ADDIS ABABA UNIVERSITY
COLLEGE OF HEALTH SCIENCES,
DEPARTMENT OF RADIOLOGY

A Cross-sectional Study on Chest Radiograph Interpretation by Medical Interns and First Year Residents

INVESTIGATOR:
GIRMA LOBE (MD, RADIOLOGY RESIDENT)

ADVISORS:

AZMERA GISSILA, (MD, ASSOCIATE PROFESSOR OF RADIOLOGY IN AAU, COLLEGE OF HEALTH SCIENCES, TASH, DEPARTMENT OF RADIOLOGY, AA, ETHIOPIA.

AMIR ALWAN, MD, ASSOCIATE PROFESSOR OF RADIOLOGY, AAU, COLLEGE OF HEALTH SCIENCES, TASH, DEPARTMENT OF RADIOLOGY, AA, ETHIOPIA.

A thesis Submitted to The Radiology Department, College of Health Science, Addis Ababa University in Preparation for Partial Fulfillment of the Requirements for the Post Graduate Study Completion in Radiology.

DECEMBER, 2020

ADDIS ABABA, ETHIOPIA

A Cross Sectional Study on Chest Radiograph Interpretation by Medical Interns and First Year Residents

ABSTRACT

Background: Accurate interpretation of chest radiographs (CXR) is essential as clinical decisions depend on readings.

AIM: To assess the ability of medical interns and first year residents of internal medicine, emergency medicine and surgery to interpret conventional chest radiographs.
MATERIALS AND METHODS: Ten conventional chest radiographs were selected that were good radiological examples of emergency and common medical conditions.
Most were conditions that a first line medical professional should be expected to recognize by the end of their training. One normal radiograph was included. The radiographs were shown to 49 medical interns and 31 first year residents of emergency medicine, surgery and internal medicine who were asked to describe their findings and write their most likely diagnosis, certainty about their diagnosis.
The response for each radiograph was scored on a scale of 0 to 2.

*RESULTS: The median score achieved was 8 of 20 (range 1-14). An increased level of training was not associated with overall score (Interns 8.1, EM 1st year residents 8.1, IM 1st year residents 8.2 surgery 1st year residents p=0.279). The overall degree of certainty was low. On no radiograph were more than 35% of participants definite about their answer. The overall certainty of the participants was significantly correlated with the overall score (r=.283 p<0.011). Seventy percent of the participants thought they were good at interpreting chest radiographs. The department of the residents has significant correlation with diagnosis of the pneumothorax with p < 0.01. Left lower 1*lobe collapse, lung metastasis, right upper lobe TB, left pneumothorax were correctly diagnosed 2.4%, 8.5%, 22% and 52.4% of the time, respectively.
CONCLUSION: First line physicians do not perform well at interpreting simple chest radiographs. We identified only the level of certainty has significant association with successful chest radiograph interpretation. Interestingly, significant number of the interns and even many residents training in different department showed good interest in radiology as a career, which may help provide training for them and improve their chest radiograph reading skill.

Dedication

This research paper is dedicated for those who teach their knowledge and skill generously for the better care of patients.

ACKNOWLEDGEMENTS

I would like to appreciate the department of radiology, CHS, Addis Ababa University for giving me the chance to undertake this research.

I would like to express my deepest gratitude to my advisors DrAzmeraGissila and Dr. Amir Alwan for their valuable and constructive comments during topic selection, proposal development, data collection and analysis.

I am also thankful to my families, colleagues and friends who helped me in searching and providing the necessary literatures, as well as data.

The last but not the least I would like to thank medical interns and first year residents of the emergency medicine, surgery and internal medicine departments for their willingness to participate in this study.

TABLE OF CONTENT

Contents Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER ONE

Introduction

1.1 Background

Despite advances in imaging modalities, conventional chest radiographs are perhaps the most commonly requested radiological examinations. Swiftly, inexpensively, and with a high degree of accuracy the CXR enables the physician to detect or rule out numerous disorders, diseases and abnormalities. It will also help to exclude several serious therapeutic complications. A normal CXR will time and again provide valuable clinical reassurance. The CXR remains the most appropriate examination in many circumstances, it is a bedrock imaging test. (1, 2)

1.2. Statement of the Problem and Significance of the Study

Accurate interpretation of chest radiographs (CXR) is essential as clinical decisions depend on readings. (3) The inadequate number of radiologists particularly in Ethiopia makes treatment of chest conditions difficult if clinicians have no adequate skill to interoperate at least emergency CXR.

As part of medical training, medical students in Ethiopia have formal radiology course for 3 weeks at their second clinical year. Residents of surgery department have 1 month formal radiology training but residents of EM and IM have no formal radiology training in their curriculum. They are also exposed to chest x-ray interpretation in their ward rotations and are expected to have adequate skill at the end of the medical education.

General practitioners work independently in many institutions and usually read chest x-ray and decide by themselves where they cannot get radiologists for consultation. Even in institutions with radiologists, while some decisions can await a formal radiology report, others need to be made acutely, often out of hours, without the input of a radiologist. So first line medical professionals are expected to be competent in interpreting common and life threatening medical conditions in the chest using CXR. This study tries to see whether this expectation is met or not.

CHAPTER TWO

2.1. Literature Review

Many published literatures demonstrate deficiencies in chest x ray interpretation by medical students. In 2002, D. R. JEFFREY et al in Bristol Royal Infirmary, UK did a research to assess the

skills of the final year medical students in the interpretation of the conventional chest radiographs and found out that medical students reaching the end of their training do not perform well at interpreting simple chest radiographs. They lack confidence and have received little formal radiological tuition. Perhaps as a result, few are interested in radiology as a career, which is a matter for concern in view of the current shortage of radiologists in the UK. (1)

From May 2000 to August 2001, Jac D. Scheiner, MD, et al at Rhode Island Hospital investigated 3rd- and 4th-year medical students enrolled in the radiology clerkship before and after completing their radiology clerkship. They included only students who had already completed both medicine and surgery clerkships in this prospective study. They found out that learning to identify life-threatening abnormalities on conventional chest radiographs through medicine and surgery clerkships is insufficient. After comparing the performance of the students, they concluded that the radiology clerkship provides a unique educational experience that significantly improves these abilities. (4)

There was a study which took place at Beth Israel Medical Center, New York USA, to evaluate CXR interpretation ability at different levels of training (Medical students, interns, IM resident, fellows, radiology resident) and to determine factors associated with successful interpretation. Their findings were that an increased level of training was associated with overall score which increases as the level of training increases. Overall certainty was significantly correlated with overall score Internal medicine interns and residents interested in a pulmonary career scored higher than those not interested. Only small proportion (15%) participants felt their CXR training sufficient. (3)

In October 2008, Vania Maria Carneiro da Silva et al did a study to evaluate competence of senior medical students in diagnosing tuberculosis based on chest X-rays at the Federal University of Rio de Janeiro School of Medicine, in the city of Rio de Janeiro, Brazil. They found out that for

medical students, who had received formal training in radiology early in their medical school course, the competence in interpreting the chest X-rays of TB patients was good.

The year of study seems to influence overall chest X-ray reading skill. (5)

Between January 20, and February 30, 2015, a survey was done on medical interns and general practitioners in ShahidBeheshti University of Medical Sciences, one of the largest medical schools in Tehran, Iran by GhazalehMehdipoo et al. They did study on 100 candidates of which 67 were medical students and 33 were GPs. The lowest rate of correct response occurred for acute respiratory distress syndrome, foreign body, and normal CXR, while the best-answered vignettes were diaphragmatic herniation and pneumoperitoneum. Self-reported confidence was associated with correct response for pneumoperitoneum, tension pneumothorax, and pulmonary edema. They concluded that diagnostic proficiency of practitioners for acute chest pathologies in their study was poor, including for distinction of a normal CXR. (6)

CHAPTER THREE

3.1 Objectives

3.1.1 General objective

- To assess competency of medical interns and first year residents in the department of emergency medicine, internal medicine and surgery on interpretation of chest radiograph

3.1.2 Specific objectives

- To assess skills of medical students competence in interpreting some emergency and common medical conditions using CXR
- To identify factors that affect success in interpreting chest radiograph

CHAPTER FOUR

MATERIALS AND METHODS

4.1 Study area and period

The study took place at TikurAnbesa comprehensive specialized Hospital from April to September 2020. TASH, located in Ethiopia's capital Addis Ababa, is the largest referral center for patients with over 900 beds.

4.2 Study Design

A prospective cross sectional study will be employed by providing self-administered questionnaire.

The main reason why we could not get more participants some of the participants were not willing to fill and return the questionnaire.

4.3 Population

4.3.1 Source population

The source population will be all medical interns and first year residents in the department of the emergency medicine, internal medicine and surgery in TikurAnbessa Hospital, Ethiopia during study period.

4.3.2 Study population

The study population will be all volunteer medical interns and first year residents in the department of the EM, IM and surgery the hospital during study period.

4.3.3 Inclusion and exclusion criteria

4.3.3.1 Inclusion criteria

- Being an intern or first year resident in the department of the EM, IM and surgery interns in TASH in the study period.

4.3.3.2 Exclusion criteria

- Medical interns and first year residents in the department of the EM, IM and surgery not

willing to participate in the study.

4.4 Sampling technique and sample size

All first year resident in the department of the EM, IM and surgery interns in TASH in the study period.

4.5 Data collection

A self-administered questionnaire containing 10 radiographs in print out and soft copy form was provided and they were asked to give a diagnosis or differential diagnosis for each radiograph. They were blinded to any clinical information except for sex and age or previous radiographs.

Table 1: illustrates the radiographs included in the study.

No	Diagnosis
1	Left tension pneumothorax
2	LLL collapse
3	Right lung mass
4	Cardiogenic pulmonary edema
5	Lung metastasis
6	Pneumoperitoneum
7	Normal
8	Right upper lobe tuberculosis
9	Aspergillosis
10	Pleural calcification

The participants were asked to indicate their degree of certainty for each answer. It was explained that not all the radiographs were necessarily abnormal. There was no limitation on the time allowed for viewing. The participants were also asked to fill in a questionnaire that included questions about their interest in radiology as a career and if they have any formal radiology department teaching they had received during their training.

4.6 Data quality control

Ten conventional chest radiographs were selected by the adviser who is a subspecialist in cardiothoracic radiology and principal investigator who is a third year radiology resident. Five of the CXR images have chest CT to cross check the findings and the rest have no chest CT but their

findings are grossly visible to make diagnosis based on only CXR. One radiograph was normal. Most of the abnormal radiographs were chosen to represent good examples of conditions that a medical intern or first year residents should be able to diagnose by the knowledge and skills they acquired during their training. Each radiograph had only one overwhelmingly likely diagnosis or a short list of differential diagnoses.

4.7 Data analysis and interpretation

The data was checked for clarity and completeness. SPSS version 26 software package was used for analysis. The continuous variable was skewed (non-normally distributed) so we used median to describe continuous variables.

The analysis included both an investigation of the participants' response to individual CXR and the use of scores which combined the results from the 10 radiographs.

Overall score ranges from 0-20 as each student was awarded a score between 0 and 2 for each radiograph whereby 0 = incorrect answer, 1 = partially correct answer (for example correct description of findings but incorrect diagnosis), 2 = completely correct answer. Most participants wrote something for each radiograph with 30 missing data.

Overall certainty: each participant rated each of their answers on a five point score that ranged from 0 (guessing) through (25% sure), through 2 (50% sure) 3 (75% sure) up to 4 (definite). These certainties were then summed to produce an overall certainty score which could theoretically range from 0 to 40, the higher the score the more certain the student was of their answers. The certainty data were not filled in appropriately in 20 out of 640 items (3.1%).

Both parametric and non-parametric statistics were used and parametric statistic were used whenever p-value were required. A p-value of less than 0.05 was taken to mean a statistically significant result. To investigate associations between categorical variables chi-square test was used, between continuous variables Pearson coefficient of correlation was used, and between continuous and ordinal categorical variables Spearman's rank correlation coefficient.

4.8 Ethical Considerations

Approval for the study was granted by the Health Science College's Research Ethics Committee.

4.9.The limitations of the study

First, the number of sample chest radiographs chosen for the survey was small.

Second, there were images with difficult findings which might be missed by expert radiologists were included.

Third, clinical information except for age and sex was not provided. It is known in many researches that interpretation improves if clinical information is provided. But the intension is to avoid guessing of the diagnosis based on clinical data. The intention of the study is to evaluate the skill of first line clinicians based on imaging findings only.

Additionally, there were low number of residents participated in the study.

RESULTS

Eighty participants included in the study, 55 men and 25 women. Among there participants 49 were medical interns and 31 were First year residents of surgery, internal medicine and emergency medicine residents in Addis Ababa University College of Health Sciences, TikurAnbessa Comprehensive Specialized Hospital. Of the 31 first year residents 9 were from emergency medicine, 11 were surgery and 11 were from the internal medicine.

The median score achieved by the entire group was 8/20 (range 1-14; Fig.1). The median score was not correlated with the level of training (8/20 for residents and interns). The median score of the participants is not significantly correlated with the sex of the participants (8 and 9 for male and female, respectively with p=0.35). There is no significant correlation between department of the residents and the overall score with r=0.022 and p=0.884 using Spearman's test.

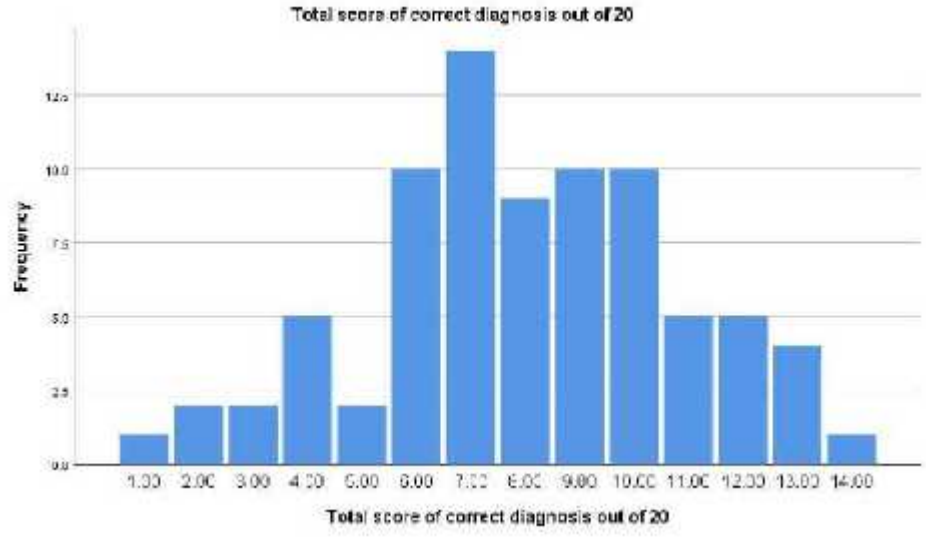


Figure 1 Frequency bar graph for score of the participants

The median overall certainty among the entire cohort was 23/40 (range 13-26). Overall certainty was not associated with level of training (Table 2). Although first year surgery residents scored highest overall score, they were least certain in their diagnosis. The field of the study for the residents has no correlation with overall certainty (r= -0.267, P =0.147). Using Spearman's rank correlation coefficient, there was a significant correlation between any individual's overall degree of certainty about their answers and their overall score of r = 0.276, p = 0.013; indicating that the students who achieved more right answers were more certain about those answers. Male students were more likely to be certain of their answer than female with median certainty scores of 24.2.0

and 21.7, respectively. This was significant using a Mann-Whitney U test with r=0.235, p =0.036.

Table 2: Score and Certainty for the Chest Radiographs by Level of Training

No	Diagnosis	Score and	Interns	EM	IM	Surger	P
1	Lefttension pneumothorax	Score	1.3	0.67	0	1.45	0.001
		Certainty	2.6	2.2	2.1	2.8	0.093
2	LLL collapse	Score	0.12	0	0.10	0	0.827
		Certainty	2.26	2	2	1.5	0.35
3	Right lung mass/ Massive pleural	Score	1.9	2	2	1.5	0.15
		Certainty	2.9	3	3.3	2.6	0.30
4	Cardiogenic pulmonary edema	Score	1.2	1.6	1.1	1.0	0.576
		Certainty	2.4	2.7	2.3	2.4	0.751
5	Lung metastasis	Score	0.41	0.33	0.91	0.22	0.001
		Certainty	3.9	2.22	3.0	2.45	0.315
6	Pneumoperitoneum	Score	1.3	1.5	1.1	1.6	0.035
		Certainty	2.5	2.7	2.5	2.6	0.515
7	Normal	Score	0.43	0.11	1.0	0.6	0.192
		Certainty	2.2	1.7	2.2	1.1	0.532
8	Right upper lobe tuberculosis	Score	1.1	1.0	1.0	1.0	0.933
		Certainty	2.4	2.2	2.5	2.2	0.684
9	Aspergillosis	Score	0.18	0.56	0.36	0.45	0.164
		Certainty	1.8	2.2	2.6	1.9	0.032
10	Pleural calcification	Score	0.14	0.33	0.64	0.73	0.00
		Certainty	1.9	2.4	2.5	1.6	0.215
	Overall	Score	7.9	8.0	8.0	8.5	0.591
		Certainty	23.7	23.7	24.3	21.3	0.562

Table 3 also lists the certainty obtained for each CXR. The degree of certainty about answers was low (Table 3).The participants are most definite about their diagnosis on the radiograph of the pneumoperitoneum, 25(31.3%), right lung mass, pneumothorax and right upper lobe TB attracted the highest degrees of certainty (30, 23.8, and 15%, respectively). The participants were most likely to guess the diagnosis of normal chest radiograph, aspergillosis and pleural calcification (8.8% for each, respectively).

Surgery residents scored higher than interns, EM and IM resident. Median overall score was 9 (112) for surgery, 8 (6-10) for IM, 8 (4-12) for EM residents and 8 (2-14) for interns. The department of the residents has no association with their score or certainty. There is significant

correlation between level of training diagnosing of pneumothorax with p=0.001. Medical interns scored better than 1st year residents of EM and IM. The diagnosis of the lung metastasis, pneumoperitoneum and pleural calcification has significant association with level of training with p values of 0.001, 0.035 and less than 0.001, respectively.

Table 3: Likelihood of being certain on each radiograph

No	Diagnosis	Degree of Certainty				
		Guess	**25%**	**50%**	**75%**	**Definite**
1	Left tension	0	9 (11.3%)	32 (40%)	20 (25%)	19 (23.8)
2	LLL collapse	4 (5%)	18 (22.5%)	30 (37.5%)	22 (27.5%)	6 (7.5%)
3	Right lung mass/ Massive pleural effusion		6 (7.5%)	15 (18.8%)	35 (43.8%)	24 (30%)
4	Cardiogenic pulmonary	1 (1.3%)	12 (15%)	27 (33.8%)	33 (41.3%)	7 (8.8%)
5	Lung metastasis	4 (5%)	18 (22.5%)	23 (28.7%)	30 (37.5%)	5 (6.3%)
6	Pneumoperitoneum	3 (3.8%)	7 (8.8%)	22 (27.5%)	23 (28.7%)	25 (31.3%)
7	Normal	7 (8.8%)	12 (15%)	33(41.3%)	19 (23.8%)	9 (11.3%)
8	Right upper lobe tuberculosis	4 (5%)	13 (16.3%)	22 (27.5%)	29 (36.3%)	12 (15%)
9	Aspergillosis	7 (8.8%)	19 (23.8%)	25 (31.3%)	26 (32.5%)	3 (3.8%)
10	Pleural calcification	7 (8.8%)	13 (16.3%)	35 (43.8%)	22 (27.5%)	3(3.8%)

Overall, the best correctly answered images were (table 4) right lung mass, pneumoperitoneum and tension pneumothorax which were correctly diagnosed 90.2%, 63.4% and 52.4% times, respectively. None of the participant correctly diagnosed invasive aspergillosis or pleural calcification.

Table 4: Performance of participants on each chest radiograph

No	Diagnosis	Correctanswer	Partially correct answer	Wrong answer	Missing
1	Left tension pneumothorax	43 (52.4)		36 (43.9)	1
2	LLL collapse	2 (2.4)	3 (3.7)	67 (81.7)	8
3	Right lung mass/ Massive pleural effusion	74 (90.2)	3 (3.7)	3 (3.7)	0
4	Cardiogenic pulmonary edema	28 (34.1)	38 (46.3)	13 (15.9)	1
5	Lung metastasis	7 (8.5)	22 (26.8)	46 (56.1)	5
6	Pneumoperitoneum	52 (63.4)	2 (2.4)	21 (25.6)	5
7	Normal	19 (23.2)		57 (69.5)	4
8	Right upper lobe tuberculosis	18 (22)	48 (58.5)	12 (14.6)	2
9	Invasive Aspergillosis		23 (28)	53 (64.6)	4
10	Pleural calcification		25 (30.5)	54 (65.9)	1

Majority of the respondents expressed interest in radiology as a career. Thirteen (26.5%) of interns were definitely interested in radiology as a career and 25 (51%) were possibly interested but 11 (22.2%) had no interest. Among 31 first year radiology residents, 7 (77.8%) of the emergency medicine and 5 (45%) of the internal medicine residents were definitely interested in radiology as a career but surgery residents are least interested, only 2 (18%). There is no significant correlation between the department of the residents and their interest in radiology as a career (P=0.07). There was also no correlation between whether participants were interested in radiology as a career and either how good they were at interpreting radiographs p= 0.873), or how certain they were of their interpretation (p = 0.840).

Only 2 (2.4%) respondents thought they were excellent at interpreting chest radiographs. Both were first year residents (each from IM and surgery). They actually scored 8 and 12. Majority 56 (68.3%) students thought they were good in interpreting chest radiograph. Twenty-two (26.8%) students thought they were bad or awful in the CXR interpretation skill. Thirteen of these were male and 9 female. The 22 participants who thought they were bad had a median score of 9 (range 3-14) which was just above the median for the group as a whole.

The amount of formal radiological teaching (from a radiologist) each student had received during their training is 3 weeks course for medical interns but all first year residents had no formal training during their residency.

DISCUSSION

The correct interpretation of the chest radiograph is known to have indisputable role in the diagnosis of the emergency and common medical conditions but there is no established system to monitor the adequacy of the skills delivered to the medical interns and residents in our country.
In health institutions where there are no radiologists, clinicians are expected to have adequate skill to independently interpret chest radiograph. Even in institutions where there are radiologists, clinicians interpret CXR and make decision before a formal reading by a radiologist. This is particularly important for radiographic emergencies such as pneumothorax, pneumomediastinum, pneumoperitoneum, cardiogenic pulmonary edema and misplacement of central venous catheters, pulmonary artery catheters, intra-aortic balloon pumps, chest tubes, gastric tubes, and endotracheal tubes.
Our study included three emergencies—pneumothorax (misdiagnosed by 43.9%), cardiogenic pulmonary edema (15.9%), and pneumoperitoneum (misdiagnosed by 25.6%). Those participants who were definitely certain about these diagnosis were correct in diagnosis and those who were not definitely certain about the diagnosis scored lower. This is a good finding because they will likely ask their senior colleagues for a second opinion.

The overall score achieved by the participants in this study was low. The median overall certainty among the entire cohort was 23/40 (13-26). We identified only few factors significantly correlated with successful interpretation. The overall certainty and department of the residents were correlated with overall score. The sex, level of training, interest in radiology as a career had no correlation with the overall score. The first year residents of all departments scored better than medical interns in overall score but the correlation between the level of the training is not significantly related with the overall score with p value of 0.562 and r=-0.066. Surgery residents performed significantly better than all but they have the least confidence in their diagnosis. Previous studies show significant correlation between level of training and overall score which is not demonstrated in our study. (3, 9) One study done in Ghana by BashiruBabatundeJimahet showed that the performance of the participants has no significant correlation with level of training. (10) In Iranian study by GhazalehMehdipoor et al, conducted among interns and GPs there was no association between level of training and overall score. But a study in US New York Bate-Israel Deacons Hospital by Lewis A. Eisen et al, overall score was correlated with level of

training but not with sex.3 The difference in the findings could be probably less integration of the radiology education in the developing countries. In our country, the training medical students get in their study is more of a lecture with no practical sessions which could contribute for this result.

Certain radiographs represented conditions that a newly qualified junior doctor may be expected to treat as an emergency out of hours without awaiting a formal radiology report. These included pneumothorax (missed by 43.9%), pneumoperitoneum (missed by 25.6 %), and cardiogenic pulmonary edema (missed by 15.9%).
The level of certainty about these important diagnoses was high (65, 60, and 68%, respectively). But all residents participated in the study from internal medicine missed the diagnosis of the pneumothorax. Thirty-five percent of the medical interns and 25% of the first year surgery residents missed the diagnosis of the pneumothorax. The interns performed better than EM and IM residents in the diagnosis of pneumothorax which could be because of the lack of attention to observe the image knowing that it is for research purpose. In Iranian study tension pneumothorax was missed in 67%, pneumoperitoneum was missed 33%, pulmonary edema 60%, Normal CXR by 85% of the participants. Ghanian study pneumothorax missed by 62.7%, pneumoperitoneum missed by 78.8%, cardiogenic pulmonary edema missed by 54.4%, pulm TB missed in 36.3%.

Only 2 (2.5%) participants correctly diagnosed left lower lobe collapse. They were male and female interns. Ghanian study 37.4% diagnosed lower lobe collapse. Neither interns nor residents 15 were able to diagnose pulmonary aspergillosis and pleural calcifications. The findings of invasive pulmonary aspergillosis are subtle and might not be visible in the chest radiograph. Proven cases of aspergillosis may have normal chest radiograph. (8) The participants also lacked confidence in diagnosing a normal chest radiograph. Thirty-five percent of the participants identified calcification in the lung field of pleural calcification but none of the participants was able to differentiate whether it was pleural based. The respondents actually were not certain on this diagnosis with only 3 (3%) individuals definite of the diagnosis.

The interpretation of the normal CXR was not easy for our participants. Only 19 (23.2%) of the participants correctly diagnosed the normal chest radiograph and only 9 participants were definite that the radiograph was normal. Fifty percent of IM residents correctly diagnosed normal CXR but among EM residents 11% were correct in diagnosis. This occurred even though they were

instructed that 1 or more of the CXR in the survey might be normal. Other researchers have noted difficulty in interpreting a study as normal. (1, 3, 10) Potentially, interpreting a normal CXR as abnormal could lead to inappropriate decisions. In Iranian study by GhazalehMehdipoor et al, only 15% correctly diagnosed normal CXR. In a study in Brazil by Ana Clara G. Miranda et al., among interns and GPs only 12% diagnosed normal CXR. In a study in Ghanian by BashiruBabatundeJimah et al, 13.1% diagnosed normal CXR.

The interpretation of normal CXR as abnormal adds unnecessary anxiety to the patient and incurs medication costs.

The individual score of the images was significantly correlated with the level of training and department of the residents for the pneumothorax, lung metastasis, pneumoperitoneum and invasive aspergillosis.

The overall level of certainty about diagnoses was low with no more than 32% of participants being definite about their answer on any radiograph. The degree of overall certainty was not associated with level of training. Male (24/40) participants were slightly more certain of their answers than female (21.7/40), but females (8.4/20) did score slightly higher overall than male (7.8/20). Two prior studies also identified a certainty on a particular CXR as being associated with successful interpretation of that CXR. (101, 3) The sex of the participants was also significantly correlated with overall certainty (P=0.047). Certainty was correlated significantly in USA Bete-Israel study with level of training ($p<0.001$) Overall certainty significantly correlated with overall score.

The degree of self-reported certainty for individual CXR significantly correlated with correct diagnosis for tension pneumothorax ($P<0.001$) and pneumoperitoneum ($p<0.001$) but not for other conditions. Iranian study also shows significant correlation for both conditions.

Though the overall score of the medical interns is low (39.5%), their overall certainty is high (59.2%). This is not a good finding because they didn't know their limitations. Even majority of them 32 (65.3%) perceive that they were good at interpreting chest radiograph but none of them dare to say excellent. This discrepancy might be vied as a negative finding as they may be less likely to seek advice from a senior colleague or a radiologist when interpreting chest radiographs.

Only 18 (22.5%) of the participants had no interest to study radiology as a career. Possibly, the

low score could not be associated with lack of interest in radiology. This finding might create a good opportunity to give trainings to improve their performance.

There are several strengths to our study. First, there is gold standard chest CT to confirm the diagnosis.

Second, we have demonstrated that fields study for clinicians is associated with interpretations of the chest radiograph especially in the emergency cases.

Third, the study confirmed that confidence on a particular CXR reading is associated with successful interpretation.

In conclusion, the study has showed that the training given to medical students and residents is not adequate and this has impact on medical education for residents and intern as well as patient management. If first line clinicians are expected to make clinical decisions based on CXR readings, more effective training is needed, particularly in radiographic emergencies because the skill they acquired as a medical training is not adequate.

Further research is needed by including physicians and residents of different departments and years of study to determine the gap and devise the best methods of achieving and assessing competency in CXR interpretation.

REFERENCES

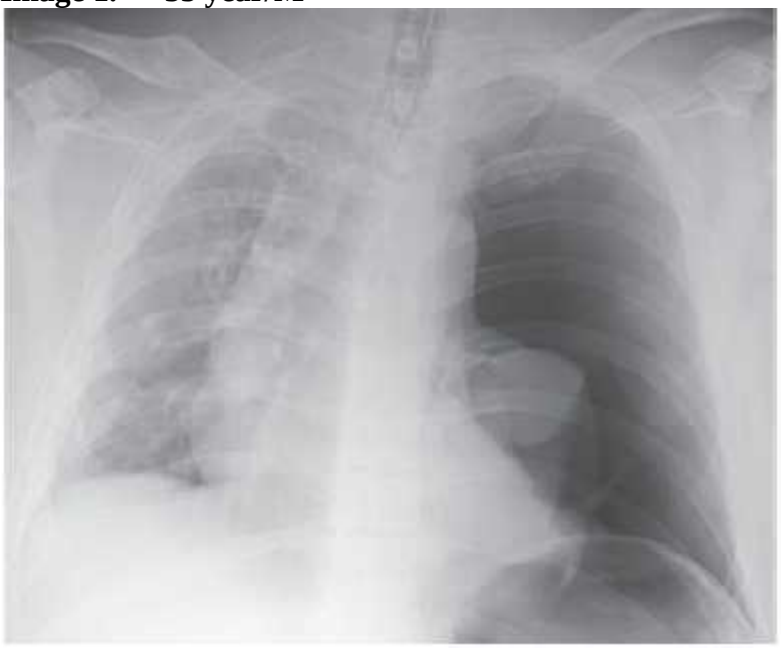
1. D. R. JEFFREY*, P. R. GODDARD, Chest Radiograph Interpretation by Medical Students in Bristol Royal Infirmary, Bristol, UK
2. Gerald de Lacey, et al The chest x-ray a survival guide 2008, Elsevier
3. Lewis A. Eisen, et al Competency in Chest Radiography Competency in Chest Radiography A Comparison of Medical Students, Residents, and Fellows, Beth Israel Medical Center, New York, NY, USA, 2006
4. JacD.Scheiner Importance of Radiology Clerkships in Teaching Medical Students Lifethreatening Abnormalities on Conventional Chest Radiographs Rhode Island Hospital, Brown Medical School, UK, 2001
5. Vania Maria Carneiro da Silva et al Competence of senior medical students in diagnosing tuberculosis based on chest X-rays Federal University of Rio de Janeiro Medical School, Rio de Janeiro, Brazil, 2009.
6. GhazalehMehdipoor et al Survey of practitioners' competency for diagnosis of acute diseases manifest on chest X-ray ShahidBeheshti University of Medical Sciences, Tehran, Iran, 2017
7. Stephen Waite et al Interpretive Error in Radiology, AJR 2017
8. M Horger, H Einsele, U Schumacher et al Invasive pulmonary aspergillosis: frequency and meaning of the ''hypodense sign'' on unenhanced CT
9. P Mehrotra et al Do radiologists still need to report chest x rays? bmj, 2015
10. BashiruBabatundeJimah et al., Competency in Chest Radiography Interpretation by Junior Doctors and Final Year Medical Students at a Teaching Hospital, University of Cape Coast, Cape Coast, Ghana, November 2020
11. Ana Clara G. Miranda et al., Radiological Imaging Interpretation Skills of Medical Interns, Recife, Pernambuco, Brazil, 2018

Data collection format

1. Socio demographic data
   1.1 Year of study
      a.) 4th year b.) Interns

   1.2 Sex
      a.) Male b.) female
2. Have you had formal radiology attachment?
      a. Yes b.) No
3. Are you interested to study radiology?
      a. Definitely
      b. Probably
      c. Not at all
4. How is your chest x ray interpretation skill?
      a. Excellent
      b. Good
      c. Bad

Image 1. 35 year/M



What is your finding?

……

……

……

……

What is your diagnosis?

……

…..

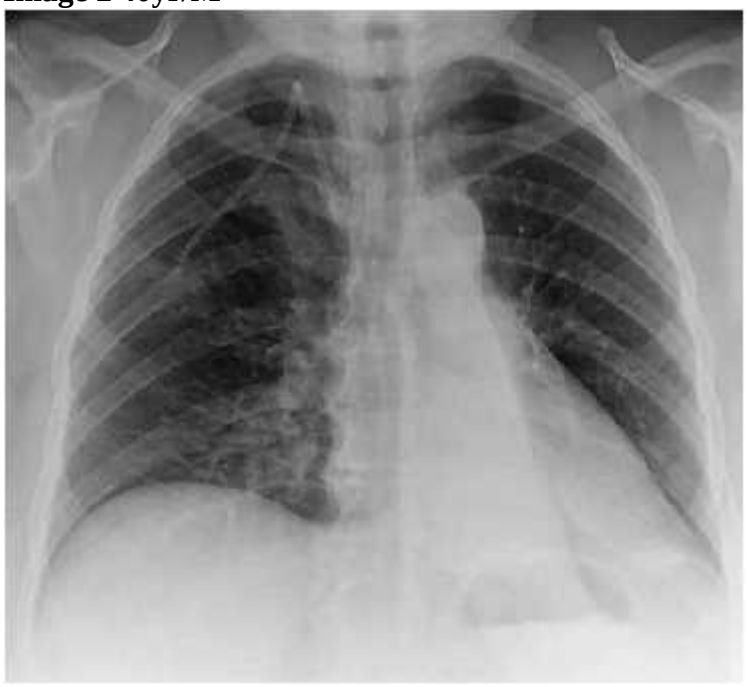
DDX:

……

How much certain about your diagnosis?

1. **25%**
2. **2. 50%**
3. **3. 75%**
4. **4. definitely**

Image 2 40yr/M



What is your finding?

……

……

……

What is your diagnosis?

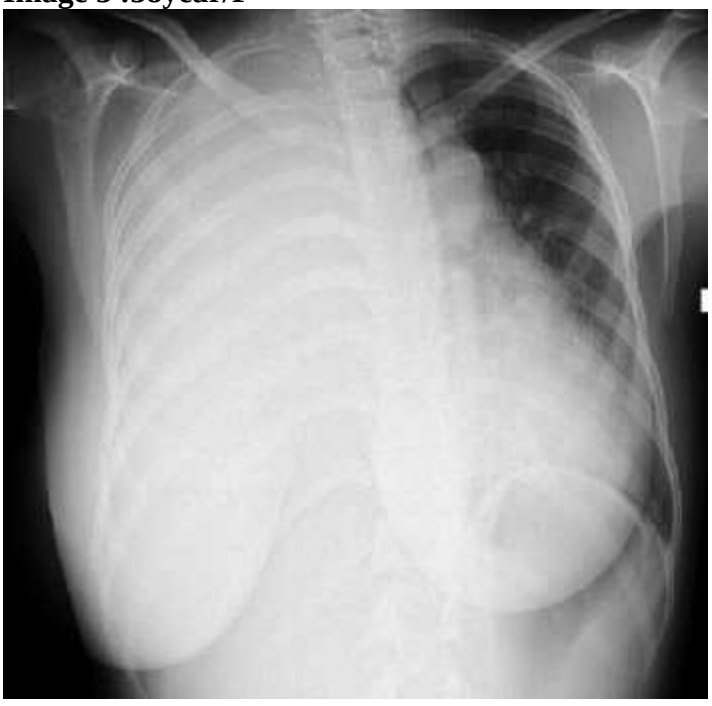
……..

DDX: ……

How much certain about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 3 :38year/F



What is your finding?

……

……

……

What is your diagnosis?

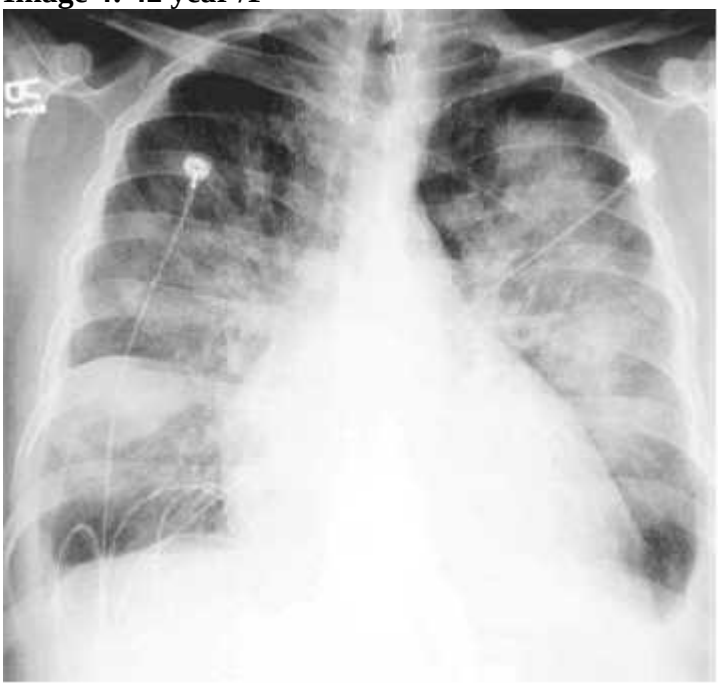
……..

DDX: ……

How much certain are you about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 4: 42 year /F



What is your finding?

……

……

……

What is your diagnosis?

……

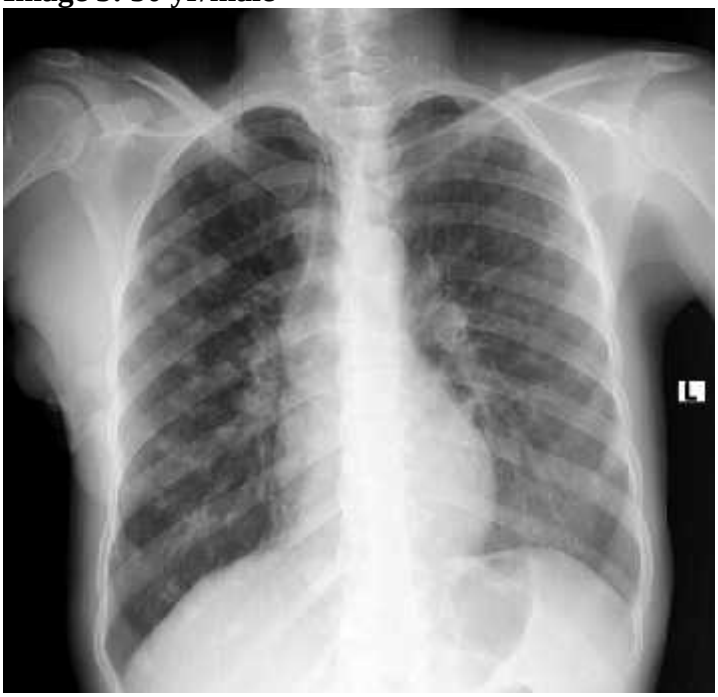
……

DDX: ……

How much are you certain about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 5: 50 yr/male



What is your finding?

……

……

……

What is your diagnosis :

……

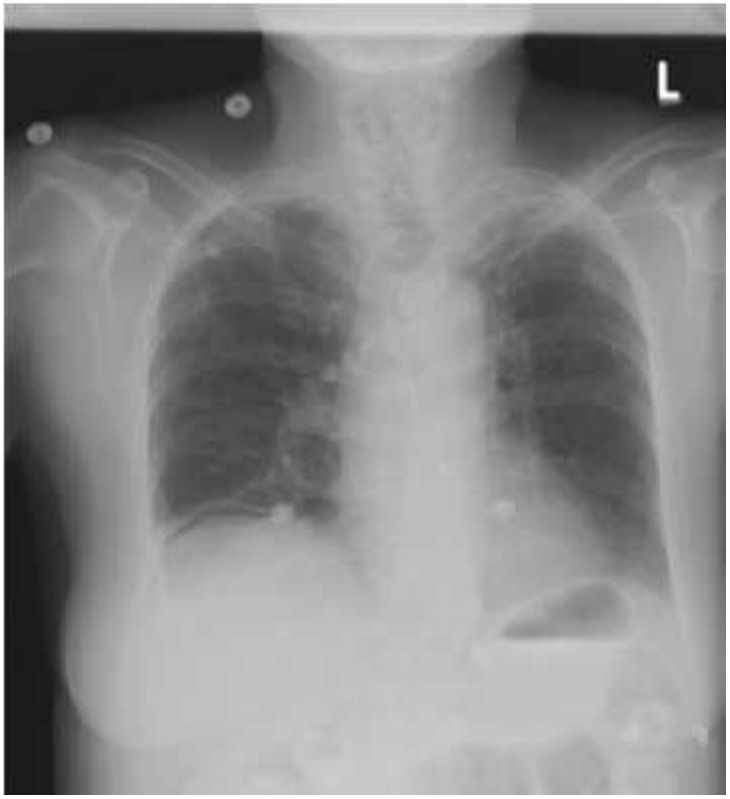
……..

DDX: ……

How much certain are you about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 6: 17 yr/F



What is your finding?

……

……

……..

What is your diagnosis?

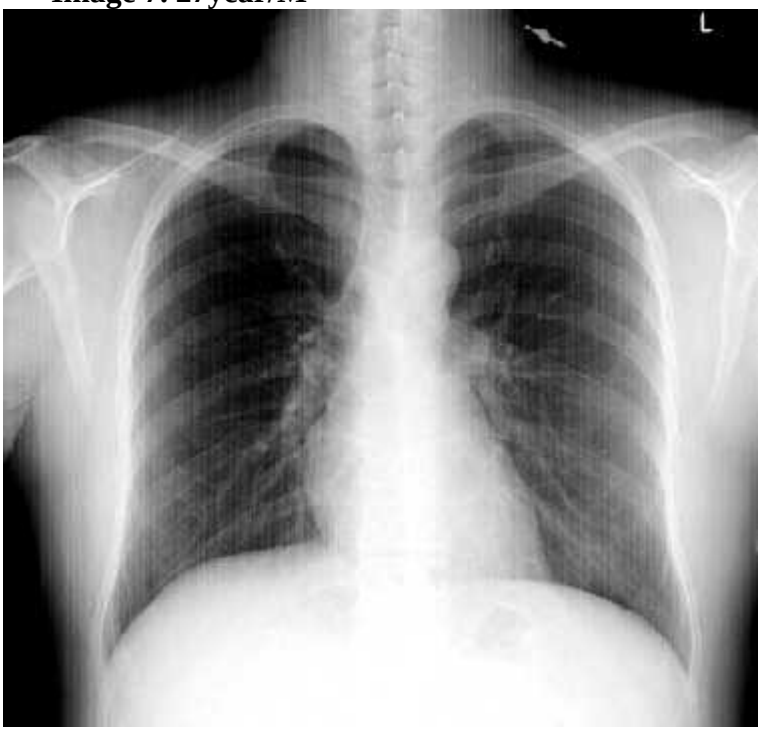
……..

DDX: ……

How much certain are you about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 7. 27year/M



What is your finding?

……

……

……

What is your diagnosis?

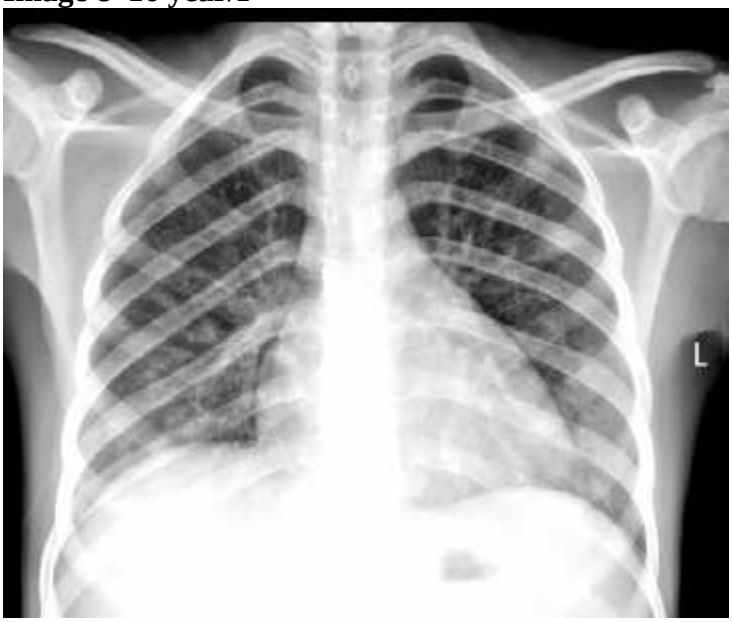
……..

DDX: ……

How much certain are you about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 8 16 year/F



What is your finding?

……

……

……

What is your diagnosis?

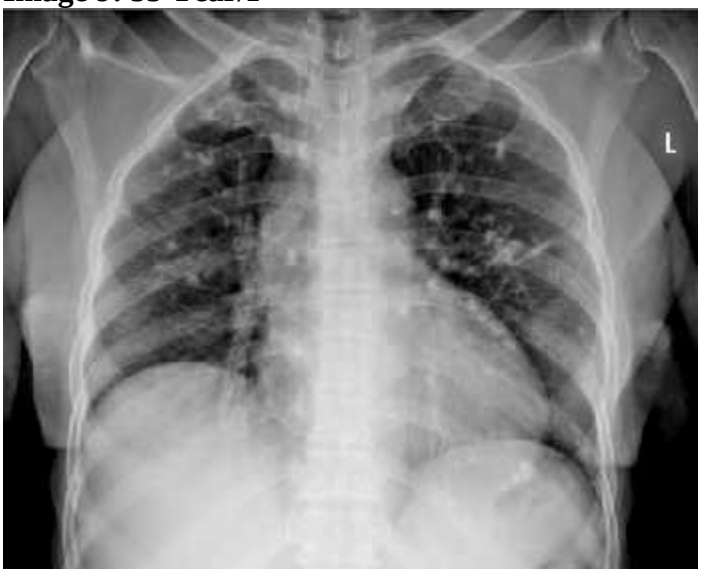
……..

DDX: ……

How much certain are you about your diagnosis?

1. 25%
2. 50%
3. 75%
4. definitely

Image 9: 55 Year/F



What is your finding?

……

……

……..

What is your diagnosis?

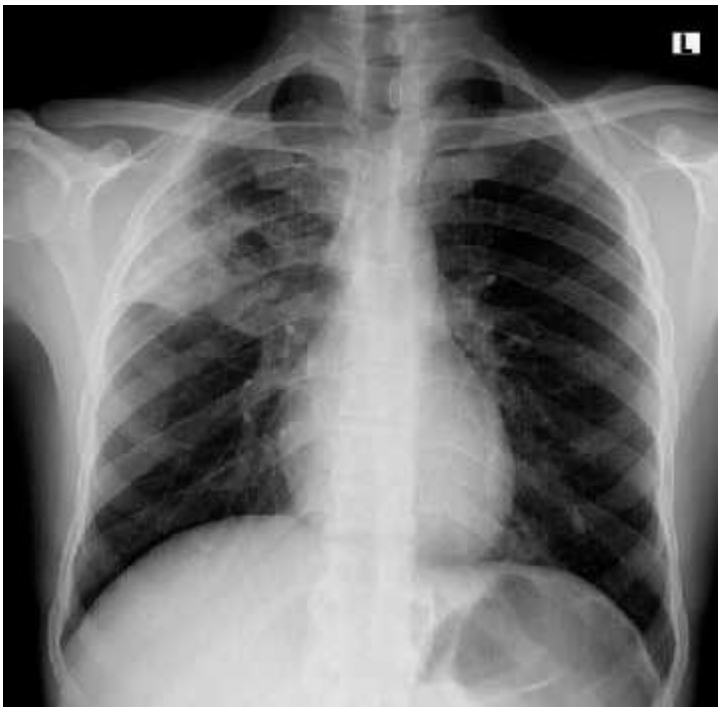
……..

DDX: ……

How much certain are you about your diagnosis?

1) 25%
2) 50%
3) 75%
4) definitely

Image 10 : 31 year/ M



What is your finding?

……

……

……

What is your diagnosis?

……..

DDX: ……

How much certain are you about your diagnosis?

1) 25%
2) 50%
3) 75%
4) definitely