Commentary: The Quants Are Coming For You

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**Central Message:** Expert clinicians continue to beat prediction models in estimating the probability of cancer among individuals with lung nodules.

**Central Picture Legend:** Farhood Farjah, MD, MPH, FACS

Sarnaik et. al. demonstrated that computational models underperformed compared to expert clinicians in predicting the diagnosis of malignancy among patients with lung lesions.[1] At least one other research team observed similar findings in the context of the pulmonary medicine clinic setting.[2] Key strengths of Sarnaik’s study include: 1) leveraging clinical trial data for secondary analyses; 2) use of myriad computational models; 3) critical evaluation of model performance with statically and clinically relevant parameters; and 4) the use of a comparator to judge model performance. Prediction is hard and changing clinical decision-making may be harder.

An important barrier to better predicting the diagnosis of lung cancer among patients with screen or incidentally detected lung nodules is the lack of strong predictors of lung cancer. Pepe et. al. demonstrated that even factors with an odds ratio of 3.0—often considered to represent a high magnitude association—are poor predictors of patient-level events.[3] An examination of Sarnaik’s Table 3 reveals odd ratios <3.0 for essentially all factors. A recent population-based study similarly showed that most conventional risk factors—such as age and tobacco use—have low magnitude associations with a lung cancer diagnosis.[4] These repeated observations do not dispute the causal nature of factors like tobacco use that lead to lung cancer, though they do
humble us in our ability to predict lung cancer at the individual level using population-level derived risk-factors. Experts may have outperformed computational models because they knowingly or intuitively use and weight factors that investigators do not know how to measure or cannot measure. A better understanding and incorporation of biological factors into models and the inclusion of time-varying predictor variables (e.g. nodule size and density) may be one way to give computational models an edge over experts.

The context in which these data were collected leads to the realization that other research methodologies are needed to compliment quantitative investigators’ efforts in their aim to change clinical decision-making. To be eligible for trial inclusion—and therefore inclusion in Sarnaik’s study—an expert clinician had to identify a patient with a lung lesion suspicious for malignancy that he or she felt amenable to biopsy with electromagnetic navigation bronchoscopy[1]. However, despite recommending a biopsy, clinicians offered estimates for the probability of lung cancer ranging from 0 to 100%. Factors other than the probability of lung cancer likely influenced clinicians to recommend a biopsy. Although it is unknown how clinicians arrived at their decision, they were correct about a cancer diagnosis 75% of the time. Will an accurate and precise estimate of the probability of lung cancer be enough to change clinical decision-making, and if so how accurate and how precise will the prediction need to be? Future investigations will not only have to take on the task of predicting the diagnosis of lung cancer but also the cognitive and affective components of clinical decision-making to better select patients for invasive diagnostic and therapeutic procedures versus ongoing imaging surveillance.
References


