

# Training the evaluation of radiographs: Normal-abnormal proportion differentially influences sensitivity and specificity

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## Rationale

Medical images, such as radiographs, are increasingly requested in everyday clinical practice and therefore medical students need to be trained in evaluation of images. Training in image evaluation usually consists of first a lecture and second a practice phase. It is uncertain if this lecture-first, practice second order is most advantageous for training students to evaluate images. Medical students, despite being novices in x-ray evaluation, already have some knowledge of anatomy and pathophysiology. An order with a practice phase prior to a lecture may enhance learning as students actively use their knowledge prior to passively acquiring expert information. Additionally, training generally concentrates on abnormalities, while x-rays in everyday clinical practice are predominantly normal. The influence of practice first versus lecture first and the normal-abnormal proportion on evaluation of images by medical students is examined.

## Methods

103 3<sup>rd</sup>-year medical students trained chest radiograph (CXR) interpretation by watching a video lecture on basic CXR interpretation followed by 20 practice cases (lecture-first order), or practicing these cases before watching the lecture (practice-first order). After each practice case students were presented the right answer. The proportion of normal-abnormal x-rays (30% vs. 70% normal x-rays during practice phase) was manipulated to make a 2x2 between-subjects design. After their respective training students made a post-test of 20 cases (60% normal) and sensitivity (correctly identified abnormal x-rays / total abnormal x-rays) and specificity (correctly identified normal x-rays / total normal x-rays) were measured.

## Results

Mean sensitivity was .97 ( $SD = .06$ ) for the lecture-first/30% normal-group; .98 (.05) for the lecture-first/70% normal-group; .90 (.08) for the practice-first/30% normal-group, and .89 (.09) for the practice-first/70% normal-group. On sensitivity, there was no interaction effect ( $F_{1,99} = .17, p = .68$ ) nor a main effect of order ( $F_{1,99} = .02, p = .90$ ), but a main effect of proportion of normal-abnormal x-rays ( $F_{1,99} = 25, p < .01, \eta_p^2 = .20$ ) in favor of 30% normal practice was found.

Mean specificity was .57 (.18) for the lecture-first/30% normal-group; .74 (.13) for the lecture-first/70% normal-group; .51 (.17) for the practice-first/30% normal-group, and .67 (.12) for the practice-first/70% normal-group. On specificity, there was no interaction effect ( $F_{1,99} = .04, p = .85$ ) but main effects of both order ( $F_{1,99} = 4.24, p = .04, \eta_p^2 = .04$ ), in favor of lecture first, and proportion

of normal-abnormal images ( $F_{1,99} = 30.1, p < .01, \eta_p^2 = .23$ ), in favor of the 70% normal images practice, were found.

## **Conclusion**

Contrary to our hypothesis, the practice-first order was not superior for sensitivity or specificity. Students may have needed the guidance of a lecture first for an effective practice phase. It should be explored what the effect of adding a third practice phase would be. Furthermore, the results show that proportion normal and abnormal x-rays in practice can differentially influence students' scores on sensitivity and specificity. Increasing the proportion of normal images in training might be useful to align image evaluation training better to the needs of everyday clinical practice.