



Transforming the Healthcare Simulation Spectrum: Now, Next and Beyond

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Radiologist Performance on eTutor

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Introduction and Aim

There is currently no software to objectively capture if students are able to spot the entire extent of the abnormality present on radiographs. Prototype of electronic teaching software for paediatric radiographs has thus been created. Non-paediatric radiologists were invited to test it prior to using it in students.

Aim is to compare the performance of non-paediatric radiologists against a paediatric radiologist's model answers on an electronic software for a set of 10 abnormal paediatric radiographs.

Method

An electronic software prototype has been created comprising of 10 paediatric radiographs showing a variety of abnormalities encountered in clinical practice. These consists of 3 cases of abnormal increased density due to consolidation or collapse (Figure 1), 3 cases of abnormal lucency due to abnormal collections of air (Figure 2), 2 cases of linear lucencies due to fractures (Figure 3) and 2 cases of abnormal air-fluid levels (Figure 4).

A paediatric radiologist outlined the main abnormality present on each of these radiographs which became the gold standard against which the performance of the non-paediatric radiologists was compared.

Each radiologist was instructed to view the chest radiographs on computers/laptops, to decide if the chest radiograph was normal or showed an abnormality. Participant was to type the abnormality in a box which could capture free text and to outline the visible abnormality on the image with a computer mouse (Figure 5). Area outlined by participant was compared against the gold standard and percentage overlap was generated (Figure 6). One minute was allocated for each case and a timer on the screen made the countdown visible to the participant. Participants were given a summary of their performance and how their outlined region of interests compared against the model answers at the end of the experiment

Results

Four non-paediatric radiologists took part in this experiment.

All abnormal lucencies, fractures and air-fluid levels were correctly identified by all radiologists. However, 2 radiologists over interpreted a case of air-fluid level in the right maxillary sinus as being traumatic.

Two radiologists each missed a case of retrocardiac left lower lobe collapse.

Regions of interest demarcated by participants showed high variability when compared against those generated by paediatric radiologist.

Average overlap of region of interest was 83.7 +/- 35.1% for fractures, 81.6 +/- 12.0% for air-fluid levels, 69.6 +/- 30.8% for lucencies and 51.6 +/- 40.0% for increased density.

Discussion

Non-paediatric radiologists score well on paediatric plain radiographs having a variety of abnormalities. Region of interest drawn vary widely among individuals. A generous range of acceptable answers for region of interest drawn as well as free text answers would be better appreciated by participants.

Limitation is small sample size of cases used and few participants. Feedback by participants is that the model answer is too strict and a range of acceptable answers should be considered. For example, "fluid level", "cavity", "cavitating", "cavitatory lesion", "abscess" can also be considered as correct answers for an air fluid level present in a focal lung lesion. Currently prototype is limited to single images with no option for multi-image cross sectional imaging.

Prototype will be fine tuned to have $\geq 50\%$ overlap deemed acceptable.

Acknowledgement

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Figures illustrating some of the cases used



Figure 1
Increased density due to right upper lobe collapse.

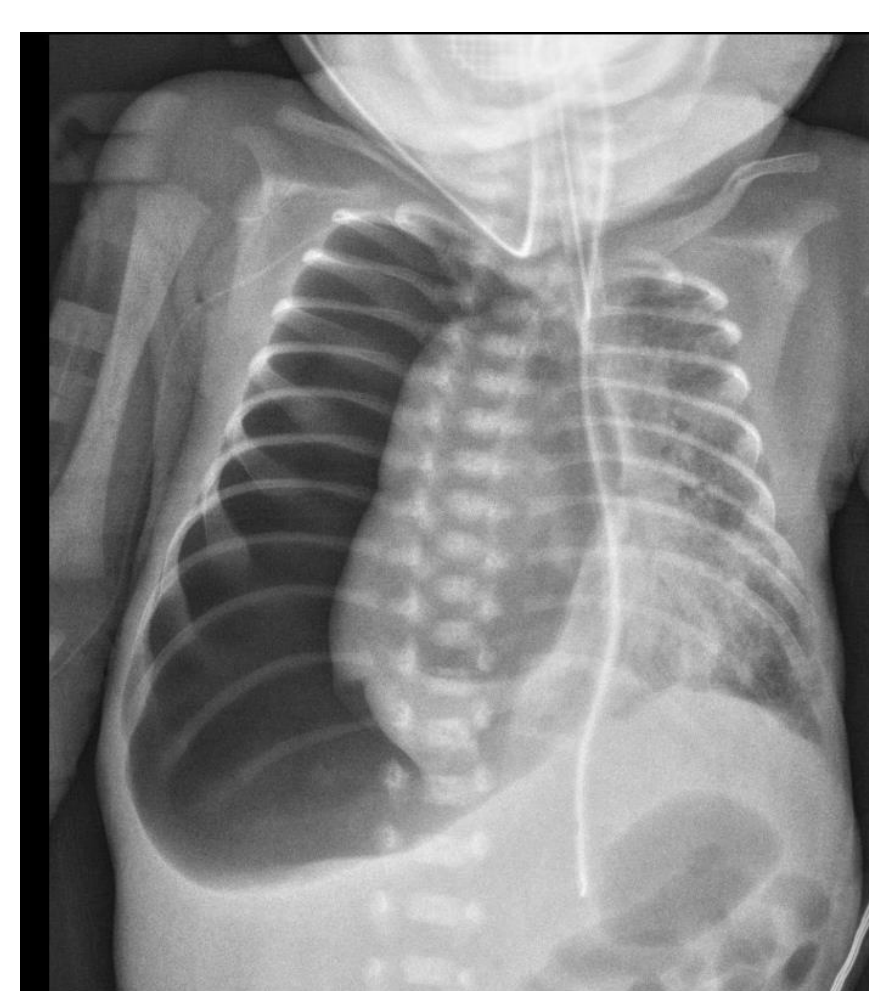


Figure 2
Abnormal lucency due to right tension pneumothorax.

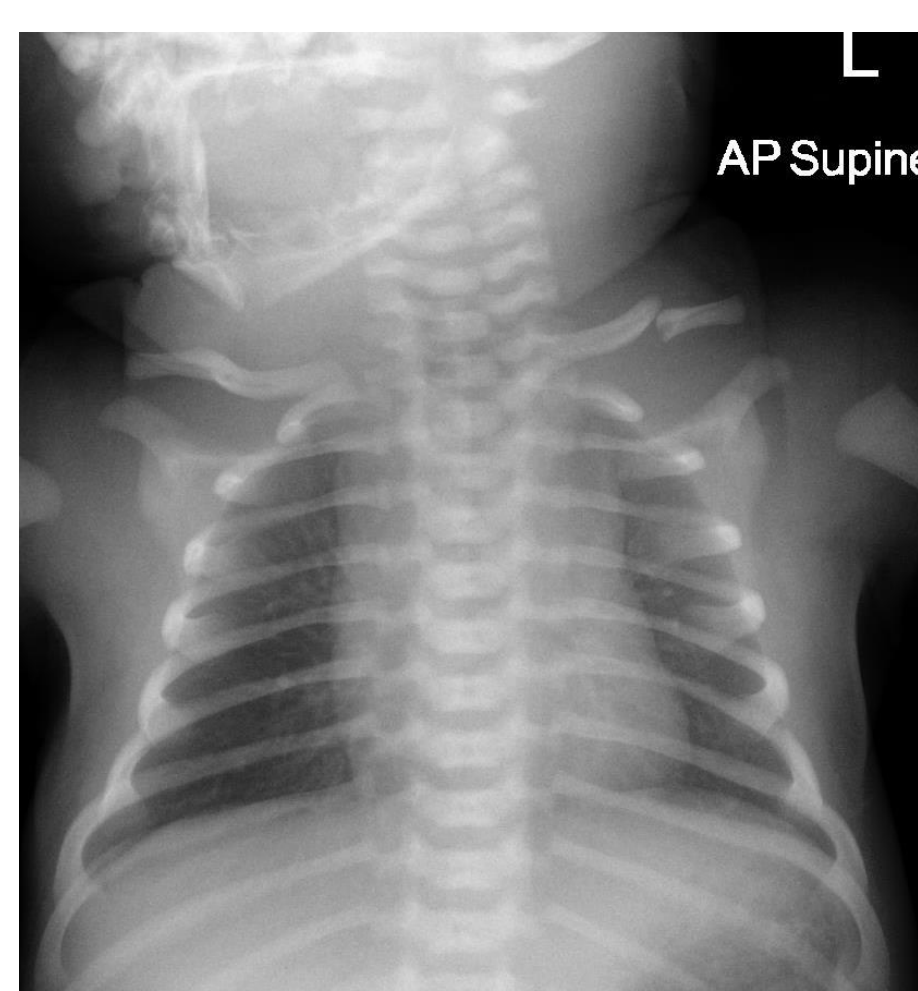


Figure 3
Linear lucency due to left clavicular shaft fracture.

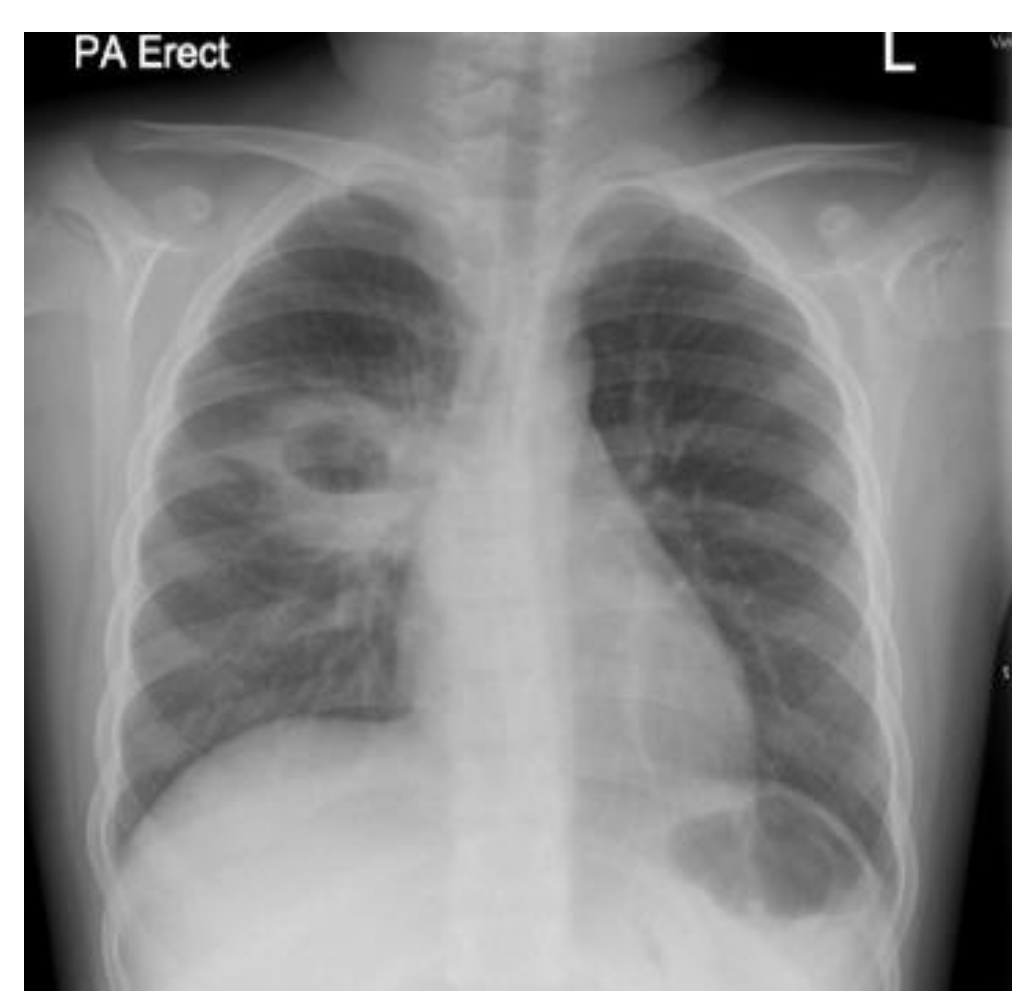


Figure 4
Abnormal air-fluid level due to cavitating lesion in the right lung.

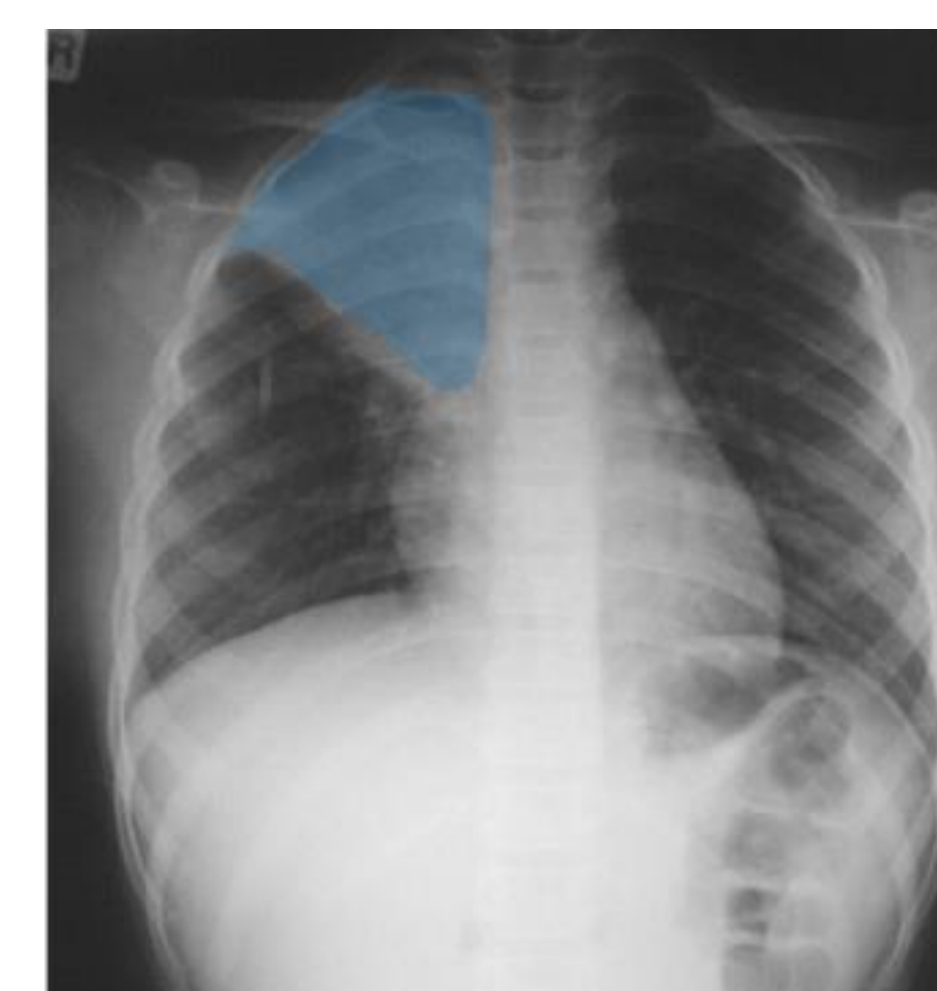


Figure 5
Area outlined by one of the participants.

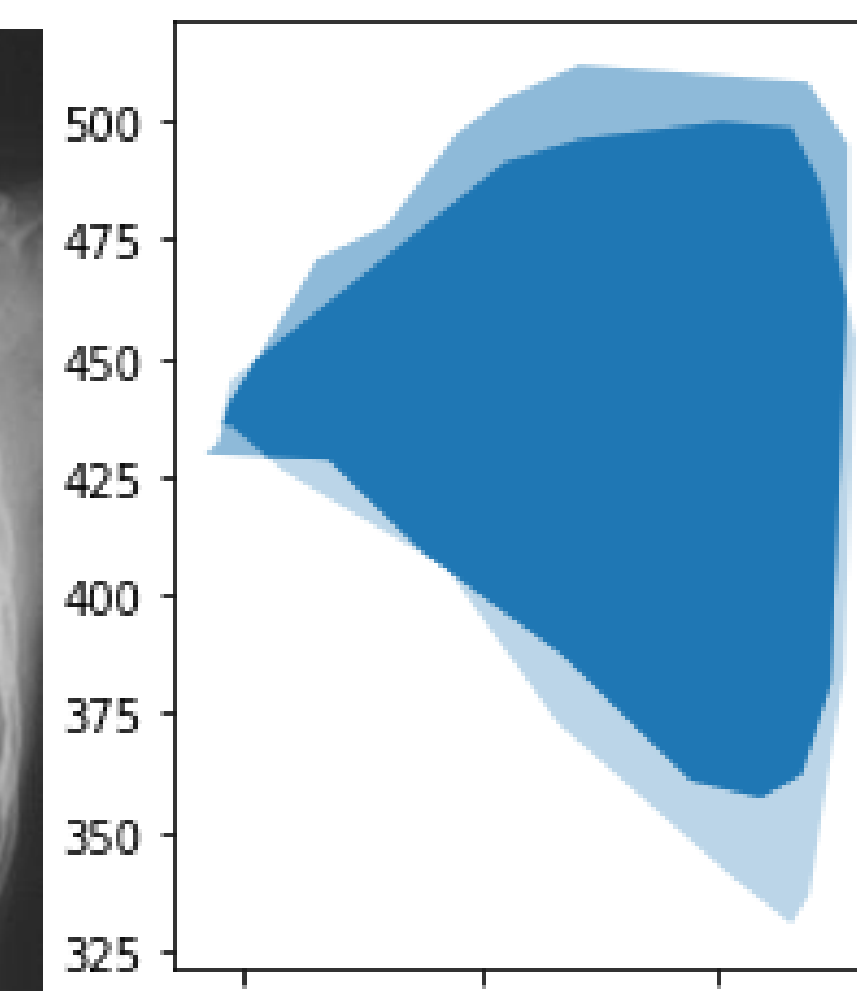


Figure 6
Percentage overlap of 88.1% when area in Figure 5 is compared against gold standard.