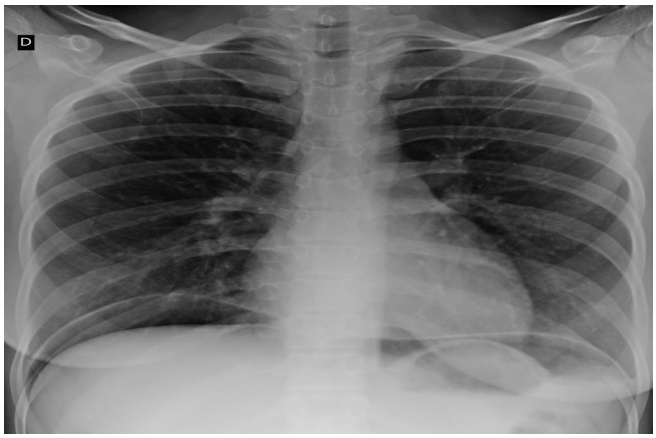


A. Pulmonary edema
B. Cannonball lesion
C. Right side pneumonia
D. Pulmonary TB

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. somehow unconfident
E. Very unconfident

9. A 56-year-old man presented to the ED with progressive abdominal pain of one day's duration. He has vomiting and constipation. Abdominal examination reveals distended but soft, with mild diffuse tenderness. CXR is shown below.
What is the most likely diagnosis?

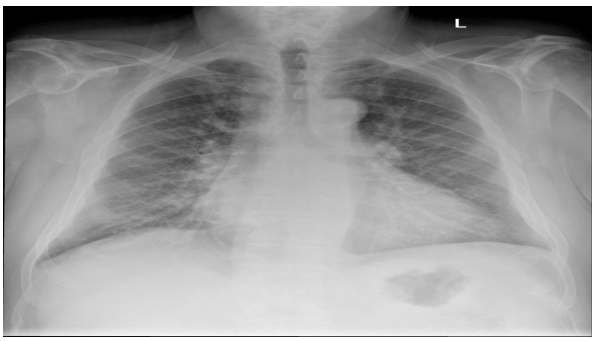


A. Normal CXR
B. Pleural effusion
C. Pneumoperitoneum
D. Congestive heart failure

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. Somehow unconfident
E. Very unconfident

10. A 65 year old male patient presented to ED with 3 day history of shortness of breath at rest, Orthopnea, PND, and lower extremities edema. He is normotensive, tachycardic, and desaturated to a level of 88% on room air. CXR is shown below. What is the most likely diagnosis?



A. Pulmonary edema
B. Bilateral Pleural effusion
C. Pneumoperitoneum
D. Congestive heart failure

How do you rate your degree of confidence in interpreting the CXR?

A. Very confident
B. Somehow confident
C. Neutral
D. Somehow unconfident
E. Very unconfident

Approval

This is to certify that the proposal entitled "A cross-sectional study on competency in interpretation of emergency CXR among Emergency and Critical Care Medicine residents in Ethiopia" by Dr. Misiker W/kidan for partial fulfillment of the requirement for the degree of specialty certificate of Emergency and Critical Care complies with the regulations of the university and meets the accepted standards concerning originality and quality which was carried out under advisors Dr. Merhai kefyalew, Dr. Meron Tesfaye

Advisors' Name:	Signature	Date
Dr. Merhai Kefyalew	_____	_____
Dr. Meron Tesfaye	_____	_____