Examining the ‘gambler’s fallacy’ in radiology

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Rationale

Humans have a tendency to behave as if past events influence events, even when the events are independent, a finding known as the ‘gambler’s fallacy'. A classic example of this fallacy is the tendency of the betting public to bet heavily on ‘red’ on a roulette wheel after a string of ‘black’ outcomes (Clotfelter & Cook, 1993; Tversky & Kahneman, 1971). While it is likely that most radiologists are aware of this fallacy, these tendencies are sufficiently ingrained that they may exert implicit pressure on behaviour even if one has explicit knowledge.

Methods

To test this idea, gave radiologists explicit instructions and asked them to examine single images from 30 mammograms. Mammograms will be displayed on two separate, single 5-megapixel monitors. The software used was (Håkansson et al. 2010). There will be 3 cases with pathology-proven masses distributed amongst the cases. Placement of the cases will be pseudorandom, constrained so that one positive case follows within two cases of another positive case. The gambler’s fallacy prediction would be that, immediately after finding a positive case, (1) time spent on a case should decline, (2) criterion should become more conservative, and (3) the chance of a false negative or mislocalization error should increase.

Results

The proportion of hits and false alarms was 0.5 and 0.07 respectively. Our original hypothesis was that the Gambler’s fallacy would result in an increase of false negative errors for the p2 case, however, the case ratings for p2 (on a modified BIRADS scale) do not significantly differ from p1 ratings. This is likely due in part to radiologists assuming such a high prevalence of positive cases, eliminating the Gambler’s Fallacy. The Gambler’s Fallacy would also predict that a positive case succeeding another positive case would have a decrease in reaction time, as radiologists may have a predetermined notion that the succeeding case is most likely negative. There is no difference in the average reaction time for cases p1 and p2, suggesting radiologists viewed both positive cases as independent events. The failing of the Gamblers’ Fallacy in this paradigm is likely reflected in the high false alarm rate.

Conclusion

Laboratory experiments struggle to demonstrate the gamblers' fallacy as in the experimental setting radiologists’ prevalence assumption results in a high false alarm rate.