

# 2022 Survey of North Dakota Emergency Medicine Physicians

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## Introduction

- Outlook of the Emergency Medicine (EM) job market was shaken after projection of 7,845 EM physician surplus were to occur by 2030 <sup>1</sup>
- Contributors of the surplus include:
  - Increased incidence of billing by Advanced Practice Providers (APPs) such as Nurse Practitioners and Physician Assistants from 23% to 29% from 2012 to 2016 <sup>2</sup>
  - 60% increase in EM residency graduates from 2008 to 2020 <sup>1</sup>
  - Estimated attrition rate of 3% <sup>1</sup>
- Concern that above projections do not adequately apply to rural states such as North Dakota:
  - Single Level 1 trauma center in the state
  - Net decrease annually in rural Emergency Physicians <sup>3</sup>
  - Increasing need for APPs for rural coverage of Emergency Departments (EDs) <sup>3</sup>
- Necessary to gauge EM physician's thoughts of current/future ND EM job market and use of APPs within the state

## Methods

- A survey was distributed by mail to all known physicians practicing EM in ND. Responses were gathered via qualtrics.com submissions and mail in forms
- 136 surveys were mailed along with a cover letter explaining the purpose of the survey, instructions on completing the survey, and a QR code to the online response form

## Results

- 53 total respondents with 83.0% male, 15.1% female, and 1.9% other
- 43.4% of respondents plan to retire within 10 years
- 88.7% of respondents plan to retire within 20 years

Figure 1. Main challenges facing emergency medicine in the next 10 years

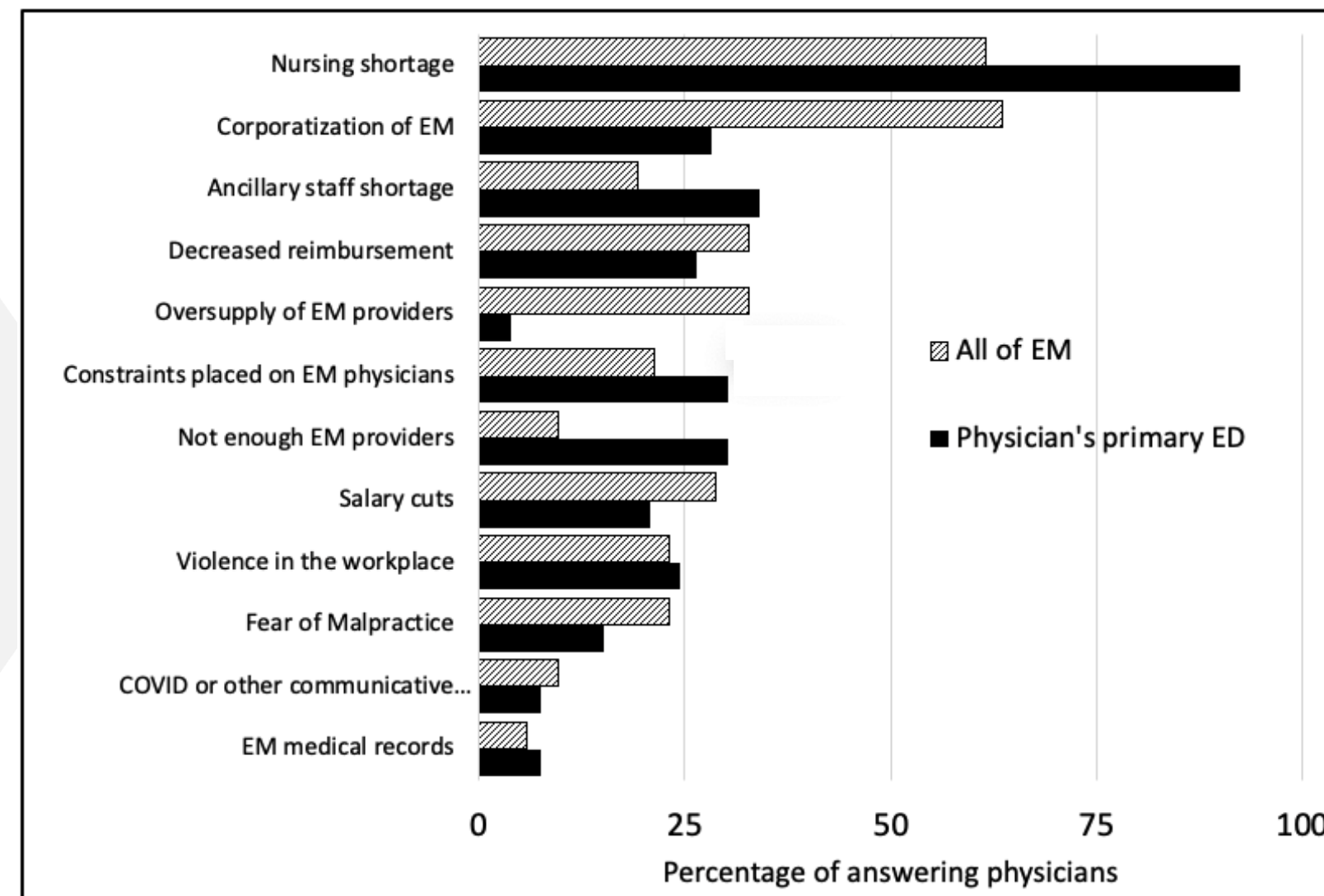


Figure 2. Physicians' comfort with APPs in critical setting

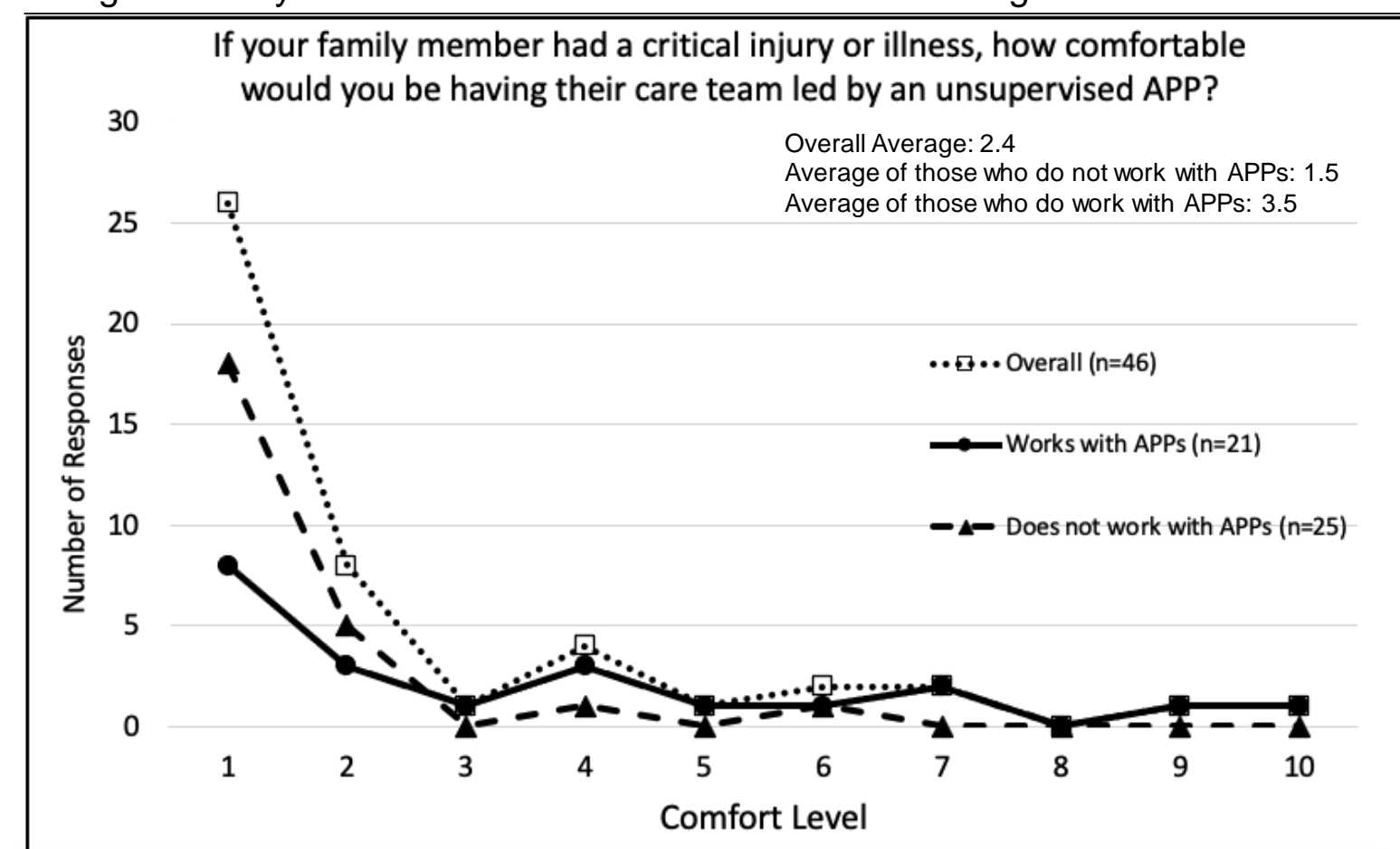
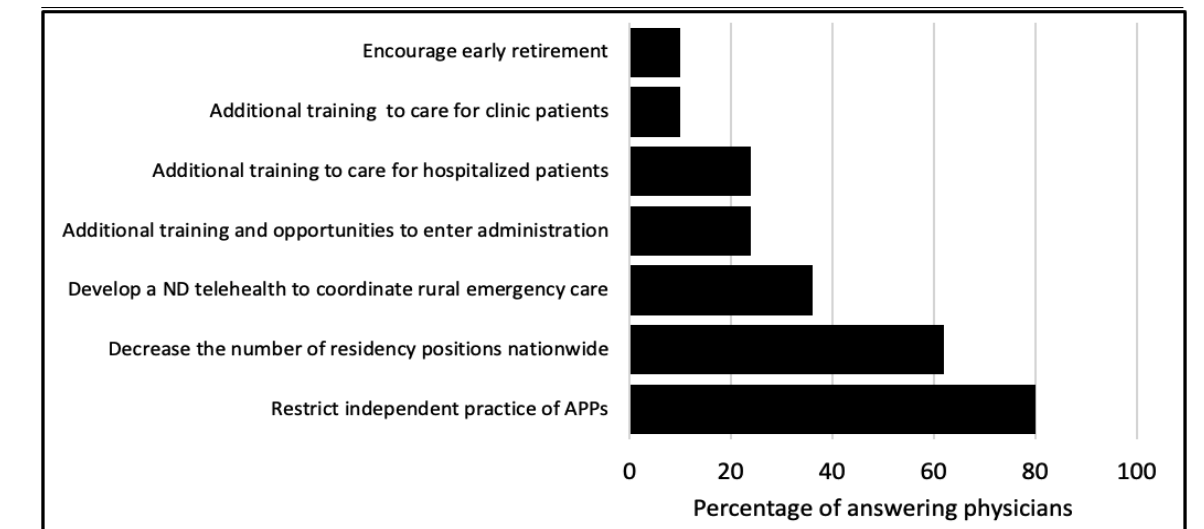


Figure 3. Recommended solutions to the 2030 EM Physician surplus projection



## Discussion

- ND attrition rate estimated at 4.34% for the next 10 years compared to the 3% used in national projection
- 0% of ND physicians indicated physician overstaffing as an issue locally.
- Concern that APP restriction neglects the necessity of APPs in rural communities
- Restriction of EM residency graduates could continue to impact rural physician shortages
- Direct interaction between physicians and APPs increases numerically indicated trust in APPs (average comfort of 3.5 vs 1.5; p=0.003)
- APPs have an important role in EM, but it is physician opinion that APPs cannot fully replace the physicians in critical situations

## Conclusion

- Projected immense surplus of EM physicians by 2030 is unlikely to impact ND due to:
  - Higher projected ND attrition rates (roughly 4.34% in ND vs 3%)
  - Current continuous need for rural providers
- ND EM physicians feel restriction of APPs in EM and changes to EM residency graduation rates are important in controlling the national surplus
- While vital to health care access in remote areas of ND, a majority of physicians do not feel comfortable with unsupervised APPs in critical settings

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# Computed Tomography Scan Characteristics of Patients with COVID-19 Associated Pulmonary Aspergillosis

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## Introduction

- There have been many recent reports of pulmonary aspergillosis in patients infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [1].
- Susceptibility is due to direct viral damage to the airway epithelium [2].
- Coronavirus disease 2019 (COVID-19) associated pulmonary aspergillosis (CAPA) was reported in as much as 33% of hospitalized patients [3].
- 2 of the most well-known radiologic findings in aspergillosis are the “halo sign” and “air crescent sign” [4]
  - The “halo sign” is a pulmonary nodule or mass surrounded by ground glass which represents hemorrhage (figure 1) [5].
  - The “air crescent sign” is an air crescent within a nodule or mass which represents resorption of necrotic tissue and is a sign of recovery (figure 2) [6].
- In this study, we evaluated the computed tomography (CT) scan findings at baseline of patients with CAPA.



Figure 1: Halo Sign  
Image courtesy of Radiopaedia



Figure 2: Air Crescent Sign  
Image courtesy of Radiopaedia

## Methods

- A total of 43 patients were identified retrospectively to have proven, probable or possible CAPA based on the consensus case definition published by the European Confederation for Medical Mycology and International Society for Human and Animal Mycology at Sanford Health Fargo [7].
- Patients with chest CT scans were analyzed for any radiographic findings suggesting pulmonary pathology.
  - The prevalence of each radiographic finding was calculated.
- Aspergillus galactomannan antigen was also analyzed in eligible patients.

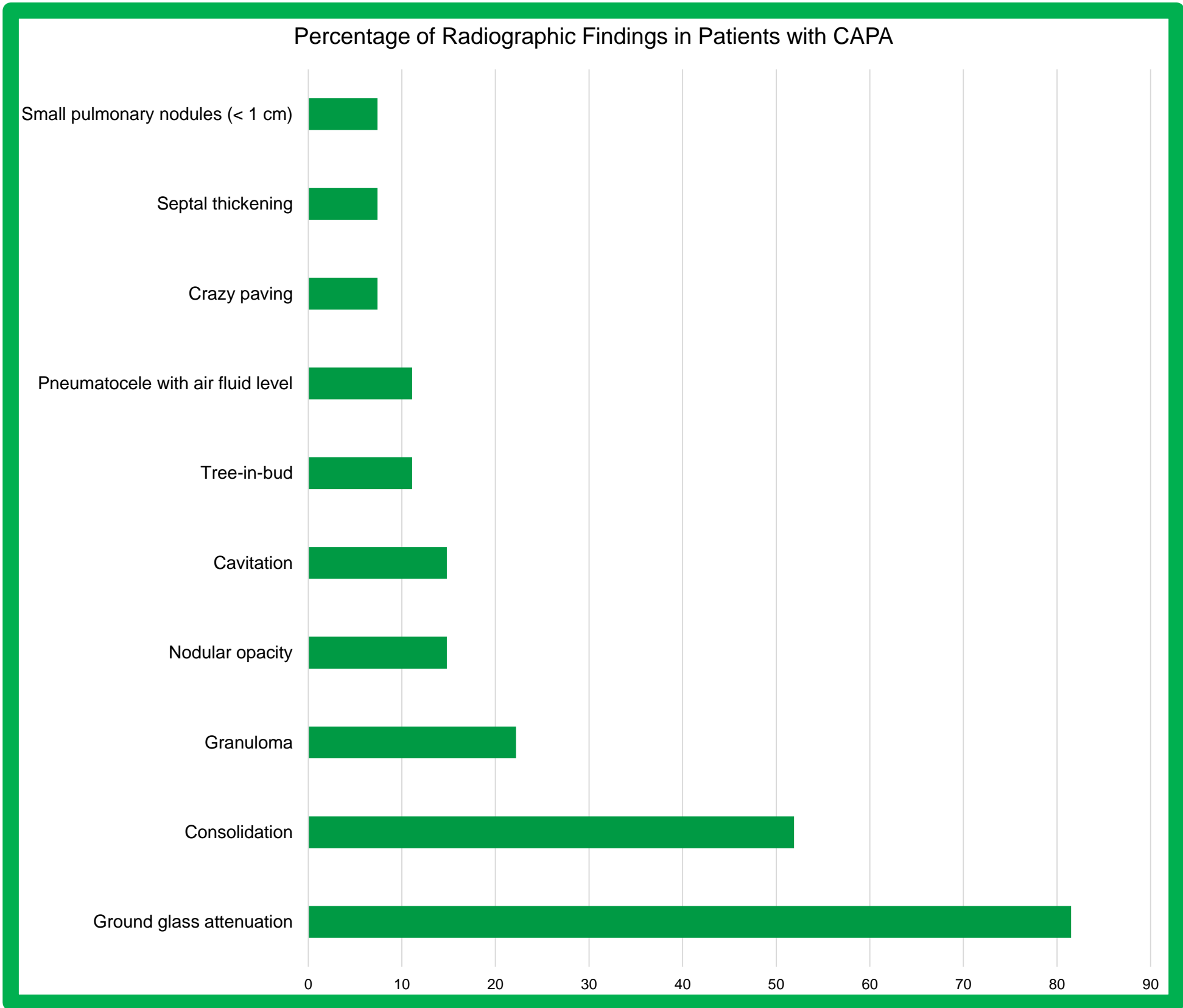


Figure 6: Percentage of Radiographic Findings in Patients with CAPA

## Results

- Of the 43 patients with CAPA, 27(63%) have had at least one baseline CT scan, 30(70%) were males, 35(81%) Caucasian with mean age of 64 years (range 28-85).
- Of 22 patients with serum galactomannan, 6(27%) had a positive result.
- Most common CT findings include ground glass attenuation 22(81%) (figure 3), consolidation 14(52%) (figure 4), and granuloma 6(22%) (figure 5).
- Other findings including small pulmonary nodules, cavitation, peribronchial infiltrates associated with tree-in-bud, pneumatocele with air fluid, septal thickening and nodular opacities are only found in 7-15% of cases. Figure 6 illustrates these findings.

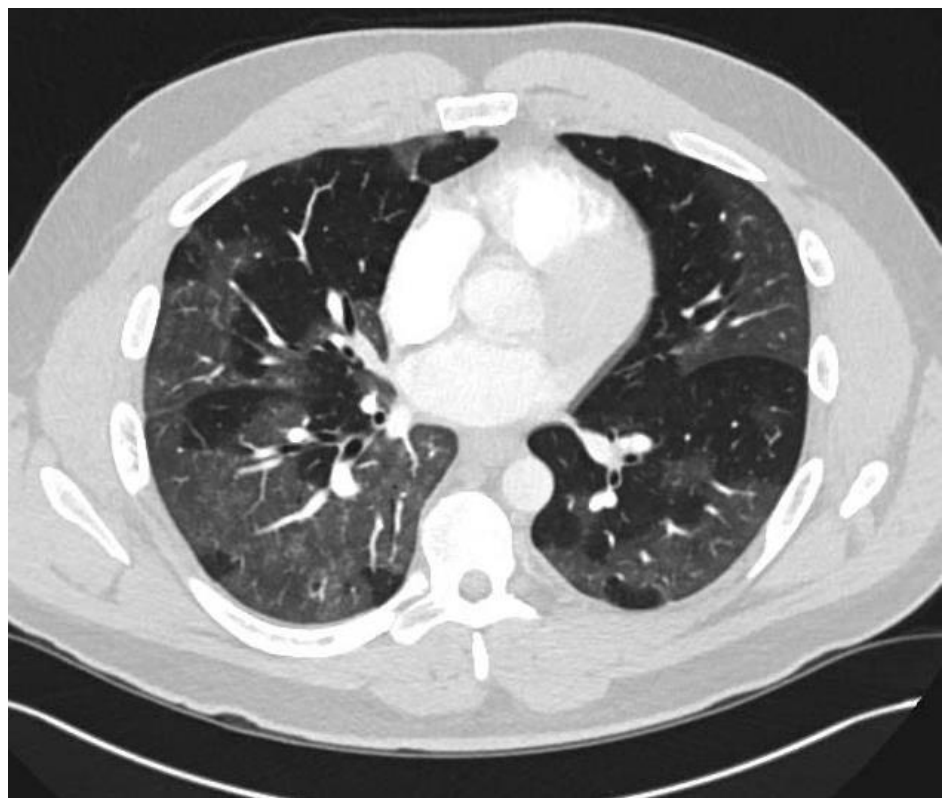


Figure 3: Ground Glass Attenuation  
Image courtesy of Radiopaedia



Figure 4: Consolidation  
Image courtesy of Radiopaedia

- The most common CT findings in the 6 patients with a positive serum galactomannan were ground glass attenuation 4(67%), consolidation 3(50%), tree-in-bud 1(17%), cavitation 1(17%), and granuloma 1(17%).



Figure 5: Granuloma  
Image courtesy of Radiopaedia

## Conclusion

- Most common CT scan findings with CAPA still reveal typical imaging appearances of COVID-19 patients.
  - These are usually non-specific findings such as ground glass attenuation, consolidation, & septal thickening [8].
- There is a wide range of radiologic features that overlap between COVID-19 pneumonia and pulmonary aspergillosis in patients with CAPA as lesions suggestive of invasive fungal infections may be hidden or mimicked by COVID-19 infection.
- Additional studies could be conducted that also have patient groups with isolated cases COVID and those with aspergillosis.

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# Association of Vaccination Status and Severity of SARS-CoV-2 Infections in Hospitalized Patients

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## Introduction

- Vaccination to prevent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection is considered the most promising approach for addressing the Coronavirus 2019 infection (COVID-19) pandemic.
- However, even vaccinated people remain at risk of COVID-19 especially with emergence of Omicron variant or B.1.1.529.
- In this study, we examined the association between levels of vaccination and clinical outcomes in hospitalized patients with COVID-19.

## Methods

- We conducted a series of observational retrospective analyses using the electronic health records (EHRs) of hospitalized adult COVID-19 patients at Sanford Health on January 2022.
- We estimated odds ratios (ORs) and 95% confidence intervals (95% CIs) for 30-day mortality, ventilatory support, ICU stay and vaccination status using logistic regression models.
- Poisson regression model was applied to the outcome variable length of inpatient days.
- Patient’s age, gender, race and number of comorbidities were included in all the models as covariates.
- All analyses were done by SPSS V 25, and p<0.05 was considered as statistical significance.



## Results

- Of 484 patients studied, 256(53%) were unvaccinated, 131(27%) fully vaccinated, 82(17%) boosted or up-to-date and 15(3%) were partially vaccinated.
- Table 1 describes the patient characteristics.

Patient Characteristics (n=484)		N(%)
Sex	Male	247 (51)
	Female	237 (49)
Age, years (mean +/- SD)		64+/-18
Vaccination Status	Unvaccinated	256 (53)
	Fully vaccinated	131 (27)
	Boosted	82 (17)
	Partial vaccination	15 (3)
Vaccination type	Pfizer	131 (27)
	Moderna	78 (16)
	J&J	19 (4)
Race	Caucasian/White	406 (84)
	American Indian or Alaskan Native	66 (14)
	African American/Black	6 (1)
	Other	6 (1)
Number of comorbidities* (mean +/- SD)		7 +/- 4
30-day mortality		80(17)
Severity of illness	Mild-moderate	92 (19)
	Severe	117 (24)
	Critical	277 (57)
ICU stay		74 (15)
Length of stay in days (mean +/- SD)		9 +/- 12

Table 1. Characteristics of COVID-19 patients in the study.  
Note. \*Underlying medical conditions associated with higher risk for Severe COVID-19:Centers for Disease Control and Prevention.  
\*\*Clinical Spectrum of SARS-CoV-2 infection: National Institutes of Health

## Severity of Infection

- Fully vaccinated (OR=0.49, p=.001) and updated patients (OR=0.46, p=.004) had significantly lower probability of critical severity compared to unvaccinated.
- Older patients (beta=0.014, p=0.015) and patients with more number of comorbidities (beta=0.114, p<0.001) had higher probability of severe or critical condition.
- Male also had higher chance to be in critical condition than female (OR=1.58, and p=0.014).

## Thirty-day Mortality

- Vaccination status is significantly related with 30-day mortality (p=0.005). Table 2.
- Older patients (p<.001) and patients with more comorbidities conditions (p=.002) had higher probability of death within 30 days.

Table 2. Estimated probability of 30 day mortality				
Vaccination status	Probability of death within 30 days	Odds Ratio	95% CI of OR	
Fully vaccinated	0.06	0.305	0.145	0.641
Boosted	0.10	0.544	0.271	1.091
Partial vaccinated	0.27	0.529	0.564	6.347
Not vaccinated	0.17		reference level	

## Need for respiratory support

- Vaccination status is not significantly associated with patients’ need for BiPAP and/or mechanical ventilation support. Table 3.

Table 3. Estimated probability of BiPAP and Mechanical ventilation				
Vaccinate status	Probability of using BiPAP or MV	Odds Ratio	Lower	Upper
Fully vaccinated	0.08	0.536	0.271	1.060
Boosted	0.08	0.542	0.248	1.185
Partial vaccinated	0.23	1.712	0.499	5.871
Not vaccinated	0.15		reference level	

## Need for ICU stay

- Vaccination status and all the covariates were not statistically related with ICU admission (ps>0.05). Table 4.

Table 4. Estimates probability of ICU stay				
Vaccinate	Probability of ICU stay	Odds Ratio	95% CI of OR	
Fully vaccinated	0.15	0.836	0.451	1.549
Boosted	0.14	0.769	0.362	1.633
Partial vaccinated	0.06	0.287	0.036	2.289
Not vaccinated	0.17		reference level	

## Length of stay

- Boosted patients LOS (6.6 d) is significantly lower than patients with no vaccination status (10.7 d, p<.001).
- Male had 36% longer stay then female (p<0.001).
- Black and Asian patients stayed more days than white and Native American (p<0.001), and more comorbidities, longer the stay. (p<0.001).

## Conclusion

- Our study findings provide real-world evidence that full and updated booster vaccinations substantially increase protection against critical infection and death in hospitalized patients with COVID-19 infection.

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# Robotic bronchoscopy diagnostic efficacy utilizing the Monarch system at Essentia Health Hospital

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## Introduction

- Why is this important? It is estimated that this year 236,740 new cases of lung cancer will be detected and around 130,180 people will die from lung cancer.
- Early detection and subsequent accurate biopsy are imperative
- Biopsy traditionally is down by either CT-guided percutaneous biopsy, transbronchial endoscopy, or in certain cases thoracostomy depending on lesion location
- Least invasive biopsy method is preferred
- A mass located in the mediastinum, or a more distal location can present a challenge, and often results in more invasive methods being necessary as a traditional bronchoscope is too large to reach distal aspects of air passages (5-6 mm vs 4.2 mm)
- Robotic bronchoscopy is a new option that has many similarities to established guided bronchoscopy but is improved by having a smaller diameter, more precise navigation, and increased stability during lesion sampling
- Previous study done at the University of Chicago Medical Center showed promising results with a diagnostic accuracy rate of 77% in a sample size of 124 patients
- Essentia Health Hospital in Fargo, ND has begun using the Monarch robotic bronchoscopy system and has been recording the results for nearly a year
- In this study, we analyzed the diagnostic accuracy and overall efficacy of the new technology by comparing our results to the results from the University of Chicago's study

## Methods

Data was reviewed on eligible cases in which robotic bronchoscopy was used to diagnose lung lesions from October 19th, 2021, to September 15, 2022, at the Essentia Health Hospital in Fargo, ND performed by Dr. Karol Kremens. The size of the lesion, appearance on radial endobronchial ultrasound, and diagnostic results were recorded and analyzed to compare diagnostic efficacy to a previous study's results, which were collected at the University of Chicago Medical Center.



Above image: Dr. Kremens and his team at Essentia Health Hospital performing a robotic bronchoscopy using the Monarch system developed by Auris Health. After CT imaging the digital file is uploaded to the Monarch system, which triangulates with sensors we place on the patient's chest to create a digital model



Image to left Example of a mass in a patient's right upper lobe which is located quite distally. This type of lesion would previously have been difficult if not impossible to reach via bronchoscopic means

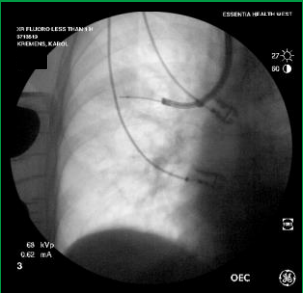


Image to right: fluoroscopic image taken as the Monarch robot biopsied a lesion located in a patient's right upper lobe

## Results

	Average	Range	Chicago
Age	69.6 years	28-86 years	68 (62-76)
Lesion diameter (mm)	25.8 mm	9 mm-62 mm	24 (13-30)
	Total	Diagnostic Yield	Chicago Yield
Diagnostic accuracy	33	26 (78%)	95 (77%)
Concentric r-EBUS view	19	17 (89%)	39 (85%)
Eccentric r-EBUS	12	8 (66.7%)	47 (84%)
Absent r-EBUS	2	1 (50%)	8 (38%)

	Fargo	Chicago
Diagnostic yield ((TP+TN)/total patients who had RB)	78%	77%
Sensitivity for malignancy (TP/[TP+FN])	73%	69%
Specificity for malignancy (TN/[FP+TN])	100%	100%
Positive Predictive Value (TP/[TP+FP])	100%	100%
Negative Predictive Value (TN/[FN+TN])	50%	58%

## Conclusions

Diagnostic accuracy of robotic bronchoscopy in our cohort over a nearly twelve-month period showed similar diagnostic yield when compared with traditional bronchoscopy with excellent safety profile. In addition, the diagnostic yield in this case series is on par with previously published results from other centers.

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