

From Computer-Interpreted Electrocardiograms To Artificial Intelligence Read X-Rays

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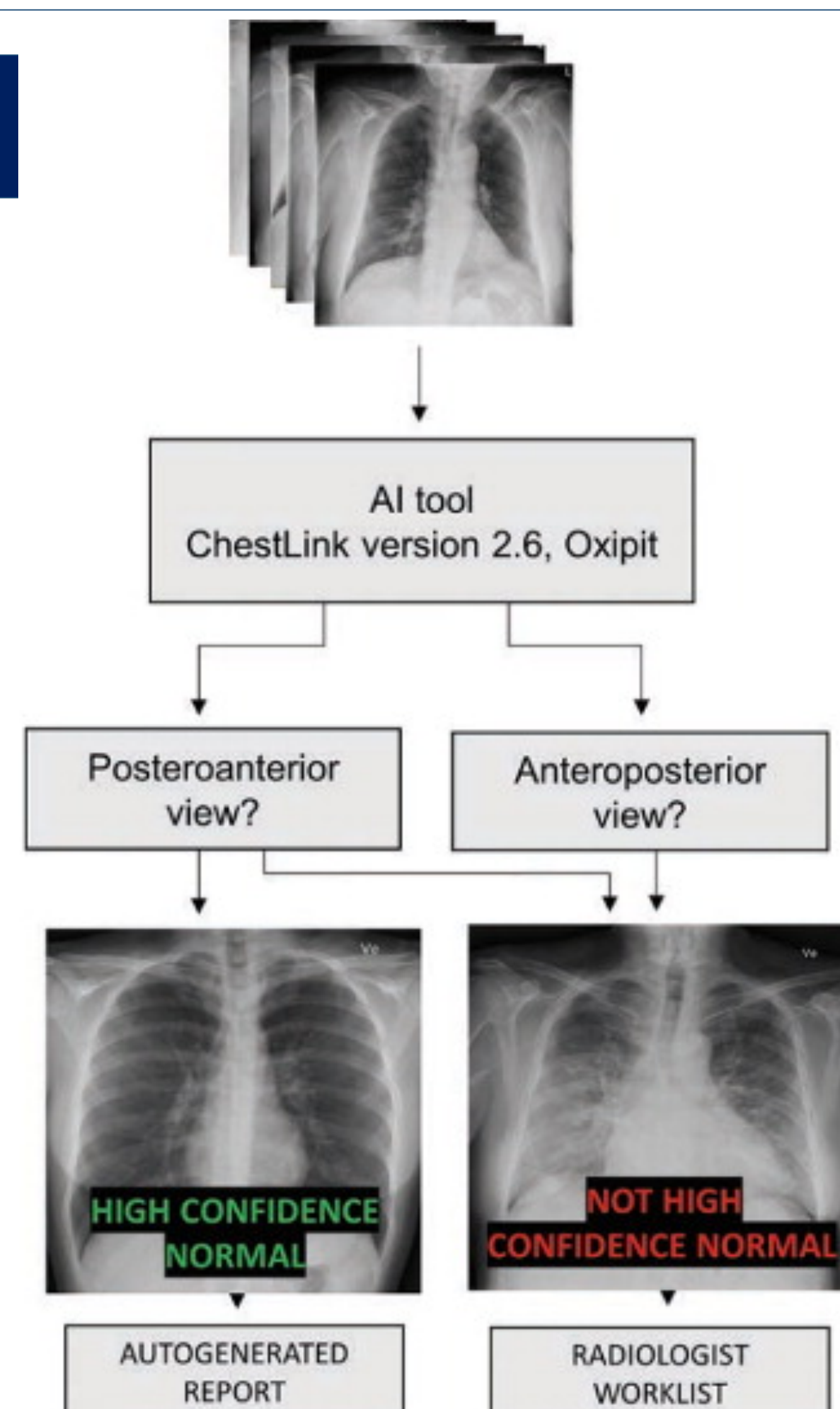
Introduction

- In 1978 a task force was commissioned to examine the role of computers in reading electrocardiograms (EKGs). Two weaknesses of using computers:
 - Increasing uncritical reliance on computer interpretation
 - Easy availability of electrocardiographic interpretation leading to overuse
- Suggested that EKG interpretation by a computer is a laboratory test that may lead to a medical diagnosis, once reviewed by a qualified physician.
- Recent integration of artificial intelligence (AI) in medical diagnostics has grown particularly in the field of radiology.
- The following explores how similar AI-assisted X-ray interpretation is to its historical counterpart computer-read EKGs, and the level to which AI-read X-rays are already being incorporated in the medical field.

Methods

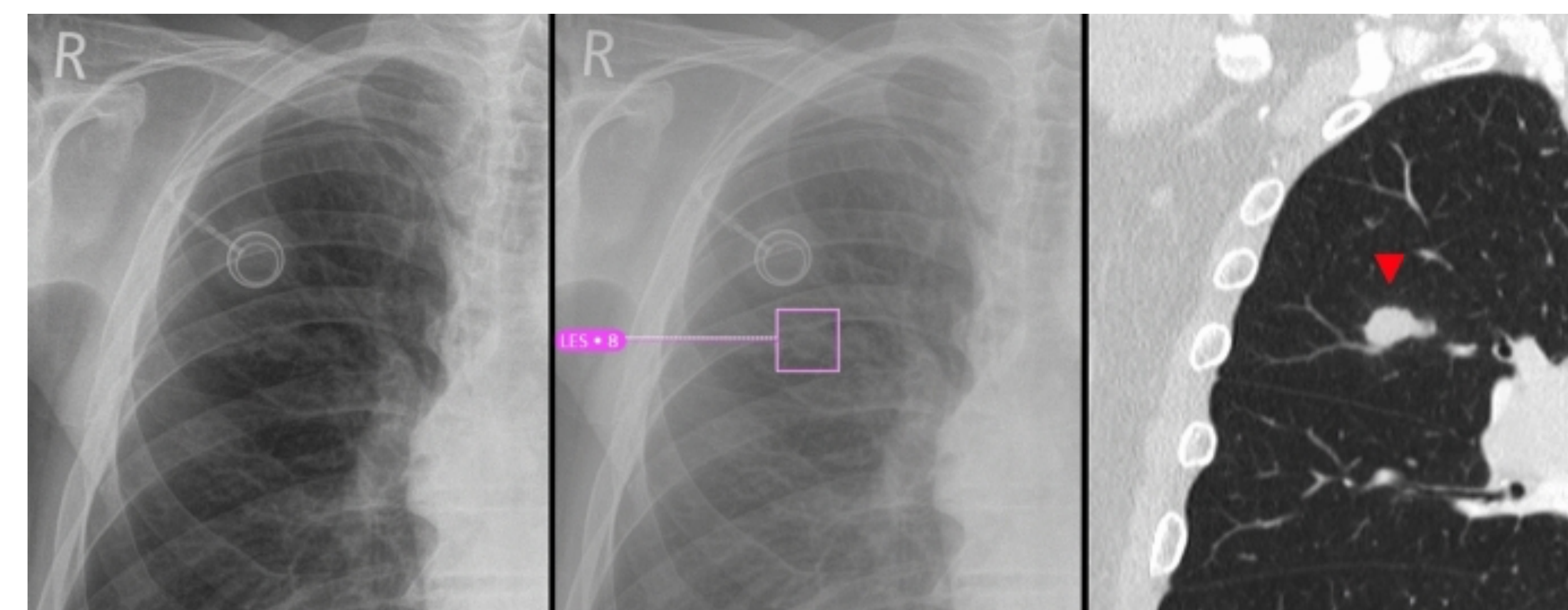
Databases were searched utilizing keywords "artificial intelligence" and "X-ray." Inclusion criteria included studies from 2019-2023 focused on examining AI-read X-rays.

Figure 1

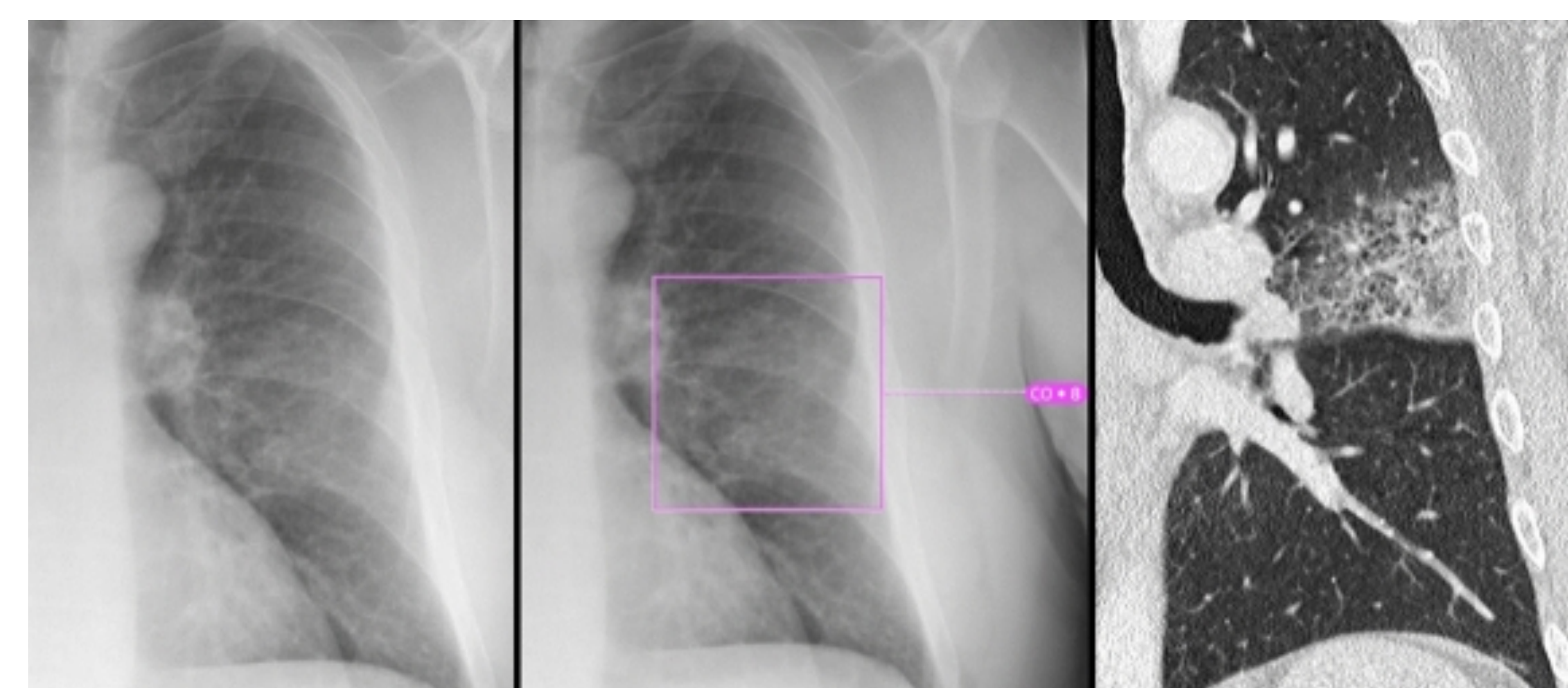


Results

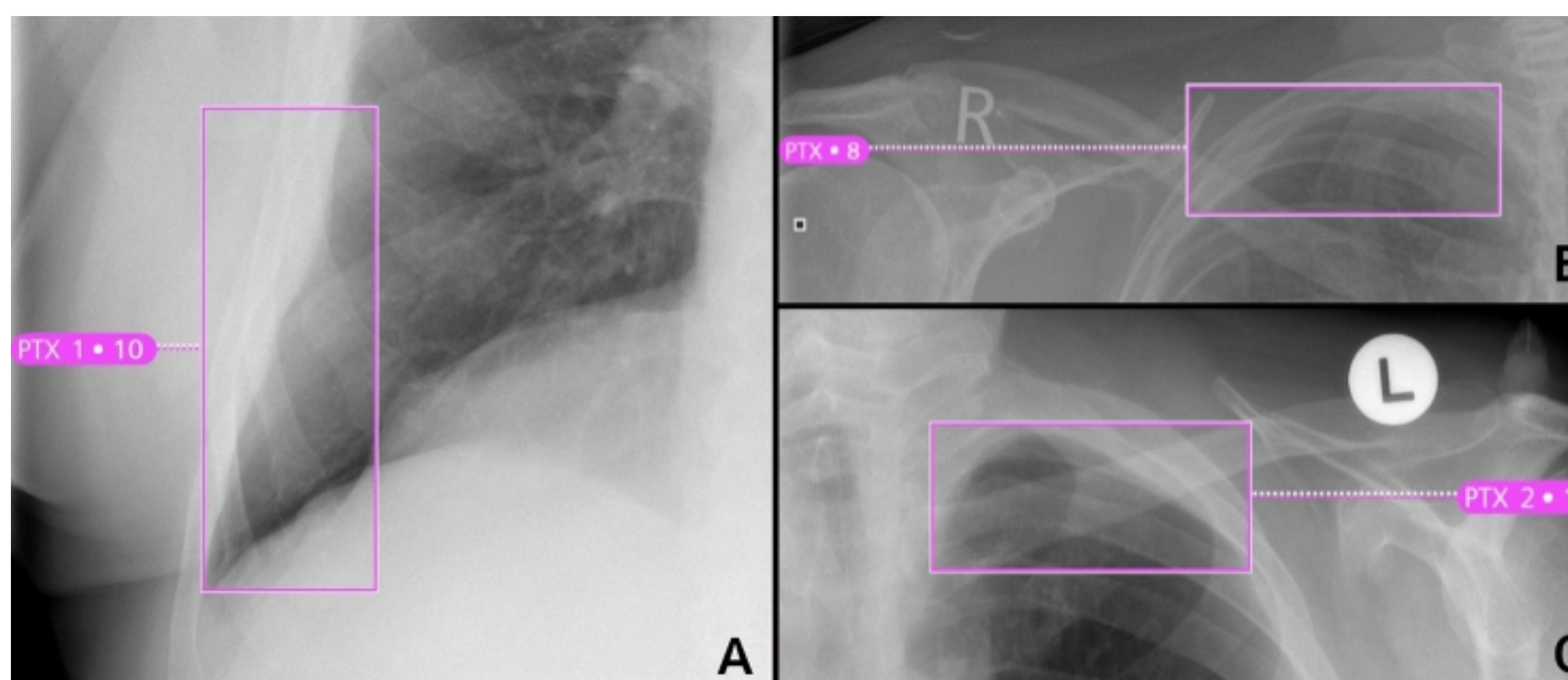
- AI has demonstrated high sensitivity for abnormal radiographs (99.1%) and critical radiographs (99.8%), outperforming radiologists in both categories (72.3% and 93.5%, respectively)¹.
- AI has the potential to autonomously report normal X-rays with a sensitivity of 99%¹ (Figure 1). Utilization of this is shown in Figure 1.
- AI has higher F1 scores (0.435) in determining pneumonia than radiologists (0.387)².
- AI showed superior sensitivity in lung lesion detection when compared to written reports (WR) (0.83 versus 0.52)³:



- Consolidations (0.88 AI versus 0.78 WR)³:



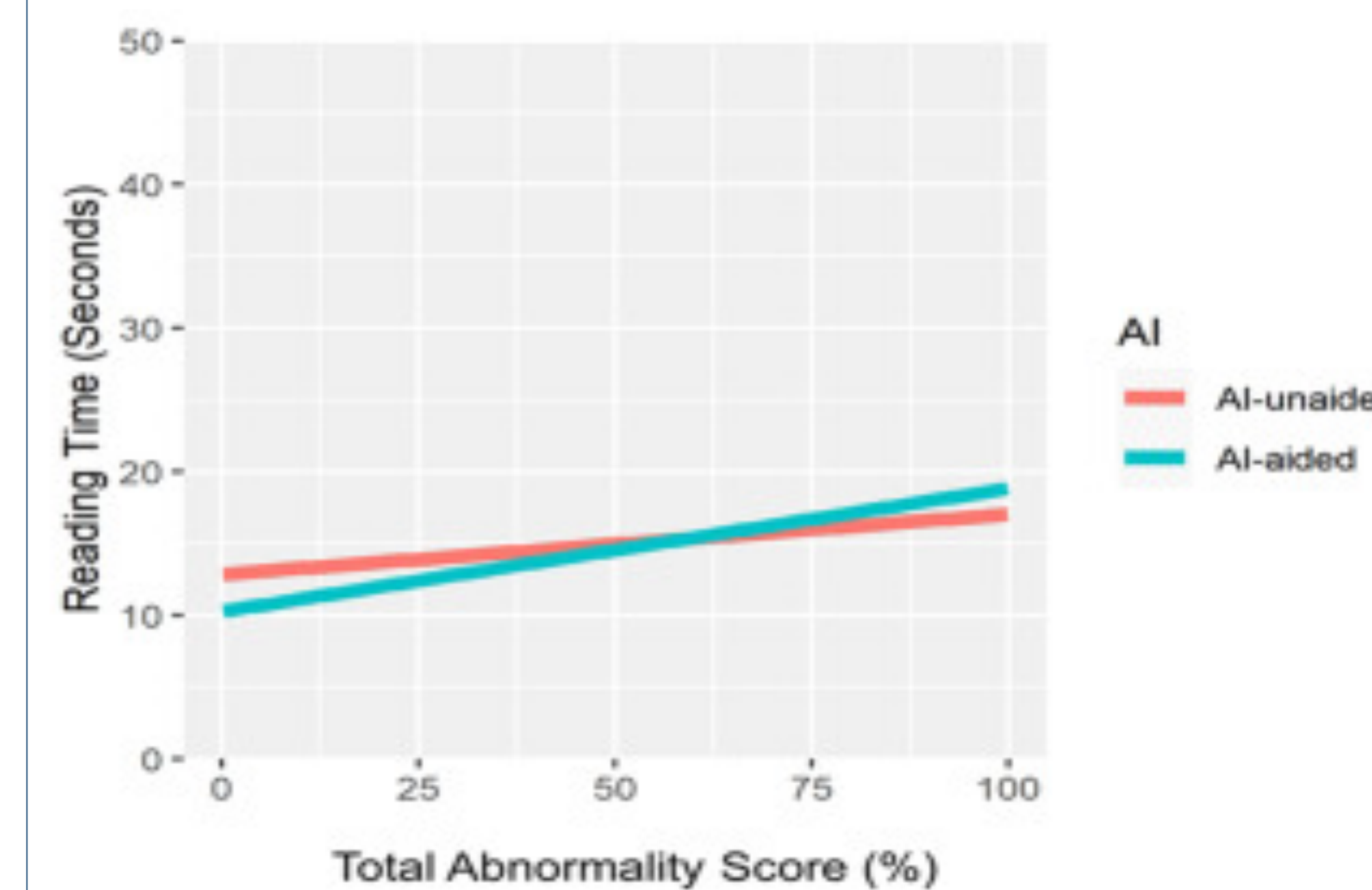
- Atelectasis (0.54 AI versus 0.43 WR)³:



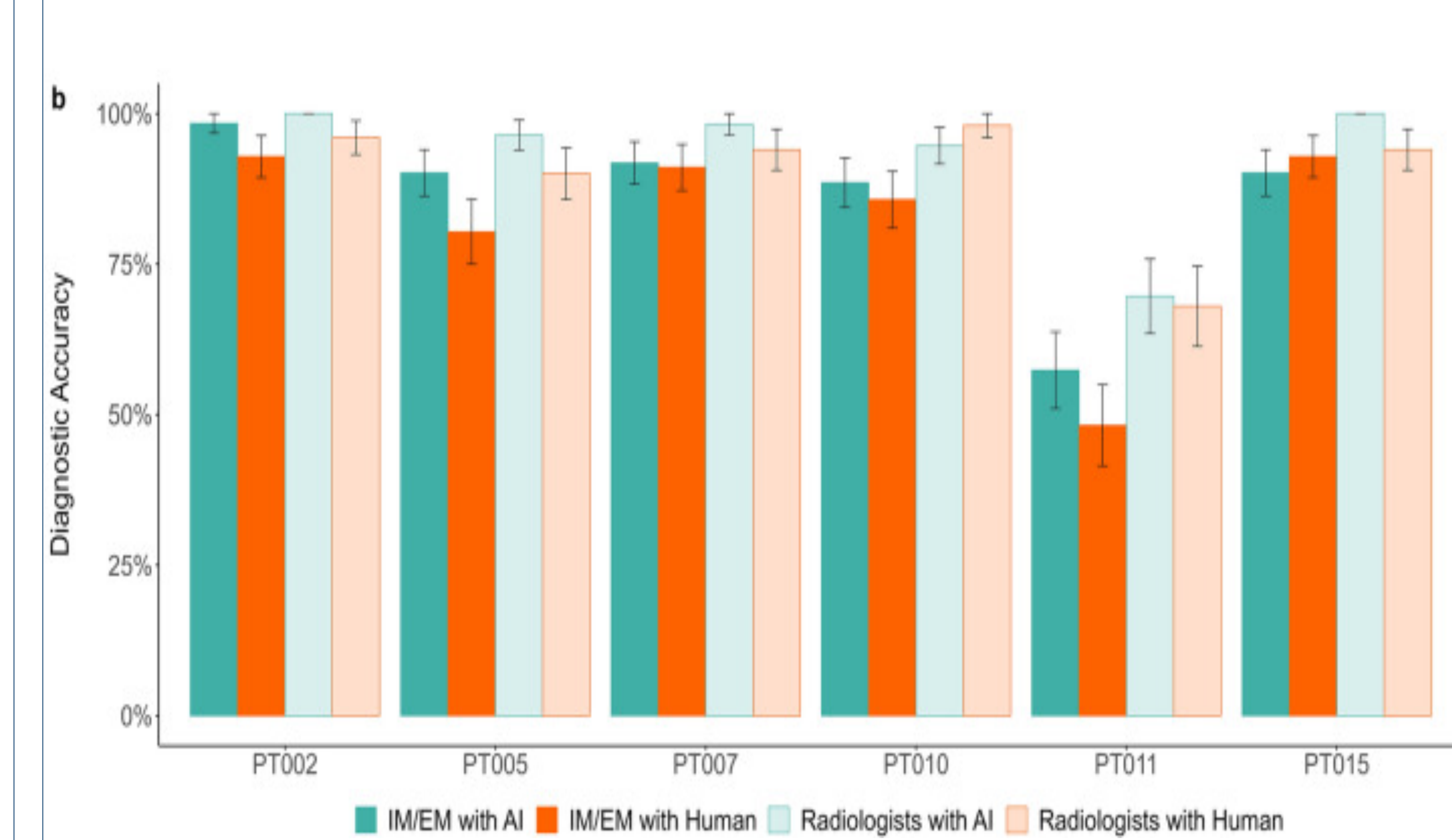
- However, this was accompanied by higher false detection rates³.

Results

- AI utilization reduces reading times compared to without AI (13.3s vs. 14.8s)⁴. With no abnormalities, times were significantly shorter (10.8s vs. 13.1s)⁴. With normal abnormalities, times did not differ. In complex cases, reading times increased when utilizing AI. Outpatient experienced a more significant reduction in reading times than inpatient locations when AI was utilized⁴.



- Non-task experts had significantly improved diagnostic accuracy (5.66% better) when utilizing AI-generated clinical advice on image findings⁵. Task experts, primarily radiologists, showed a modest but non-significant increase of 3.41%⁵



Ex. AI utilization of X-ray, possible diagnoses, radiologist interpretation backed by a percent chance from AI⁶



Diagnosis	Negative	Suspicious	Positive	%
Atelectasis	Negative	Suspicious	Positive	% 2
Cardiomegaly	Negative	Suspicious	Positive	% 0
Effusion	Negative	Suspicious	Positive	% 2
Infiltration	Negative	Suspicious	Positive	% 42
Mass	Negative	Suspicious	Positive	% 37
Nodule (< 3 cm)	Negative	Suspicious	Positive	% 50
Hernia	Negative	Suspicious	Positive	% 20
Pneumothorax	Negative	Suspicious	Positive	% 54
Consolidation	Negative	Suspicious	Positive	% 30
Edema	Negative	Suspicious	Positive	% 0
Emphysema	Negative	Suspicious	Positive	% 28
Fibrosis	Negative	Suspicious	Positive	% 50
Pleural Thickening	Negative	Suspicious	Positive	% 31

References

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Conclusion

- AI excels in X-ray interpretation, offering potential autonomous reporting and faster readings.
- AI-read X-rays should require verification by a trained radiologist to ensure accurate diagnoses.
- The two weaknesses the task force of 1987 were concerned with EKGs apply to X-Rays:
 - uncritical reliance on AI interpretation
 - overuse of x-rays due to easy availability of interpretation.
- X-ray interpretation by AI is a laboratory test that may lead to a medical diagnosis, once reviewed by a qualified physician.