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A Prospective Applicant's Outlook on Radiology in Light of Artificial Intelligence



A recent survey of 322 medical students showed that more than two-thirds (67.7%) believed that artificial intelligence (AI) would result in a reduced demand for radiologists [1]. Interestingly, another survey of primarily radiologists and radiology residents done by the European Society of Radiology showed that of the 675 respondents, 32.3% believed that AI would result in a decrease in future radiology job opportunities [2]. When I was a student finishing my second year of medical training, I shared the same hesitations, going so far as to believe that AI would largely replace the role of diagnostic radiologists [3]. Now finishing my core rotations, with a diverse set of newfound clinical experiences, I have had the opportunity to see firsthand the integral role radiology plays in various settings. These experiences have greatly shifted my outlook on the future of radiology, which I would like to discuss in this letter.

Something I had not appreciated before rotations is the clinical knowledge with which radiologists are equipped. Like all other physicians, they too completed medical school. I think this becomes easy to overlook when radiologists are working primarily behind the scenes rather than at the patient's bedside. When *Nature Medicine* publishes an article showing the progress of deep-learning algorithms in their ability to detect pneumonia and wrist fractures on radiography, at the level of a radiologist [4], it becomes easy to dismiss their essentiality. Although AI will only continue to improve in

detecting what is not normal on imaging, it is faulted in its inability to provide a clinical interpretation and consequent implications. As AI progresses, this need will likely result in radiologists' playing a bigger, more visible role in patients' multidisciplinary teams.

Where I think AI has the potential to make a more immediate impact in the field of radiology is through improving the PACS user interface. Earlier research on the implementation of PACS showed that when interpreting a study, radiologists spent only 15% of their time on actual image interpretation and recognition of findings and the remaining 85% of their time reporting, calling images up, waiting for hanging protocols, and so on [5]. With improvement of this interface, radiologists would become more efficient, having more time to produce higher-quality image interpretations.

For the reasons outlined herein, AI's biggest contribution to radiology will likely be triaging images through detection of what is not normal and optimizing the PACS user interface for the foreseeable future. These advances will greatly improve the efficiency of radiologists, allowing higher-quality image interpretation and a bigger, more visible role in patients' multidisciplinary teams. Because radiologists are clinicians, they will always have a role in patient care, regardless of how advanced AI may become. Although the field of radiology is changing, medical students considering the profession should rest assured that it is here to stay.

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Handle With Care: Use of Proportions to Assess Changes in Acute Appendicitis During the 2020 COVID-19 "Surge"



We commend Romero et al [1] for exploring the impact of the COVID-19 pandemic on acute surgical disease. They noted an increase in the proportion of cases that were graded as severe on CT scan and concluded that delays in seeking medical care led to increasing severity of acute appendicitis at the time of presentation. Use of proportions, however, is vulnerable to changes in both numerator and denominator. Although raw numbers are not included in the article, based on Figure 1, we can estimate the number of patients who presented within each severity category during the pandemic and nonpandemic periods. In fact, there was no difference in the number of patients presenting with grades 4

and 5 acute appendicitis when the nonpandemic period is compared with the pandemic period (24 versus 23 patients).^{*} What the authors observed was not an increase in severe cases but a decrease in mild cases.

The authors posit pandemic-related delays in care resulted in more severe disease. However, when one considers the raw numbers, other potential explanations arise. It is possible that more patients with mild, self-limiting disease recovered at home during the pandemic period and those with severe disease continued to present despite pandemic-related limitations on access to medical care. Previous work has suggested that mild, self-limiting appendicitis may, in fact, be a different disease compared with severe, perforated cases [2,3], which would support this explanation. Similar decreases in overall appendicitis cases were noted in our own study of five institutions across the United States [4] and in a multicenter study in Jerusalem, Israel [5]. In these studies, as seems to be the case in the current study,

^{*} We based this calculation on the data presented in Figure 1 [1]. Nonpandemic (total N = 135): grade 4 is approximately 15% (20 patients) and grade 5 is approximately 3% (4 patients), for a total of 24 patients with severe disease. Pandemic (total N = 54): grade 4 is approximately 35% (19 patients) and grade 5 is approximately 8% (4 patients), for a total of 23 patients with severe disease. Grade 4 is described as ruptured appendicitis, and grade 5 is “complicated appendicitis.” Of note, when the authors “dichotomized” their results into nonsevere and severe disease, it seems that grade 3 (“appendicitis with peri-appendicitis”) was included in the severe category. From a clinical or surgical standpoint, peri-appendicitis is quite a broad category, although presumably most of these patients could still have a straightforward operation. From the standpoint of our calculation, including grade 3 would actually have led to a larger number of “severe” patients in the nonpandemic period, further emphasizing the point of this letter. However, we based our calculation on grades 4 and 5 because, from a clinical standpoint, these are patients with truly severe disease.

changes were driven primarily by decreases in mild appendicitis cases with few changes in volume of severe cases.

Relying exclusively on proportions of severe appendicitis without investigating changes in both numerator and denominator risks missing half the story. Per Strengthening the Reporting of Observational Studies in Epidemiology guidelines for observational research, raw numbers should be included to place any summary statistics, such as proportions, into appropriate context [6]. For appendicitis, the denominator (all cases of acute appendicitis) seems susceptible to health care utilization—among other factors. Recognizing divergent trends in severe and mild forms of this disease may deepen our understanding of its natural history and pathophysiology.

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Reply to “Handle With Care: Use of Proportions to Assess Changes in Acute Appendicitis During the 2020 COVID-19 ‘Surge’”



We thank Dr Neufeld et al for their letter to the editor, in which they point out that the use of proportions should be manipulated carefully. We agree about that topic; however, we believe that with the right analysis, all data can provide useful information.

We state in our investigation that the real impact of the pandemic period was a decrease in the total amount of abdominal CTs performed in patients with suspected appendicitis, all corresponding to patients with a real indication of it. We acknowledge their statement of a reduction in mild appendicitis cases instead of an