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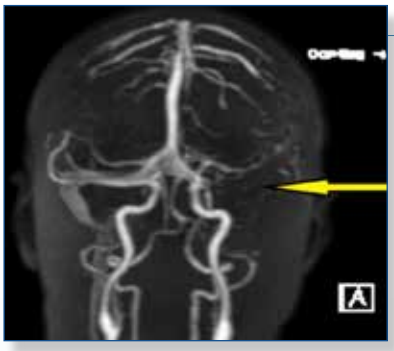

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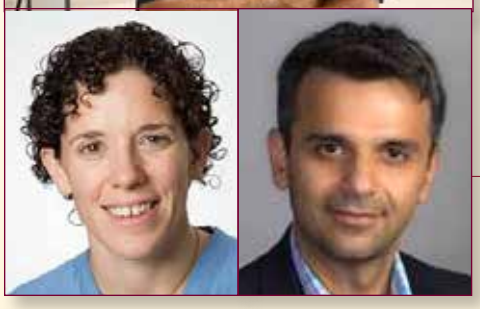

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Presentations and Outcomes of Severe Cardiac Complications in COVID-19: Rhode Island Experience

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ABSTRACT

Forty-one (41) patients admitted to Rhode Island hospitals with COVID-19 from April to November 2020 were identified to have severe cardiac complications. Clinical presentations of cardiovascular system toxicity in COVID-19 included myocarditis, pericarditis, cardiomyopathy, ACS and cardiac arrhythmia. Clinical features, hospital outcomes and post-discharge outcomes were characterized. Acute myocarditis (46.3%) and cardiomyopathy (29.3%) were the most common findings followed by cardiac arrhythmia, acute coronary syndrome, and pericardial disease. Pulmonary involvement of COVID-19 was absent in 41.5% of patients. Comorbid cardiovascular conditions were absent in 29.3% of patients. Severe cardiac complications in COVID-19 were associated with an in-hospital mortality rate of 61%. Among survivors with COVID-19-related cardiomyopathy, only 20% demonstrated recovery of LV function on follow-up echocardiography done within 12 weeks after initial diagnosis. Identification, diagnosis and management of severe cardiac complications in COVID-19 are discussed.

KEYWORDS: COVID-19, myocarditis, cardiomyopathy, acute coronary syndrome, arrhythmia, pericarditis

ABBREVIATIONS

ACEi – Angiotensin-converting enzyme inhibitors
ACS – Acute coronary syndrome
ARB – Angiotensin II receptor blockers
NSTEMI – non-ST elevation myocardial infarction
STEMI – ST elevation myocardial infarction
RV – Right ventricle/ventricular
VF – Ventricular fibrillation
VT – Ventricular tachycardia

INTRODUCTION

COVID-19 is a clinical syndrome arising from infection with SARS-CoV-2 coronavirus which is known to produce interstitial pneumonia with/without respiratory failure, and thrombosis due to hypercoagulability. Cardiac injury may also occur. The incidence and extent of severe cardiac complications in COVID-19 is undefined and the range of presentations and outcomes is still being characterized. This report adds to the growing body of evidence by providing detailed information on severe cardiac presentations in COVID-19, hospital outcomes and establishes early post-discharge outcomes in follow-up. We aim to aid the clinician in early identification, diagnosis and management of cardiac complications in COVID-19.

METHODS

Patient Selection

Institutional review board approval was obtained for retrospective review of patient records. 2,229 patients admitted with COVID-19 to the Rhode Island Hospital, The Miriam Hospital and Newport Hospital in Rhode Island from April 1 to November 30, 2020 were identified. All patients identified tested positive for presence of SARS-CoV-2 coronavirus via nasopharyngeal swab or serum serology testing. Discharge diagnoses associated with hospitalization were reviewed for the following: myocarditis, viral myocarditis, cardiomyopathy, cardiogenic shock, congestive heart failure, acute systolic heart failure, cardiac arrythmia, ventricular tachycardia, ventricular fibrillation, pericarditis, pericardial effusion, cardiac tamponade, ST elevation myocardial infarction and non-ST elevation myocardial infarction. In addition, cardiac troponin I values were obtained for all 2,229 cohort patients, those with a maximum troponin value ≥15 mg/dL were selected. The final study population included patients with at least one of the above discharge diagnoses and/or cardiac troponin I ≥15 mg/dL.

Definitions of Cardiac Complications

- Myocarditis was defined as elevated cardiac troponin I and absence of acute coronary syndrome.
- Cardiomyopathy was defined as newly diagnosed left ventricular dysfunction in absence of CHF history.
- RV dysfunction was defined as newly diagnosed right ventricular systolic dysfunction in the absence of CHF history.
- Cardiac arrhythmia was defined as presence of cardiac arrhythmia during hospitalization.
- Pericarditis was defined as presence of chest pain or other symptoms, EKG changes and/or pericardial effusion during hospitalization.

- Acute coronary syndrome (STEMI, NSTEMI) was defined as anginal symptoms, EKG abnormalities, cardiac troponin I elevation and as noted by discharging provider.
- Patients presenting with STEMI were presumed to have coronary ischemia as the cause of troponin I elevation and cardiomyopathy, rather than myocarditis. Additionally, patients may have had more than one severe cardiac finding, e.g., cardiomyopathy and myocarditis.

Post-hospital discharge, follow-up with cardiology clinic and echocardiogram, if obtained, were reviewed for surviving patients.

RESULTS

A total of 41 patients hospitalized with COVID-19 infection were identified to have severe cardiac complications. Clinical characteristics and outcomes are presented in **Table 1** (click to view pdf). The overall incidence of severe cardiac complications among the larger hospitalized cohort was 1.8%. Clinical findings for all patients, survivors and non-survivors are summarized in **Table 2**. The mean age was 66 [61-71 95%CI]; 30 of 41 patients (73.2%) were male, and 29 of 41 (70.7%) patients had a previous history of cardiac or related conditions, including coronary artery disease, hypertension, congestive heart failure and diabetes. The most common presenting symptom was dyspnea occurring in 41.5% of patients, with chest pain reported by 17.1% of patients. Concurrent COVID-19 pneumonia, defined as characteristic patchy diffuse pulmonary infiltrates and hypoxia, was present in 24 of 41 (58.5%) patients. Concurrent pulmonary embolism was present in 3/41 (7.3%) patients. Cardiogenic shock was present in 21 of 41 (51.2%) patients.

Myocarditis was found in 19/41 (46.3%) of patients; cardiomyopathy was found in 12/41 (29.3%) of patients; STEMI in 8/41 (19.5%), pericarditis was found in 5/41 (12.2%); and severe RV dysfunction was found in 5/41 (12%) of patients. 15 of 41 (36.6%) of patients experienced cardiac arrythmia with atrial fibrillation occurring in 22% and ventricular tachycardia/fibrillation occurring in 12% of patients.

In patients without a previous history of CHF, newly diagnosed left ventricular dysfunction as defined by ejection fraction <50%, was found in 11 patients. Newly diagnosed left ventricular dysfunction was associated in 2/12 patients with ST elevation myocardial infarction and with

Table 2. Summary of COVID-19 clinical findings among patient with severe cardiac complications

	All Patients [95%CI]	Survivors [95%CI]	Non–survivors [95%CI]
Total #	41	16	25
Age	66 [61–71]	61 [54–68]	70 [61–79]
Female (%)	11 (26.8)	5 (31.3)	6 (24.0)
Cardiovascular risk factors present (%)	29 (70.7)	9 (56.2)	20 (80.0)
COVID–19 pneumonia present (%)	24 (58.5)	7 (43.8)	17 (68.0)
Cardiogenic shock present (%)	21 (51.2)	4 (25)	17 (68.0)
New LV dysfunction (%)	12 (29.3)	9 (56.3)	3 (16.0)
New RV dysfunction (%)	11 (26.8)	3 (18.8)	8 (32.0)
Severe Cardiac Complication (%):			
Cardiomyopathy	12 (29.3)	9 (56.3)	3 (12.0)
Myocarditis	19 (46.3)	10 (62.5)	9 (32.0)
Pericarditis	5 (12.2)	3 (18.8)	2 (8.0)
Severe RV dysfunction	5 (12.2)	0 (0.0)	5 (20.0)
STEMI	8 (19.5)	2 (12.5)	6 (24.0)
NSTEMI	11 (26.8)	4 (25)	7 (28.0)
Arrythmia	15 (36.6)	3 (18.7)	12 (48.0)
BNP (pg/mL) mean	680 [398–961]	368 [164–573]	882 [452–1313]
Troponin (ng/mL) mean	17 [10–25]	23 [7–39]	14 [7–21]
Troponin <0.5 ng/mL (%)	11 (26.8)	5 (31.3)	6 (24.0)
CRP (mg/dL) mean	211 [171–252]	191 [131–251]	226 [171–282]
D–dimer (mg/mL) mean	10740 [5309–16171]	8785 [460–17110]	12015 [4771–19258]
Received COVID–19 specific treatment (%)	21 (51.2)	4 (25.0)	17 (68.0)
LOS (days) mean	9 [6–13]	9 [4–13]	10 [5–15]

Abbreviations: BNP – brain natriuteric peptide, CRP – c-reactive protein, LOS – length of hospital stay, LV – left ventricular, LVEF – Left ventricular ejection fraction, MI – myocardial infarction PCI – percutaneous coronary intervention, RV – Right ventricle

Normal reference values: BNP 0.0-72.3 pg/mL, troponin I 0.006-0.06 ng/mL, D Dimer 0-300 ng/mL and CRP 0-10.0 mg/L.

viral myocarditis in 10/12 patients. In patients without a previous history of CHF, newly diagnosed right ventricular dysfunction was observed in 11 patients, with 5/11 (45.4%) characterized as severe by echocardiographic examination.

The most common electrocardiographic changes included ST segment depressions in 10 of 41 (24.4%) patients, ST elevations in 8 of 41 (19.5%), as well as atrial fibrillation, T wave inversions, sinus tachycardia and others.

Serum chemistry analysis revealed a B-natriuretic peptide mean of 680 [398-961 95%CI] pg/dl, mean troponin I 17 [10–25 95%CI] mg/dl, mean CRP 211 [171–252 95%CI] mg/dl, and mean DDimer 10740 [5309–16171 95%CI] mg/ml. Pericardial effusion was found in 5 of 41 (12.2%) patients. Three patients presented with findings of cardiac tamponade and underwent pericardiocentesis. Pericardial fluid volumes removed ranged from 250–700cc, fluid analysis revealed nucleated cells ranging from 86–17,544 cells/cmm, and cytologic examination with reactive acute inflammation in 3/3 samples.

Cardiac catheterization was performed in 6 of 41 patients. Findings included normal coronary arteries in 2 patients with acute viral cardiomyopathy, and coronary artery disease including single and multivessel disease in 4 patients. Three patients presenting with STEMI underwent percutaneous coronary intervention and coronary artery stent placement.

Twenty-one of 41 (51.2%) patients received COVID-19 specific treatment defined as corticosteroids and/or remdesivir. Cardiac specific treatment included management of acute myocardial infarction (26.8%), goal-directed management of congestive heart failure (21%), anti-arrhythmic agents (12%) as well as pericardiocentesis, ECMO, and PCI. The average length of stay in hospital was 9 [6-13 95% CI] days. Mortality was observed in 25 of 41 (61%) of patients.

Among 16 patients who survived to discharge, 13 patients had follow-up data as presented in **Table 3**. Among patients with COVID-19 cardiomyopathy 5 patients had follow-up echocardiography with a mean follow-up time of 2.75 months; 4/5 (80%) had persistent reduced LV function and 1/5 (20%) had recovery of normal LV function.

DISCUSSION

Clinical presentations and outcomes of 41 patients with severe cardiac complications hospitalized with COVID-19 infection were examined. Acute myocarditis and cardiomyopathy were the most common findings followed by acute coronary syndrome and pericardial disease. Cardiac arrhythmias due to atrial fibrillation and ventricular arrythmias were also found. Severe RV dysfunction was found in 12% of patients. Severe cardiac complications in COVID-19 were associated with a high mortality rate; 61% of patients died in hospital after initial presentation. Among survivors with COVID-19 related cardiomyopathy, only 20% demonstrated recovery of LV function on follow-up echocardiography within 12 weeks of diagnosis.

Findings which included the high incidence of pre-existing

Table 3. Post-hospital discharge outcomes in survivors among COVID-19 patients with severe cardiac complications

Age/ Sex	Outcome	Cardiac Complication	Readmission to Hospital within 30 days	Outcome after discharge	Duration of follow-up
68/M	Survived	Myocarditis, pericarditis, cardiomyopathy	None	Admitted with CHF, LVEF severely reduced 6 weeks later	1.5 months
67/M	Survived	Cardiomyopathy, myocarditis	None	LVEF 35%, symptoms of CHF	1.5 months
54/M	Survived	Cardiomyopathy	None	LVEF 35%	6 months
24/M	Survived	Cardiomyopathy	None	Lost to follow up	
54/F	Survived	Pericardial Effusion	None	No further cardiac complications	7 months
59/M	Survived	Pericarditis	None	Normal cardiac function, no effusion	1.5 months
56/F	Survived	Cardiomyopathy, myocarditis	None	Improved, LVEF 60%, RV normal	2 months
61/F	Survived	Myocarditis, cardiomyopathy, cardiac arrythmia	None	Lost to follow up	
51/M	Survived	Cardiomyopathy, myocarditis	None	Improved symptoms, pending repeat echocardiogram	2 months
67/F	Survived	Cardiomyopathy, myocarditis	None	Lost to follow up	
73/M	Survived	STEMI	None	LVEF 35%, ongoing symptoms of CHF	7 months
91/M	Survived	NSTEMI, myocarditis	None	No echocardiography, functional status continues to decline	4 months
50/M	Survived	Myocarditis, NSTEMI	+	Deceased during readmission	1 month
69/F	Survived	Myocarditis, NSTEMI	None	No further cardiac complications	11 months
73/M	Survived	NSTEMI, myocarditis	None	Cardiac stress test with coronary disease, medically managed	3 months
63/M	Survived	STEMI, cardiomyopathy	None	EF 38%, improved symptoms	7 months

Abbreviations: CHF – congestive heart failure, LVEF – Left ventricular ejection fraction, RV – Right ventricle

cardiac co-morbidities (71%), the presence of COVID pneumonia (58.5%) and cardiogenic shock (51%) and the relatively high mortality among this cohort (61%) are consistent with previous reports.[1-5] We report an overall low incidence of severe cardiac complications among the larger hospitalized cohort of 1.8%. Notably, 41% of patients with severe cardiac complications did not have associated COVID-19 pneumonia, 29% did not have cardiac comorbidities and most surprising, at least 32% did not have a significant elevation of troponin I. These findings suggest that the clinical presentation of severe cardiac complications in COVID-19 is not dependent upon the presence of pulmonary findings, existing cardiovascular disease or elevated biomarkers. Additionally, new RV dysfunction was present in upwards of 25% of patients suggesting yet another pathway for cardiac manifestations in the COVID-19 patient population. Overall, the range of pathology to the cardiovascular system in COVID-19 is broad and includes myocarditis, pericarditis, cardiomyopathy, ACS, severe RV dysfunction and cardiac arrhythmia.

Myocarditis and Cardiomyopathy associated with COVID-19

No formal definition of cardiomyopathy and myocarditis in COVID-19 infection exist currently.[1-6] We define COVID-19 associated cardiomyopathy as a clinical syndrome with the following components: active SARS-CoV-2 infection, signs and symptoms of acute congestive heart failure, and newly discovered systolic ventricular dysfunction. We define viral myocarditis due to COVID-19 as active SARS-CoV-2 infection with an elevation in the serum troponin I biomarker in the absence of type I myocardial infarction. We note that it is challenging to delineate viral myocarditis from type 2 myocardial infarction, where myocardial demand may outpace supply resulting in relative ischemia and ultimately myocardial infarction.[6] Within these clinical definitions, 3 major pathways of cardiac injury in COVID-19 associated cardiomyopathy emerge: ischemia-related, direct cardiac cytotoxic/cytokine-mediated effect, and acute right ventricular failure with volume overload.[7-9]

COVID-19 has been shown to induce a prothrombotic state and may predispose toward coronary plaque rupture with resulting acute coronary syndrome.[10] Ischemia due to coronary artery disease does not fully explain the presentation of cardiomyopathy in COVID-19.[11] SARS-CoV-2 which has been shown to infect myocardial cells through ACE2 receptor may lead to direct cytotoxic myocardial damage resulting in myocarditis and ventricular dysfunction.[6,8-10] The cytokine release and subsequent activation of immune-inflammatory mechanisms in the myocardium may be responsible for acute ventricular dysfunction.[5-7] Right ventricular failure appears to be a separate clinical entity in COVID-19 and may be explained by concurrent cardiac cytotoxic damage, severe interstitial pneumonia, and associated thrombotic microangiopathy which may lead to acute RV systolic dysfunction and pressure overload in setting of increased pulmonary pressures.

Clinical features of COVID-19 associated myocarditis and cardiomyopathy include presenting symptoms of dyspnea, chest pain and fever, elevated cardiac troponin I and BNP, elevated inflammatory markers including CRP and DDimer and findings of ventricular dysfunction on echocardiography. Elevated BNP and NT-proBNP are associated with poor outcomes and reflect volume overload and clinical heart failure.[3-5,7,11] Elevated troponin levels are associated with increased mortality in all patients with COVID-19.[3-5,7] Myocarditis and cardiomyopathy in COVID-19 occur in the absence of pulmonary findings, requiring vigilance and specific attention to the cardiac findings from the clinician.

It is unclear if treatments aimed at viral replication, such as the anti-viral remdesivir, and at the inflammatory cascade such as dexamethasone and other corticosteroids, are effective in treating COVID-19 associated myocarditis and cardiomyopathy.[11] We observed a wide variety of treatment approaches and further study will be required to ascertain survival benefits. We recommend clinicians follow established treatment guidelines for COVID-19 and utilize goal-directed congestive heart failure management including ACE/ARBs, beta-blockers with known mortality benefit, diuretics and other guideline-driven strategies.[12]

Pericardial disease in COVID-19

We report 5 cases of pericarditis associated with COVID-19, 3 of which presented with cardiac tamponade and cardiogenic shock. Clinicians must remain vigilant to recognize this presentation as cardiac biomarkers were not significantly elevated, and most cases were identified after the onset of cardiogenic shock. The mechanism of pericarditis may be similar to myocarditis with reactive inflammation occurring in the pericardium with resulting effusion. SARS-CoV-2 has been detected in pericardial fluid associated with cardiac tamponade.[13-15] As in other viral pericarditides, diagnosis may be suspected when the patient reports chest pain, and is found to be hypotensive, tachycardic with muffled heart sounds along with the finding of pulsus paradoxus in the setting of cardiac tamponade.[14,15] Echocardiography is crucial to confirm the diagnosis of pericardial effusion and assess for the presence of cardiac tamponade. Fulminant myopericarditis appears to be a rare but life-threatening cardiac complication in COVID-19 infection.[13] Management of pericardial disease in COVID-19 is supportive in nature and may rely on use of corticosteroids. The role of non-steroidal anti-inflammatory agents and colchicine, standard of care in idiopathic/viral pericarditis prior to COVID-19, has not been established.[15] Pericardial drainage is indicated when cardiac tamponade is detected.

ACS in COVID-19

The overall incidence of ACS in COVID-19 has been reported to be 1%; we report 8 cases of STEMI and 11 cases of suspected NSTEMI.[16] Identification of ACS in COVID-19 is challenging due to the considerable overlap between the presentation of viral myocarditis and acute ischemia.[6]

Hypercoagulability and the hyperimmune response associated with COVID-19 may lead to coronary plaque instability and rupture, leading to formation of coronary thrombosis and resulting clinical presentation.[16-18] Type 2 myocardial infarction is common in COVID-19 and is associated with worse outcomes.[4] The presence of chest pain and other anginal symptoms, ischemic changes on ECG and elevated troponin should prompt evaluation and treatment for acute coronary syndrome per established AHA/ACC guidelines.[19] In our report, patients with suspected NSTEMI were ultimately referred for coronary disease risk stratification to the post-hospital, and presumably, post-infectious setting. In cases of STEMI, treatment included percutaneous coronary intervention in 4 cases and medical management in others, similar to other reports.[16-18] ACS patients with COVID-19 showed an increased risk of cardiogenic shock, life-threatening arrhythmia and had decreased overall survival.[17] Further investigation is necessary to delineate the management approach to ACS in COVID-19.

Severe RV dysfunction in COVID-19

Right ventricular dysfunction has been identified in COVID-19 infection with a rate of 30% noted in several reports, associated with elevated right ventricular systolic pressures.[20] We observed severe right ventricular dysfunction in 12% of patients. RV dysfunction and pressure overload may arise from left ventricular dysfunction in the setting of myocarditis or acute ischemia.[20-22] The right ventricle may be subject to direct myotoxic effects of SARS-CoV-2 and thrombotic microangiopathy accompanied by micro- and macro-thrombosis in the pulmonary vasculature leading to RV volume overload.[20,21] Patients presenting with circulatory shock should undergo screening for RV function via echocardiography.[20] Specific management recommendations for RV dysfunction in COVID-19 are not yet available. Options include measures to reduce pre-load, after-load, anti-coagulation and addressing other underlying factors. In our report all 7 patients with severe RV dysfunction died in hospital.

Arrhythmia in COVID-19

Cardiac arrythmias have been reported to complicate up to 17% of COVID-19 infections with VT/VF occurring in up to 5.9% of cases.[23,24] We observed cardiac arrhythmia in 60.9% of patients and 12% with VT/VF. Atrial fibrillation was the most commonly observed arrhythmia in our report and others.[23] A wide range of cardiac arrhythmias in COVID-19 has been reported including tachy and bradyarrhythmias, QTc prolongation and ventricular tachycardia and/or fibrillation.[23-26] The pathogenesis of cardiac arrhythmia in COVID-19 is as yet poorly characterized but may stem from direct myocardial injury, severe hypoxia-related myocardial stress and further direct injury to the conduction system related to inflammation and cytokine activation cascade in the myocardial tissues.[24] Amiodarone was the most commonly reported anti-arrhythmic medication reported in the treatment of cardiac arrhythmia in COVID-19.[23] In our report 3 out of 5 patients who experienced VT/VF died in hospital. One patient with existing severe aortic stenosis developed atrial fibrillation refractory to medical management and transitioned to comfort care.

Treatment and outcomes in COVID-19 associated cardiac complications

Treatment of severe cardiac complications in COVID-19 rests on early identification and is based on established treatment of congestive heart failure, ACS, pericardial disease and cardiac arrhythmia.[1,6,8,25] We observed a range of treatment approaches including goal directed management of congestive heart failure, medical and invasive management of myocardial infarction and pericarditis, and anti-arrhythmic medications in cardiac arrythmia.

Owing to the early occurrence of the first "wave" of the COVID-19 pandemic in Rhode Island, we report on limited post-discharge outcomes in survivors with severe cardiac complications. Among 9 patients who had newly diagnosed cardiomyopathy with left ventricular dysfunction caused by myocarditis or ACS and survived to discharge, 5 patients had follow up echocardiography within 12 weeks with only 1 patient showing an improvement in left ventricular function. Echocardiographic findings of diastolic dysfunction after COVID-19 myocardial injury have also been reported.[25] We recommend that registries are established to track outcomes in COVID-19 patients with severe cardiac complications.

CONCLUSIONS

Presentations and outcomes of COVID-19 patients with severe cardiac complications were identified and described. Clinicians must be aware of and recognize cardiac complications associated with COVID-19 including myocarditis, cardiomyopathy, pericardial disease, severe RV dysfunction and cardiac arrhythmias, which may occur in the absence of pulmonary findings, comorbid cardiovascular disease and elevated cardiac biomarkers. Early outcomes suggest that most patients do not fully recover left ventricular function after the initial diagnosis of COVID-19 associated cardiomyopathy, but further investigation is required.

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Thrombosis in COVID-19: A Narrative Review of Current Literature and Inpatient Management

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ABSTRACT

COVID-19 infection has been associated with an increased incidence of thrombotic events leading to poor patient outcomes. Given the rapid rise of the COVID-19 pandemic, the ability to conduct prospective trials has been limited and data regarding the use of standard-dose versus intermediate-dose thromboprophylaxis, use of empiric therapeutic anticoagulation, and use of extended-duration thromboprophylaxis after discharge has been largely based upon observational data without any high-quality prospective data guiding their use. In this article, we will review the incidence and frequency of arterial and venous thrombotic events along with the current literature surrounding the use of intermediate-dose thromboprophylaxis, empiric therapeutic anticoagulation, and use of extended-duration thromboprophylaxis for patients hospitalized with COVID-19.

KEYWORDS: coronavirus 2019, COVID-19, COVID-19 coagulopathy, thrombosis, anticoagulation

INTRODUCTION

In December 2019, a novel coronavirus pneumonia of unknown origin emerged in Wuhan, China. The pathogen that was subsequently implicated, Coronavirus 2019 (COVID-19), was a novel enveloped RNA betacoronavirus which behaved similarly to the severe acute respiratory syndrome coronavirus (SARS-CoV) in 2002 and 2003 and the Middle East respiratory syndrome coronavirus (MERS-CoV) in 2012.[1,2]

Early publications described a variety of symptoms along with abnormal coagulation parameters – prolonged prothrombin time and partial thromboplastin time, elevated D-dimer and fibrinogen levels, and decreased antithrombin activity.[3-5] A retrospective study observed that derangements in coagulation parameters were associated with poorer patient outcomes – patients whose abnormal coagulation parameters met the International Society of Thrombosis and Haemostasis (ISTH) criteria for disseminated intravascular coagulopathy (DIC) demonstrated decreased survival.[6]

Furthermore, early literature described an underlying inflammatory state in COVID-19. This initial investigation was spurred by the high pathogenicity previously seen in SARS-CoV and MERS-CoV where studies demonstrated an increased amount of proinflammatory cytokines.[7,8] Similarly, patients with COVID-19 displayed increased proinflammatory markers suggesting that an underlying inflammatory state played a critical role in the development of acute respiratory distress syndrome (ARDS) seen in these viral infections.[3-5] Post-mortem examination of COVID-19 patients demonstrated direct viral infection of the endothelial cells leading to diffuse endothelialitis, microvascular dysfunction, and widespread thrombotic microangiopathy, supporting previous observations regarding the higher incidence of DIC in COVID-19 non-survivors.[6, 9,10]

Given these findings, it has been thought that altered coagulation parameters in COVID-19 are a marker of thrombotic complications rather than bleeding risk. Tang et al demonstrated improvement in 28-day mortality in severe COVID-19 patients with markedly elevated D-dimer levels who received thromboprophylaxis with either low-molecular-weight heparin (LMWH) at 40-60mg daily or subcutaneous unfractionated heparin (UFH) at 10,000–15,000 IU daily.[11] This finding led to the adoption of prophylactic anticoagulation in the management of hospitalized COVID-19 patients.[12-15] This practice has varied from institution to institution and included: D-dimer guidance for the initial choice of anticoagulation; use of higher intensity or therapeutic anticoagulation; and extended-duration prophylaxis.[16-18] The aim of this review is to the summarize the literature surrounding the frequency and incidence of thrombotic events along with the literature surrounding the management and prevention of thrombosis in hospitalized COVID-19 patients.

VENOUS THROMBOEMBOLISM (VTE)

Early in the pandemic, there was an observed increased incidence of thrombotic events in hospitalized COVID-19 patients and it was recognized that VTE [pulmonary embolism (PE) and deep venous thrombosis (DVT)] were common complications.[19,20] The incidence of VTE in these reports were variable and subject to selection bias with overrepresentation of critically-ill patients, differences in study design, geographical differences, and other variables.[11,19,20]

Given these variations, Nopp et al performed a meta-analysis to determine the prevalence of VTE after excluding

studies determined to have a high risk of bias. Ultimately, 66 retrospective studies were determined to have low risk of bias and involved 28,173 total patients (1,819 ambulatory patients, 20,886 non-ICU patients, 5,468 ICU patients) who developed 1,824 total VTEs, which consisted of DVTs (including catheter-related thrombosis), PEs, or VTEs (composite of both), as defined within the retrospective studies. The pooled prevalence of VTEs was 14.1% (95% confidence interval [CI], 11.6–16.9; I^2, 97.1%). In the ICU, the pooled prevalence of VTEs was 22.7%, PE was 13.7% and DVT was 18.7%. In non-ICU patients, the pooled prevalence of VTEs was 7.9%, PE was 3.5%, and DVT was 4.1%.[20] In contrast, a prior study examining the incidence of DVT/PE in hospitalized patients by evaluating the National Hospital Discharge Survey found a DVT incidence of 1.3% and PE incidence of 0.4%.[21] In the medical ICU setting, studies regarding the incidence of DVT and PE with thromboprophylaxis ranges between 5–23% and 0.7–6%, respectively.[22-24] Therefore, when compared to historical data COVID-19 appears to be associated with a higher incidence of VTE in the ICU, non-ICU, and aggregate setting.

Helms et al compared 150 ICU patients with COVID-19 ARDS to a historical cohort of 233 ICU patient with non-COVID-19 ARDS. After matching, there were more VTEs in the COVID-19 cohort (11.7% vs 4.8%; p=0.035) along with significantly more PEs (11.7% vs 2.1%; p=0.008). Both cohorts were either on prophylactic or therapeutic anticoagulation.[25] In another study examining the incidence of PE, 107 ICU patients with COVID-19 were compared to a historical cohort of 40 ICU patients with H1N1 influenza, and a historical cohort of 196 ICU patients admitted for neither influenza nor COVID-19. The cumulative incidence of PE was 20.6% vs 7.5%, respectively (absolute risk [AR] 13.1%; 95% CI, 1.9-24.3) vs 6.1% (AR 14.4%; 95% CI, 6.1–22.8).[26] Both studies demonstrate an observed higher incidence of thrombotic events when compared to non-COVID-19 patients or other viral pneumonias.

ARTERIAL THROMBOEMBOLISM (ATE)

Early literature described an increased incidence of VTE; however, as the pandemic progressed there was growing literature regarding an increased incidence of ATEs – strokes (CVA), myocardial infarctions (MI), systemic arterial embolism, and acute limb ischemia (ALI).[27,28] Bilaloglu et al studied 3,334 hospitalized COVID-19 patients, of whom 365 developed ATEs (1.6% CVA, 8.9% MI, 1% systemic thromboembolism). In 829 ICU patients, 18.6% experienced an ATE. In 2,505 non-ICU patients, 8.4% experienced an ATE.[27] A meta-analysis found that 8 of the 42 studies in the analysis reported ATEs with an overall incidence of 2%; however, in the non-ICU setting the incidence was 1% compared to 5% in the ICU setting. The pooled incidences per specific ATEs were: MI 0.5%, CVA 1%, and ALI 0.4%.[28]

MONITORING COAGULATION PARAMETERS

Many institutions have adopted the practice of checking coagulation parameters not only on admission but also throughout hospitalization as it is thought to provide prognostic value.[3,4,6] In early observational data, elevated D-dimer levels on admission or levels that increased during hospitalization were associated with higher in-hospital mortality.[6,12] COVID-19 non-survivors had larger increases in D-dimer and fibrinogen levels when compared to COVID-19 survivors.[6,28] Based upon these observations, many institutions implemented aggressive diagnostic and therapeutic interventions even in the absence of clinical signs of VTE. However, it is unclear whether these elevated D-dimer levels are a marker of severe inflammation and the resultant cytokine storm in patients with severe disease rather than a reliable predictor of VTE. Given the uncertainty, societies such as the American Society of Hematology (ASH), CHEST, and ISTH do not incorporate the use of conventional coagulation parameters to guide anticoagulation (**Table 1**); however, many ongoing prospective trials are incorporating D-dimer levels to help stratify patients which may provide information regarding its utility.[13-15]

VTE PROPHYLAXIS

Early in the pandemic, the use of pharmacological VTE prophylaxis was adopted based upon the findings that its use was associated with an improved 28-day mortality (p=0.03). It was also noted that in patients who did not receive heparin-products (LMWH, UFH), mortality rose with rising D-dimer levels > 6 times the upper limit of normal (p=0.02).[11] However, questions remained regarding the adequacy of standard-dose thromboprophylaxis (defined as LMWH 40mg daily or subcutaneous UFH 5000 IU three times daily) in this population, particularly in critically-ill COVID-19 patient, which has led to the widespread use of dose-escalated prophylaxis and therapeutic anticoagulation.

INTERMEDIATE-DOSE PROPHYLAXIS

Given the paucity of data surrounding the use of intermediate-dose prophylaxis prior to the COVID-19 pandemic, Eck et al conducted a meta-analysis of 70 randomized trials examining intermediate-dose LMWH prophylaxis versus placebo. Ultimately, it was found that use of intermediate-dose LMWH prophylaxis led to a minimal, but statistically significant improvement in all-cause mortality at the cost of a statistically significant increase in major bleeding (defined as fatal bleeding; symptomatic bleeding in critical area/organ including intracranial bleed; or bleeding leading to transfusion of ≥ 2 units of red cells).[29] However, given an increased incidence of thrombosis associated with a higher mortality in COVID-19 patients, many institutions empirically incorporated the use of intermediate-dosing prophylaxis with variable outcomes.[17]

Table 1. Summary of Societal Recommendations for Thromboprophylaxis in COVID-19[13-15]

	American Society of Hematology (ASH)	International Society for Thrombosis and Haemostasis (ISTH)	CHEST
Lab† Guidance in Anticoagulation Choice or Escalation	NR	NR	NR
Thromboprophylaxis (includes intermediate-dose and therapeutic anticoagulation)	Prophylactic-intensity over intermediate- or therapeutic-intensity anticoagulation in acutely-ill and/or critically-ill COVID-19 patients without suspected or confirmed VTE.	Prophylactic–dose UFH or LMWH in acutely-ill and/or critically-ill COVID-19 patients after assessing bleeding risk. Intermediate-dose LMWH can be considered in high-risk patients. Obese patients defined by actual body weight or BMI should consider a 50% increase in the dose of thromboprophylaxis. Would not consider treatment-dose as prophylaxis.	Prophylactic-dose anticoagulation in acutely-ill and/or critically-ill COVID-19 patients over intermediate or full treatment dosing.
Extended-Duration Thromboprophylaxis	NR	Should be considered patients that meet high-risk criteria. Recommend use of LMWH or DOAC. Duration can be 14-30 days.	Do not routinely recommend, but can consider in patients at low risk of bleeding and increased VTE risk.

† Labs include prothrombin time, partial thromboplastin time, D-dimer, fibrinogen; NR: no recommendation; RCT: randomized controlled trial; LMWH: low-molecular-weight heparin; UFH: unfractionated heparin; "critically-ill" defined as patients suffering from a life-threatening condition who would typically be admitted to an intensive care unit (ICU)

Rannuci et al performed a prospective observational study of 16 ICU patients with COVID-19 ARDS to characterize their coagulation profile through standard coagulation parameters and viscoelastic coagulation tests. In this study, lab parameters were monitored after increases to intermediate-dose LMWH. After 7 days of the increase to intermediate-dose LMWH there were significant time-related decreases in fibrinogen levels (p=0.001), D-dimer (p=0.02) and improved viscoelastic testing suggesting a decrease in hypercoagulability and clot firmness.[30] Similarly, in a retrospective study of 468 patients, those with severe COVID-19 who received intermediate-dose prophylaxis (defined as LMWH 40mg twice daily or subcutaneous UFH 7500 IU three times daily) were shown to have stable or decreasing D-dimer levels while patients who only received standard-dose prophylaxis were observed to have D-dimer levels significantly increase during their hospitalizations (p<0.001). It was also found that the use of intermediate-dose prophylaxis was associated with improved 30-day mortality (p=0.045) without significant differences in bleeding (p=0.1).[17]

INSPIRATION was a randomized trial examining the use of intermediate-dose LMWH (defined as 1mg/kg daily) versus standard-dose prophylaxis in 660 patients with COVID-19 in the ICU. The use of intermediate-dose was not associated with significant differences in 30-day mortality (43.1% vs 40.9%; p=0.50), risk of VTE (3.3% vs 3.5%; p=0.94), ATE in the form of CVAs (0.3% vs 0.4%; p=0.97), ventilator-free days (30 vs 30 days; p=0.50), or ICU length of stay (5 vs 6 days; p=0.14). There was a numerically higher rate of major bleeding (2.5% vs 1.4%) with use of intermediate-dose prophylaxis but did not meet the pre-defined noninferiority criteria; however, there was no significant difference in rate of non-major bleeds (4.3% vs 1.5%; p=0.07).[31]

In the ICU setting, this prospective randomized trial has demonstrated no differences in outcomes with numerically increased major bleeding events. However, the role of intermediate-dose prophylaxis in the non-ICU setting remains unclear and ongoing prospective trials are underway to answer this question.

THERAPEUTIC ANTICOAGULATION

Another strategy in dose-escalated anticoagulation has been the empiric use of treatment-dose or therapeutic anticoagulation. Paranjpe et al conducted one of the earliest retrospective studies examining the use of therapeutic anticoagulation. In 395 mechanically ventilated patients who received therapeutic anticoagulation, there was improved 21-day mortality (29.1% vs 62.7%) but not in other subsets (22.5% vs 22.8%). It was observed that a longer duration of therapeutic anticoagulation was associated with reduced mortality (p<0.001). Of note, there was no increased rate of bleeding events among those that received therapeutic anticoagulation (1.9% vs 3%; p=0.2).[16]

In a follow-up trial that retrospectively included 4,389 patients showed that use of therapeutic anticoagulation was associated with a 47% reduction in mortality (p<0.001) when compared with no anticoagulation. However, the use of standard prophylaxis was associated with a 50% reduction in mortality (p<0.001) compared with no anticoagulation. In adjusted analysis comparing therapeutic anticoagulation to prophylaxis, there was a non-statistically

significant reduction in mortality (p=0.08). Furthermore, the use of therapeutic anticoagulation was associated with a 31% reduction in the incidence of intubation (p=0.02) compared to no anticoagulation. Similarly, prophylaxis was associated with a 28% reduction in the incidence of intubation (p=0.003) compared with no anticoagulation. Adjusted analysis showed no statistical difference in incidence of intubation between the two interventions (p=0.63). Overall major bleeding rates, counted only after initiation of anticoagulation treatment, were low (2%); however, the rate was proportionally highest in patients who received therapeutic anticoagulation (3.0%), followed by no anticoagulation (1.9%) and lowest in standard prophylaxis (1.7%).[32]

HESACOVID, the only published prospective study examining empiric use of therapeutic anticoagulation in COVID-19, was an open-label, phase II randomized trial comparing the use of therapeutic enoxaparin (defined as 1mg/kg twice daily) versus standard prophylaxis (defined as subcutaneous UFH 5000 IU three times daily or enoxaparin 40 mg daily). This trial enrolled 20 total patients who were mechanically ventilated. Therapeutic enoxaparin led to a higher ratio of successful 28-day liberation from mechanical ventilation (p=0.031) and a decrease in D-dimer levels (4176 µg/L vs 1469 µg/L; p=0.009). In the standard prophylaxis group, D-dimer levels demonstrated an increase over time (3408 µg/L vs 4878 µg/L; p=0.004). There was no difference in all-cause 28-day mortality between therapeutic enoxaparin versus standard prophylaxis (p=0.26), in-hospital mortality (p=0.16), or ICU-free days (p=0.07). Although this study did not actively investigate thrombotic events each group had 2 VTEs (2 DVT in the therapeutic group; 1 DVT and 1 PE in the prophylactic group). There were no major bleeding events.[33] These results, coupled with the decreasing D-dimer levels, is suggestive of anti-inflammatory properties of higher doses of anticoagulation, similar to the previous findings of Rannuci et al.[30]

Current societal guidelines regarding the use of therapeutic anticoagulation state that in the absence of a clear indication for therapeutic anticoagulation (i.e., newly-confirmed, recent history, or suspected VTE, atrial fibrillation, mechanical cardiac valves, or long-term secondary VTE prevention) the use of empiric therapeutic anticoagulation is not recommended for ICU or non-ICU patients.[13-15] Several randomized trials are underway to examining the empiric use of therapeutic anticoagulation in COVID-19. Of note, the interim analysis of three randomized trials (ACTIV-4a, REMAP-CAP, ATTACC) led to a pause in enrollment in critically-ill patients admitted to the ICU over concerns of futility for efficacy (e.g., no reduction in need for organ support) and increased safety events (e.g., major bleeding). The publication with additional clarifications is pending; however, current societal guidelines recommend the use of standard-dose thromboprophylaxis.[13-15,34]

EXTENDED-DURATION PROPHYLAXIS

Given the higher incidence of thrombosis in patients hospitalized with COVID-19, there has been concern for the development of thrombotic events after discharge, prompting some institutions to prescribed extended-duration VTE prophylaxis. Prior to the pandemic, the practice of extended-duration VTE prophylaxis for non-surgical patients was largely based upon multiple outcome studies that demonstrated that a large proportion of hospital-associated VTEs occurred post-discharge, and most within 6 weeks after discharge.[35,36] This has prompted the development of the modified IMPROVE score based upon several clinical factors (**Table 2**) where groups deemed high-risk derived benefit from VTE prophylaxis after discharge.[37,38]

Since the start of the pandemic, a retrospective study examined 1,877 patients discharged after hospitalization with COVID-19 observed 9 hospital-associated VTEs. This was compared to a historical cohort of 18,159 medical patients who were discharged and found to have 56 hospital-associated VTEs. This study demonstrated that COVID-19 hospitalization did not appear to have an increased risk of post-discharge VTE.[39] Another retrospective study examined 163 patients after hospitalization with COVID-19 and observed 4 thrombotic events. The cumulative 30-day incidence of overall thrombosis after discharge was 2.5% and the cumulative 30-day incidence of VTEs after discharge was 0.6%.[40] When these results are compared to the control arms of prior randomized trials examining the use of extended-duration VTE prophylaxis in medical patients, COVID-19 does not appear to be associated with an increased incidence of VTE after hospitalization.[35,36]

Multiple societies do not provide any recommendation regarding the use of extended-duration VTE prophylaxis.[13-15] However, ISTH states that extended-duration VTE prophylaxis should be considered for patients meeting high-risk criteria based upon the modified IMPROVE score.[13]

Table 2. Modified IMPROVE Score[38]

Risk Factor	VTE Risk Score
Prior VTE	3
Diagnosed thrombophilia*	2
Current lower limb paralysis or paresis**	2
History of cancer†	2
D-dimer > 2 times upper limit of normal	2
ICU or coronary care unit stay	1
Complete immobilization‡ > 1 day	1
Age > 60 years	1

High Risk Score > 4 corresponding with a nearly three-fold higher VTE risk at discharge and warrants consideration for extended-duration VTE prophylaxis; *Congenital or acquired condition leading to increased risk of thrombosis; **Leg falls to bed by 5 seconds but has some effort against gravity (taken from National Institute of Health Stroke Scale); †Cancer present at any time in past 5 years; ‡Defined as confined to bed or chair with or without bathroom privileges.

CONCLUSION

The COVID-19 pandemic has gripped the medical community, disrupting routines and normal hospital workflow, and its management has changed at a seemingly dizzying pace. Based upon early observational data, COVID-19 patients develop an inflammatory response leading to an increased incidence of thrombosis.[6,9-11] The practice of intermediate-dose prophylaxis, empiric therapeutic anticoagulation, and extended-duration prophylaxis has been largely guided by observational studies. Of the published prospective trials, INSPIRATION has demonstrated no differences in outcomes with intermediate-dose prophylaxis in the ICU population, and HESACOVID has demonstrated a higher ratio of successful liberation from mechanical ventilation with therapeutic anticoagulation. Current guidelines recommend managing hospitalized COVID-19 patients similarly to any acutely ill patient – routine use of pharmacological VTE prophylaxis, unless medically contraindicated, with some societies considering intermediate-dose prophylaxis.[13-15] Therapeutic anticoagulation is reserved for patients with other clear indications for anticoagulation.[13-15] Similarly, extended-duration prophylaxis is reserved for patients deemed to be at high-risk based upon the modified IMPROVE score.[13,38] There are several ongoing, prospective trials hoping to provide high-quality evidence to help guide VTE prevention and management in COVID-19.

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Seroprevalence of SARS-CoV-2 among Internal Medicine Residents at a Major Academic Medicine Residency Program

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ABSTRACT

BACKGROUND: Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) and its associated disease (COVID-19) are a significant cause of morbidity and mortality across the United States. Internal medicine (IM) residents are a critical component of the healthcare workforce yet their seroprevalence of SARS-CoV-2 antibodies is largely unknown. The aim of this research was to ascertain the seroprevalences of SARS-CoV-2 among internal medicine residents during the first peak of COVID-19.

METHODS: IM residents were enrolled in a surveillance program that included PCR and antibody testing for SARS-CoV-2 in June 2020. Residents also completed a short questionnaire to obtain sociodemographic information and characterize potential workplace exposure to COVID-19.

RESULTS: A total of 101 IM residents participated in the study (out of N=162). Of the 101 samples, three (2.9%) tested positive for SARS-CoV-2 antibodies. No residents tested PCR positive for SARS-CoV-2.

DISCUSSION: The implementation of COVID-19 patient cohorting and the incorporation of telemedicine to communicate with hospitalized patients into clinical practice early in the pandemic may have prevented the spread of the virus among the surveyed clinical trainees.

CONCLUSION: Despite significant engagement with COVID-19 patients, IM residents demonstrated a low rate of SARS-CoV-2 seroprevalence.

KEYWORDS: seroprevalence, SARS-CoV-2, internal medicine residents

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is the novel infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). First identified at the end of 2019, it has quickly spread internationally and was declared a global health emergency of international concern on January 30th, 2020[1] and subsequently a pandemic on March 11th, 2020 by the World Health Organization.[2] The United States has been significantly impacted by the virus with the greatest number of diagnosed cases and deaths globally.[3] Certain populations are at greater risk for exposure and infection with the virus. Healthcare workers (HCWs) represent a particularly vulnerable population for infection with SARS-CoV-2 due to significant exposure and close contact with COVID-19 patients.[4] Incidence and prevalence data of COVID-19 among HCWs is limited but initial population surveys have estimated prevalence to be as high as 11%.[5] While there is likely to be variability based on the type of setting and health care position evaluated,[6] one study of HCWs in a tertiary care center in the United States found a prevalence of nearly 10% without significant differences in prevalence across job title and work area.[7]

In many healthcare systems, residents are heavily relied upon as essential frontline caregivers during the COVID-19 pandemic.[8] With significant inpatient, outpatient, and critical care responsibilities, Internal Medicine (IM) residents represent an important subset of the frontline healthcare workforce caring for adult patients in a number of settings where there is treatment of known individuals with COVID-19 as well as individuals who may be pre-symptomatic or asymptomatic. Understanding the prevalence of COVID-19 among this group of HCWs would provide key information on exposure risk for this uniquely vulnerable subset of clinicians. This study presents the results of antibody and PCR-based testing for SARS-CoV-2 among IM residents in a single large, academic training program in the United States during the first peak of the COVID-19 pandemic in the spring of 2020. Participants were also asked to complete a survey that included sociodemographic information as well as information on exposure to COVID-19 in the clinical setting. This is the first study to describe the prevalence of anti-SARS-CoV-2 prevalence among resident trainees working in an IM training program while exploring potential risk factors for COVID-19 exposure and infection.

METHODS

All active resident trainees in a major academic IM residency program in Providence, Rhode Island were offered voluntary SARS-CoV-2 testing at a single site over the course of two weeks (June 8, 2020 through June 23, 2020). All residents were aged 18 years or older at time of testing.

Verbal consent was obtained at the time of testing. Trained clinical staff performed a nasopharyngeal (NP) swab for PCR-based SARS-CoV-2 swab and a venipuncture for antibody-based SARS-CoV-2 testing during the same encounter. SARS-CoV-2-specfic antibodies were measured using SARS-CoV-2 IgG test (Abbott, Lake Forest, IL). SARS-CoV-2 PCR tests were performed using one of the seven platforms: ePlex® SARS-CoV-2 Test(GenMark, Carlsbad CA), cobas SARS-CoV-2 Test (Roche, Indianapolis, IN), Xpert® Xpress SARS-CoV-2 (Cepheid, Sunnyvale, CA), BD SARS-CoV-2 (Becton, Dickinson and Company, Sparks, MD), SARS-CoV-2 Assay (Hologic, San Diego, CA), TaqPath COVID-19 Combo Kit (Thermo Fisher, Waltham, MA) and ARIES® SARS-CoV-2 Assay (Luminex, Austin, TX). On presentation for SARS-CoV-2 testing, individuals were asked to complete a one-page questionnaire via REDCap. This standardized form included baseline demographics such as age, sex, race and ethnicity as well as exposures and self-reported symptoms consistent with COVID-19 infection and information related to potential COVID-19 exposure in the workplace. Residents were asked to report on COVID-19 symptoms from January 1st through May 31st of 2020. Residents were asked to respond to questions about workplace COVID-19 exposure beginning on March 1st which was the approximate date of the first diagnosed case of COVID-19 in Rhode Island. This study was conducted for surveillance purposes and reviewed by the Rhode Island Department of Public Health Institutional Review Board.

RESULTS

Of 162 active 2019-2020 IM residents in this academic residency program, 101 (62.3%) provided consent, were tested for SARS-CoV-2 and completed the survey. Sociodemographic characteristics of the participants are outlined in **Table 1**. Based on surveyed workplace activities related to potential COVID-19 exposure (**Table 2**), nearly all of the residents reported working on an inpatient medical unit (N=100) and a significant majority reported working in an intensive care unit setting (N=75). There were a number of residents who worked in an emergency department (N=22) and nearly half (N=48) responded that they had worked in an outpatient clinical setting. The vast majority (N=95) of residents cared for at least one patient with COVID-19 and almost half (N=45) cared for at least 20 COVID-19 patients with 11 residents having cared for 50 or more patients infected with the virus. Residents also reported the incorporation of changes in clinical service provision to mitigate the spread of COVID-19 with 79 noting they had provided clinical care in a setting where COVID-19 patients were cohorted and 91 documenting the use of telemedicine for patient care encounters, including the hospital setting. Despite the relatively low prevalence of COVID-19, a notable number of residents (N=30) reported prior symptoms consistent with

Table 1. Study Participant Characteristics

Overall Participants	101
Gender	**% (N)**
Male	54.5 (55)
Female	44.6 (45)
Decline to Answer	0.9 (1)
Race	**% (N)**
White	55.4 (56)
Black or African American	5.9 (6)
American Indian or Alaska Native	1.0 (1)
Asian	35.6 (36)
Native Hawaiian or Pacific Islander	0.0 (0)
Other	3.0 (3)
Decline to Answer	1.0 (1)
Ethnicity	**% (N)**
Hispanic/Latino	5.0 (5)
Non-Hispanic/Latino	94.0 (95)
Decline to Answer	0.9 (1)

Table 2. Exposures through clinical work

Settings where patient care was conducted (Participants may have chosen more than one)	**% (N)**
Inpatient Medical Floor	99.0 (100)
Intensive Care Unit	74.3 (75)
Emergency Department	21.8 (22)
Outpatient Clinic	47.5 (48)
Other	4.0 (4)
None	0.0 (0)
Used telemedicine (either phone or video) to provide patient care	**% (N)**
Yes	90.1 (91)
No	9.9 (10)
Served in a clinical setting where COVID+ patients were cohorted	**% (N)**
Yes	78.2 (79)
No	21.8 (22)
Estimated total number of COVID+ patients cared for	**% (N)**
0	5.9 (6)
1 to 9	32.7 (33)
10 to 19	16.8 (17)
20 to 29	17.8 (18)
30 to 39	13.9 (14)
40 to 49	1.0 (2)
50+	10.7 (11)

COVID-19 infection (**Table 3**). Relatively few had received testing for COVID-19 (N=19) before this surveillance study and three individuals had previously documented COVID-19 infection.

Of the 101 serum samples collected, three (2.9%) were positive for SARS-CoV2 antibodies. None who participated had a positive PCR test.

Table 3. Self-report of symptoms and prior COVID testing

Experienced symptoms of COVID since January 1, 2020?	% (N)
Yes	29.7 (30)
No	70.3 (71)
Previously tested for COVID	**% (N)**
Yes	18.8 (19)
No	81.1 (82)
Previously documented COVID infection	**% (N)**
Yes	2.97 (3)
No	97.0 (98)

DISCUSSION

This is the first study examining IM resident exposure to COVID-19 during clinical activities as well as seroprevalence for the disease. Despite working with a significant number of COVID-19 patients, few of the surveyed trainees were infected with SARS-CoV-2. Of note, the current study was performed after the first peak of COVID-19 in the state (March-June 2020). The low seroprevalence rate is reassuring given the relatively frequent care provided by residents to individuals with COVID-19. It is also reassuring that the same number of individuals who had documented COVID-19 infection were found to be seropositive for SARS-CoV-2 antibodies suggesting that previous testing strategies had successfully diagnosed cases of the disease. It is not surprising, given the clinical training requirements for residents, that virtually all residents reported working in an inpatient medical unit and that the vast majority reported working in an intensive care unit. The academic medical centers where surveyed residents had participated in clinical activities were responsible for the inpatient and intensive medical care of the vast majority of COVID-19 cases in the state of Rhode Island. It is also not surprising then that nearly all of the residents (N=95) reported caring for a patient with COVID-19.

The clinical care of patients with COVID-19 was provided during the initial months of the pandemic when there were still many aspects of care related to COVID-19 that were unknown, in addition to shortages of personal protective equipment (PPE) and COVID-19 testing supplies. The residents followed hospital-wide guidelines regarding re-use and sterilization of PPE as these protocols changed. Hospital-wide protocols were developed based on CDC or RI Department of Health guidelines as available at the time.

Several specific strategies were used to prevent the spread of the virus among the surveyed clinical trainees. Residents were encouraged, but not mandated, to use telehealth technologies including audio and/or video interviews in both inpatient and outpatient settings. The vast majority of residents (N=91) participated in this risk mitigation technique in order to reduce face-to-face exposure of individuals infected with or potentially infected with COVID-19. In addition to changes in clinical care delivery, the residency administration made program-wide changes in educational activities including the transition of formal didactics to socially distanced and virtual sessions. Efforts were made to reduce congregating including spacing out computer work stations and designating specific socially distanced work areas per resident team. Resident lunches were transitioned to individually packaged meals. All residency sanctioned social activities were postponed unless made virtual. Although many of these protocols were developed early in the pandemic when many aspects of SARS-CoV2 were still unknown, these risk mitigation strategies may have also prevented the spread of the virus among the surveyed clinical trainees.

The vast majority of residents cared for at least one patient with COVID-19 and a significant number of residents reported working cohorted COVID-19 patient units (N=79). Despite the relatively high exposure to COVID-19 in the workplace, however, relatively few of the surveyed residents reported having previously been tested for COVID-19. Alarmingly, fewer individuals who reported symptoms consistent with COVID-19 had been previously tested for the disease. There are several potential explanations for this including testing supply shortages, a lack of easily accessible testing sites for clinical trainees who have demanding clinical work schedules, underreporting of symptoms to residency leadership or employee health, and a lack of clear guidance on who needed testing in the early months of the pandemic. From March through June 2020, residents were asked to call hospital Employee and Occupational Health Services to determine need for testing if symptomatic. The administered survey requested self-reported COVID-19 related symptoms during a time period that included the two months prior to the first diagnosed case of COVID-19 in Rhode Island. This same time period overlapped with seasonal influenza which shares a similar symptomatology with COVID-19. Residents may have experienced COVID-19-like symptoms prior to the known arrival of COVID-19 to Rhode Island making exposure to the virus less likely during that time. Additionally, the responses of residents may be impacted by recall bias, a phenomenon which has not been fully explored in the context of self-reported COVID-19 symptoms and serum antibody testing. Ultimately the low SARS-CoV-2 antibody seroprevalence compared to the more frequent self-report of COVID-19-like symptoms may

indicate a poor correlation between self-reported COVID-19 symptoms and seropositivity.

While there are many strengths to this study including some of the first detailed seroprevalence data among this important subset of HCWs, there are some inherent weaknesses of the methodological approach and results that limit the conclusions that can be drawn from the study. The first limitation is the response rate from active residents as 61 out of 162 active residency trainees did not participate in the study. While participation in the study was actively advertised throughout the residency program and there were multiple sessions for sample collection held across a greater than two-week period, participation may have been limited by a number of factors that could impact the study findings and interpretability of the results. Anecdotally, residents cited scheduling as the primary reason limiting their ability to participate. Additionally, there were likely a number of other interventions implemented to mitigate the spread of COVID-19 among HCWs in this academic center that were not surveyed in the questionnaire. As a result, it is difficult to determine causality between the low seroprevalence results and the queried mitigation interventions included in the questionnaire. Finally, given the low number of seropositive cases of COVID-19 in this study sample, it is not possible to identify meaningful associations between seropositivity and sociodemographic characteristics or reported workplace exposure. This study may not be generalizable to other settings.

CONCLUSION

With the sustained COVID-19 pandemic, HCWs continue to experience a high level of potential exposure to SARS-CoV-2 as they care for patients who are often severely ill. IM residents at a major academic medical center responsible for the clinical care of many severely ill COVID-19 patients report significant workplace exposure. However, they also report the incorporation of interventions to mitigate the spread of COVID-19 in the workplace including cohorting of COVID-19 and the use of telemedicine to communicate with hospitalized patients. Despite caring for a significant number of COVID-19 patients in a potentially challenging workplace environment, this study demonstrated a low seroprevalence of SARS-CoV-2 antibodies among surveyed residents indicating that efforts to limit infections among this group of HCWs have been successful. Administrators of residency programs and the health systems in which residents work should ensure access to COVID-19 testing, particularly for those reporting symptoms consistent with COVID-19 infection.

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Epidemiology and Clinical Characteristics of Emergency Department Patients with COVID-19 in a Rhode Island Healthcare System

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ABSTRACT

BACKGROUND: Rhode Island (RI) has been severely impacted by the COVID-19 pandemic. This study aims to describe emergency department (ED) patients with COVID-19 within the largest healthcare system in RI.

METHODS: A retrospective electronic medical record review of 1,209 adult patients evaluated and diagnosed with COVID-19 in 4 EDs during the first peak (March 15, 2020 to May 16, 2020) was conducted. Sociodemographic, clinical, management, and ED disposition information were summarized.

RESULTS: Median age of patients was 55 years (IQR 40-69), 55.2% were male, and 47.8% were Hispanic/Latinx. Over half of the patients (60.5%) were admitted to the hospital. Supplemental oxygen was used by 32.2%.

CONCLUSION: This study presents the clinical and sociodemographic characteristics of ED patients with COVID-19 presenting to the largest healthcare system in Rhode Island. Continued analysis is warranted to provide further insight into the trends in this pandemic.

KEYWORDS: COVID-19, pandemic, emergency department, healthcare disparities

BACKGROUND

Coronavirus disease (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), has brought tremendous challenges to governments and health systems worldwide.[1] To date, there have been over 100 million cases of COVID-19 worldwide with the United States (U.S.) accounting for over one-quarter of cases. Globally, COVID-19 has killed over 3 million people, approximately 20% in the U.S.[2] The first known cases of COVID-19 infection in the state of Rhode Island (RI) were reported in March 2020.[3] Within a year of the emergency in RI, there have been 123,000 cases and over 2,000 deaths from COVID-19 in the state. During the initial peak of disease in the spring of 2020, there were nearly 40 new cases per 100,000.[4]

In the early stages of the pandemic, COVID-19 testing took place predominantly in the emergency department (ED) setting. This study describes the epidemiological and clinical characteristics of COVID-19 patients presenting to the EDs of the largest healthcare system in RI during the first peak of COVID-19.

MATERIALS AND METHODS

This is a descriptive study of electronic medical record review of emergency department visits by adult patients (age 18 years or older) presenting to one of the four EDs within the largest healthcare system in RI between March 15, 2020 and May 16, 2020. The four EDs include two community EDs, a level one adult trauma center, and a level one pediatric trauma center. The study timeframe reflects the weeks leading up to and immediately after the estimated initial peak of COVID-19 in the state.[5] Ethical approval for this research was approved by the Rhode Island Hospital institutional review board.

Data were abstracted from the electronic health record (Epic) and entered into a password protected online database. Any adult patient evaluated at one of the study locations with a positive polymerase chain reaction (PCR) test for COVID-19 was included. Only the first visit by the patient with a positive test result was included in the analysis as there was no ability to discriminate between new and persistent symptoms. Data collected included sociodemographic information on age, sex, ethnicity, race, insurance status, and zip code. Patient home zip code was used to evaluate the geographic distribution of COVID-19 presentations.

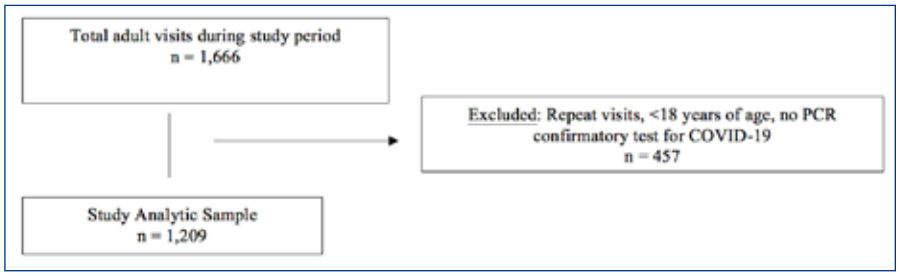
Clinical data included chief complaint, pertinent past medical history, oxygen administration, medications received, laboratory values, and patient disposition from the ED. A list of comorbidities was derived from literature describing common risk factors for worse prognosis with COVID-19 in addition to a list of common chronic diseases in the United States.[6-10] Obesity was defined as a body mass index greater than 30 kg/m^2.[11]

Data Analysis

STATA Version 13.0 (Stata Corp; College Station, TX) and Microsoft Excel 365 (Microsoft Corp; Redmond, WA) were used for all analyses. Summary statistics and group disaggregations were reported in the characterization of patients using frequencies and medians with associated interquartile ranges (IQR). Differences in the initial values for

inflammatory markers were assessed by a Student's t-test to determine the statistical significance of values between patients who were admitted and discharged. A p-value < 0.05 was considered statistically significant. Age was stratified by ten-year bands as has been done for prior COVID-19 analyses.[7] Geographic data were used to map frequency distributions based on home addresses for the population studied.

Figure 1. Study Flow Diagram



RESULTS

Demographic Characteristics

Of the 1,666 visits during the study period, 1,209 patient visits were included in the final analysis after excluding encounters for patients less than 18 years of age, multiple visits, and those without a confirmed positive COVID-PCR (**Figure 1**).

Table 1 shows the demographic data for the cohort. Males comprised 663 (54.8%) of the patients. By race, there were 574 (47.5%) Hispanic or Latinx patients, 435 (36.0%) White or Caucasian patients, and 193 (16.0%) Black or African American patients. The median age of patients was 55 years (IQR: 40–69) with patients between the ages of 60–69 representing the largest proportion of patients (18.4%), followed by an equal number of presentations for the 40–49 (17.0%) and 50–59 age groups (17.0%). Extremes of age represent the lowest number of patient visits by age: age 18–29 comprised 11.2% of the patients aged 90 and above contributed to 2.7% of the population.

Nearly half of all patients preferred a non-English language (46.1%), with Spanish as the predominant language of this group (40.1%). The majority of patients had private insurance (59.8%). Roughly a quarter of patients had either Medicare (16.8%) or Medicaid (7.6%) (**Table 1**).

Figure 2 illustrates the distribution of patient presentations by home zip code on a map of the state. The majority of patients were from Providence county (86.4%), while the remaining four Rhode Island counties ranged between 1.0% and 1.6% of patients. Twenty-two patients (1.8%) presented from states other than RI, in large part from other northeastern states such as Massachusetts, Connecticut, and New York.

Clinical Characteristics

Hypertension (23.8%), diabetes mellitus (23.2%), and obesity (20.8%) were the top three comorbidities in this cohort (**Table 1**). These were followed by cardiovascular disease (19.5%) and chronic respiratory disease (11.1%)

Table 2 summarizes symptoms recorded at time of triage. The mean number of symptoms per patient was 1.8. The symptoms reported with greatest frequency were shortness

Table 1. Demographics & Comorbidities of Study Population

Characteristic	Patients, No. (N = 1209)
Age, median (IQR)	**55 (40–69)**
Age group in years, n (%)	
18– 29	136 (11.2%)
30– 39	149 (12.3%)
40– 49	205 (17.0%)
50– 59	205 (17.0%)
60– 69	223 (18.4%)
70– 79	158 (13.1%)
80– 89	100 (8.3%)
> 90	33 (2.7%)
Sex	
Male	663 (54.8%)
Female	546 (45.2%)
Race/ethnicity, n (%)	
White	435 (36.0%)
Black	193 (16.0%)
Hispanic or Latinx	574 (47.5%)
Not reported	7 (0.6%)
Preferred language, n (%)	
English	652 (53.9%)
Spanish	485 (40.1%)
Portuguese	19 (1.6%)
Cape Verdean	10 (0.8%)
Other	43 (3.6%)
Insurance status, n (%)	
Insured (Private)	723 (59.8%)
Insured (Medicare)	203 (16.8%)
Insured (Medicaid)	92 (7.6%)
Self-pay	163 (13.5%)
Unspecified	28 (2.3%)
Comorbidities, n (%)*	
Hypertension	288 (23.8%)
Diabetes mellitus	280 (23.2%)
Obesity	251 (20.8%)
Cardiac disease†	236 (19.5%)
Chronic respiratory disease	134 (11.1%)
Cancer	100 (8.3%)
Chronic kidney disease	92 (7.6%)
Stroke	44 (3.6%)

* Total does not reflect entire patient cohort as patients can have no or multiple conditions

† Cardiac disease excludes hypertension and stroke

Figure 2. Number of COVID-19 Cases by Rhode Island County*†‡

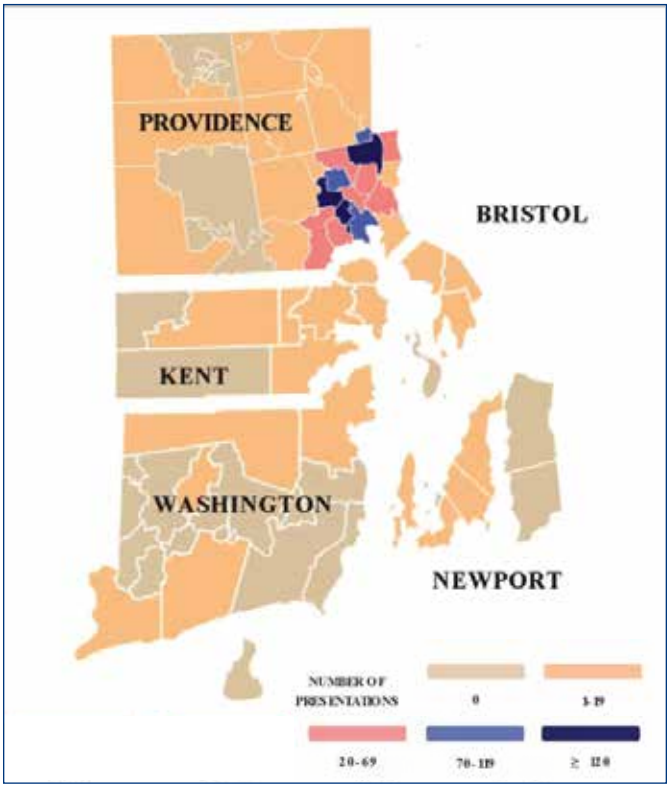


Table 2. Symptoms at Emergency Department Presentation for patients with COVID-19*

Symptoms	
Mean symptoms per patient (IQR)	**1.8 (1–2)**
Individual symptoms, n (%)	
Shortness of breath	416 (34.4%)
Fever	320 (26.5%)
Cough	288 (23.8%)
Headache	86 (7.1%)
Fatigue	80 (6.6%)
Diarrhea	72 (6.0%)
Abdominal pain	71 (5.9%)
Altered mental status	56 (4.6%)
Symptoms as classified by organ system, n (%)	
Respiratory	749 (35.2%)
Constitutional	509 (24.0%)
Gastrointestinal	206 (9.7%)
Neurologic	116 (5.5%)
Psychiatric	62 (2.9%)
Musculoskeletal	48 (2.3%)
Cardiac	27 (1.3%)
Other	408 (19.2%)

*Symptoms were classified by organ systems: Respiratory: cough, shortness of breath, respiratory distress, pleurisy, upper respiratory infections, nasal congestion; Constitutional: fever, chills, fatigue; Gastrointestinal: abdominal pain, diarrhea, emesis, nausea; Neurologic: dizziness, cerebrovascular accident, headache, seizures, migraine, tremors; Psychiatric: altered mental status, suicidality; Musculoskeletal: muscle pain, diffuse body pain, generalized body aches; Cardiac: syncope, hypertension, tachycardia/palpitations, atrial fibrillation

Table 3. ED Treatment & Disposition

Oxygen	Frequency, n (%)*
Room air	810 (67.8%)
Nasal cannula	282 (23.6%)
Ventilator	38 (3.2%)
Bi-level positive airway pressure	27 (2.3%)
High flow nasal cannula	25 (2.1%)
Nonrebreather mask	7 (0.6%)
Other†	6 (0.5%)
Medications	**Frequency, n (%)**
Analgesics	1,040 (23.2%)
Antibiotics	625 (14.0%)
3rd generation cephalosporin	190 (30.4%)
Penicillin	120 (19.2%)
Vancomycin and derivatives	114 (18.2%)
Macrolide	109 (17.4%)
Tetracycline	28 (4.5%)
Quinolone	18 (2.9%)
Anaerobic antiprotozoal-antibacterial	7 (1.1%)
4th generation cephalosporin	7 (1.1%)
1st generation cephalosporin	5 (0.8%)
Carbapenem	4 (0.6%)
Gastrointestinal	487 (10.9%)
Anesthetics	244 (5.5%)
Sedative/Hypnotics	113 (2.5%)
Antihyperglycemics	100 (2.2%)
Cardiovascular	178 (4.0%)
Anticoagulants	95 (2.1%)
Heparin	66 (50.4%)
Aspirin	32 (24.4%)
Enoxaparin	22 (16.8%)
Apixaban	6 (4.6%)
Clopidogrel	2 (1.5%)
Ticagrelor	2 (1.5%)
Rivaroxaban	1 (0.8%)
Glucocorticoids	74 (1.7%)
Methylprednisolone IV	24 (38.1%)
Prednisone PO	20 (31.7%)
Dexamethasone IV	9 (14.3%)
Hydrocortisone IV	8 (12.7%)
Hydrocortisone PO	2 (3.2%)
Diuretics	42 (0.9%)
Antiplatelet	36 (0.8%)
Muscle relaxants	7 (0.2%)
Antifungals	6 (0.1%)
Antivirals	2 (0.0%)
ED Disposition	**Frequency, n (%)**
Admit	738 (61.0%)
Discharged	459 (38.0%)
AMA	4 (0.3%)
Expired	3 (0.3%)
Other**	5 (0.4%)

* From 1,195 patients with documented mode of oxygen delivery
†Includes continuous positive airway pressure (3), laryngeal mask airway (1), Oxymizer (1), and tracheostomy mask (1)
** Eloped, transferred to another facility, or unspecified disposition

Table 4. Initial Laboratory Values Measured in the ED, by Disposition

Test	Overall	Overall 95% CI	Admitted	Admitted 95% CI	Discharged	Discharged 95% CI	p-value	Reference range
Erythrocyte sedimentation rate (mm/hr)	62.3	(58.3, 66.3)	63.3	(59.2, 67.3)	32.4	(17.4, 47.4)	0.01	0–15 mm/hr
C-reactive protein (mg/L)	104.5	(97.8, 111.2)	107.6	(100.7, 114.5)	55.5	(36.6, 74.4)	<0.001	0–10.0 mg/L
Lactate dehydrogenase (U/L)	306.2	(291.5, 321.2)	312.1	(296.5, 327.8)	218.8	(195.5, 242.0)	<0.001	100–220 U/L
D-Dimer (ng/mL)	1574	(1080.7, 1913.3)	1527.2	(1101.4, 1953.0)	218.9	(151.8, 286.1)	0.35	0–230 ng/mL
Ferritin (ng/mL)	832.9	(749.9, 918.5)	857.4	(769.4, 945.4)	394.8	(250.2, 539.4)	0.02	22–322 ng/mL
Hematocrit (%)	39.5	(39.2, 39.9)	38.9	(38.5, 39.3)	41.2	(40.6, 41.7)	<0.001	37%–47%
Hemoglobin (g/dL)	13.2	(13.1, 13.3)	13	(12.8, 13.1)	13.9	(13.6, 14.1)	<0.001	13.5–16.0 g/dL
Glucose (mg/dL)	151.9	(145.8, 158.0)	160.7	(152.7, 168.6)	130.1	(12.7, 137.5)	<0.001	67–99 mg/dL
Calcium (mg/dL)	8.9	(8.9, 8.9)	8.8	(8.8, 8.9)	9.1	(9.0, 9.1)	<0.001	8.5–10.5 mg/dL
Sodium (mEq/L)	136.5	(136.2, 136.8)	136.3	(135.9, 136.8)	136.8	(136.5, 137.2)	0.17	135–145 mEq/L
Potassium (mEq/L)	3.9	(3.8, 3.9)	3.9	(3.9, 4.0)	3.8	(3.7, 3.8)	<0.001	3.6–5.1 mEq/L
Chloride (mEq/L)	101.1	(100.8, 101.5)	100.6	(100.2, 101.1)	102.4	(102.0, 102.8)	0.01	98–110 mEq/L
CO2 (mEq/L)	23.9	(23.7, 24.2)	23.7	(23.4, 24.0)	24.4	(24.1, 24.7)	<0.001	22–32 mEq/L
Blood urea nitrogen (mg/dL)	22.5	(21.2, 23.8)	26	(24.3, 27.7)	13.9	(12.8, 15.0)	<0.001	6–24 mg/dL
Creatinine (mg/dL)	1.3	(1.2, 1.4)	1.5	(1.4, 1.6)	0.9	(0.8, 0.9)	<0.001	0.6–1.2 mg/dL

of breath (34.4%), fever (27.5%), and cough (23.8%). Of the 1209 total patients, 84.7% presented with at least one of these symptoms.

Table 3 shows the ED disposition for patients in this study. Of 1,209 patients, 738 (61.0%) were admitted, while 459 (38.0%) were discharged home. Three people expired in the ED (0.26%). The remaining 11 (<1.0%) included patients who left the hospital against medical advice, eloped, or were transferred to another facility.

Of the 1,209 patients in the cohort, 1,195 had documented modes of oxygen requirement. From the 1,195 patients with documentation, there were 385 (32.2%) patients requiring supplemental oxygen, with 23.6%% requiring nasal cannula, and 3.2% on mechanical ventilation. The majority of these patients (67.8%) remained on room air (see **Table 3**).

Patients differed significantly in lab values from tests done in the hospital. Overall, mean inflammatory markers were elevated for admitted patients as compared to those discharged (**Table 4**). Erythrocyte sedimentation rate (ESR) was significantly higher for admitted patients when compared to discharged (63.3 mm/hr vs 32.4 mm/hr, p=0.01), C-reactive protein (CRP) was also higher (107.6 mg/L vs 55.5 mg/L, p<0.01), as well as lactate dehydrogenase (LDH) (312.1 IU/L vs 218.9 IU/L, p<0.01), ferritin (857.4 ng/mL vs 394.8 ng/mL, p=0.02). There was no statistically significant difference in D-dimer values.

Patients received multiple types of medications while in the ED including antibiotics, glucocorticoids, and anticoagulants (**Table 3**). Fourteen percent of medications dispensed were antibiotics. Anticoagulants and glucocorticoids represented a small percentage of medications administered (1.5 % and 1.1 % respectively). **Table 3** also demonstrates the most common antibiotics administered included third generation cephalosporins (30.4%), penicillins (19.2%), and vancomycin (18.2%). The most common glucocorticoid administered was intravenous methylprednisolone (38.1%). The most common anticoagulant administered, was heparin (50.4%).

DISCUSSION

This study evaluates characteristics of COVID-19 patients from the largest health system in the state of RI. The demographic profile is consistent with other reports with patients who self-identify as Hispanic/Latinx being disproportionately affected by COVID-19. Nearly half of the patients in our study (47.5%) were Hispanic, while the proportion of the Hispanic population in RI is much smaller at 16.3%, highlighting a vast disparity.[10] This is consistent with previously described literature and known trends.[11]

The results of our study mimic general trends in sociodemographics, sex, age, and presenting complaints that have

been previously identified in the literature.[12-17] In the studied population, patients in their sixth decade of life tended to present with greater frequency to the ED. This trend was similar to that seen in literature from New York City, China, and Italy.[8,10,14] The age group affected by COVID-19 was also disproportionately skewed toward older patients compared to the share of the population in Rhode Island.[18] This data reinforces prior observations that those older than 60 years of age are not only more susceptible to severe presentations of COVID-19, but that they make up a greater share of infections.

There has been long-standing knowledge of healthcare disparities for Hispanic/Latinx, African American, and Asian/Pacific Islanders/Native Americans in the US.[19-21] The COVID-19 pandemic has further highlighted these disparities as shown by the disproportionate numbers of cases, hospitalizations and deaths.[22-24] Our study shows a disproportionate number of patients were Hispanic/Latinx. In addition to prioritizing older adults, public health efforts must also focus on this population to mitigate the devastating effects of the disease. Rhode Island public health authorities have sought to do so by strengthening COVID-19 vaccination campaigns in communities with large Hispanic/Latinx communities.[25,26]

Clinical findings differed in an expected manner in admitted and discharged patients. Inflammatory markers collected in the ED were overall higher in admitted patients, consistent with known trends in severity of disease.[27] Of patients requiring supplemental oxygen, a very small portion of patients utilized positive-pressure ventilation reflecting the practice of early intubation.[28]

Particularly interesting is the lower frequency of steroid use. This too is consistent with the trends at the time as official recommendations for steroids were not published until September 2020.[29] We note a more liberal use of antibiotics at the time, also likely attributed to a lower threshold to treat possible superimposed bacterial infections in the setting of many COVID-19.[30]

Limitations

Due to the retrospective nature of this study, data were limited in relation to the variables available and the manner in which they were documented. There are inherent issues in relying on the medical record, namely, the inability to control for inaccuracies in documentation or missing data. While our data with regards to comorbidities reflects that of national trends, we were limited to what was documented in the medical record.[7] It is commonplace for the list of a patient's medical history to not be up to date. It is possible that our data reflects results pulled from an out-of-date list. However, it is uncommon for chronic conditions such as heart disease and chronic kidney disease to be "cured" or managed to an extent where their presence on the medical history list would be deemed inaccurate. Also, due to the retrospective nature of this data, we are unable to attribute any causality to the data represented.

CONCLUSION

Trends in this study are similar to trends identified in the literature, including the identification of older patients and Hispanic communities having a disproportionate burden of disease. Future studies are warranted to evaluate any change in trends over the course of the pandemic to appropriately allocate public health resources.

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Where Are They Now? Charting Careers for 32 Years of New England Surgical Society Podium Presentation Winners

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ABSTRACT

BACKGROUND: The New England Surgical Society (NESS) has been a pillar of the regional medical community since 1916, founded to promote surgical knowledge sharing across a small but diverse geographical region. Annual podium awards recognize high-quality research by surgical trainees.

DESIGN: We described trends among 81 research abstracts and career trajectories for their trainee authors (1987–present).

RESULTS: Among abstracts, 80.2% were clinical research, 12.3% basic science, and 7.4% education. 87.6% resulted in publications. Awardees represented 19 institutions and were predominantly residents (74.0%), with the remainder being fellows and students. 71.4% are now practicing attendings in 14 surgical subspecialties while 18.2% remain in surgical training. 44.2% currently reside in New England.

CONCLUSION: NESS attracts a range of high-quality research and winners demonstrate a range of successful careers with a propensity for academic surgery. Findings of low attrition and many currently living in New England highlight the value of regional conferences for strengthening local professional connections.

KEYWORDS: regional conference, graduate medical education, surgery, resident awards, academic research, gender parity

INTRODUCTION

The New England Surgical Society (NESS) was founded in 1916 with 18 founding members from 6 states. 13 papers were presented that year.[1] Since its founding, NESS has held a commitment to research and education across a small but diverse geographic region. Its inaugural president, Dr. Samuel Mixter, stated "the great value of medical meetings is to meet men, to know men, and to get their views," and he charged the society with the task of "add[ing] materially to the sum of surgical knowledge."[2] Dr. John Wheeler, NESS' second president, further elaborated on the importance of the society. He believed that all surgeons, even "those of us who inhabit the smaller towns of New England" had meaningful expertise to offer: "If each of us will contribute his mite to the cause of surgical progress and see to it that his mite represents his very best effort, I venture to say that the effect on the Society as a whole and on its individual members will be startlingly beneficial."[2]

Records show that a Resident Award, later renamed the Podium Prize Award, was bestowed annually to trainees at NESS beginning some time in or before 1987. Initially given only to the single best podium presentation, as of 1996 the society began recognizing the three top trainee presentations. The presentation of such awards recognizes some of the best surgical research in New England and reflects the ideals of NESS. This project was initiated to describe the content of this research and the career trajectories of award winners.

METHODS

Using the list of prior award-winning abstracts provided on the NESS website, investigators used Internet search, PubMed, and correspondence with current program directors to collect data about winning abstracts and authors. Searches for publication history were conducted predominantly using PubMed. Most data about award winners were available from U.S. News (health.usnews.com) and profiles on department webpages. Data was collated and described using summary statistics.

RESULTS

The award list spans 32 years (1987–2019) and cites 81 abstracts. Given some repeat winners, this represents the work of 77 awardees.

Trends among abstracts are described in **Table 1**. 80.2% (65/81) of winning abstracts were for clinical research, 12.3% (10/81) for basic science, and 7.4% (6/81) for surgical education or history, spanning 14 different surgical specialties. At least 87.6% (71/81) went on to full publication in peer-reviewed research journals.

Awardees hailed from 19 different research institutions. At the time of their award, 74.0% (57/77) of recipients were residents and 14.3% (11/77) were surgical fellows, with the remainder being research fellows (7.8%, 6/77) and students (3.9%, 3/77). Four awardees went on to win a subsequent second award. These awardees were all female, and therefore, while women made up 40.2% (35/77) of awardees, they received 43.2% (39/81) of awards. (See **Table 2**.)

Table 1. Trends among winning NESS research presentations

Specialty	Frequency % (n)
Breast	4.9% (4/81)
Cardiac	1.2% (1/81)
Colorectal	7.4% (6/81)
Critical Care	6.2% (5/81)
Endocrine	3.7% (3/81)
General Surgery	4.9% (4/81)
Vascular	6.2% (5/81)
Minimally Invasive	2.5% (2/81)
Pediatric Surgery	9.9% (8/81)
Plastics	1.2% (1/81)
Surgical Oncology	17.3% (14/81)
Thoracic	1.2% (1/81)
Burn	1.2% (1/81)
Hepatobiliary	3.7% (3/81)
Trauma/Emergency General Surgery	19.8% (6/81)
Surgical Education or History	7.4% (6/81)
Medicine	1.2% (1/81)
Type of Research	
Clinical Research	80.2% (65/81)
Basic Science Research	12.3% (10/81)
Other (Medical Education, History, etc.)	7.4% (6/81)
Research Institution	
Baystate	3.7% (3/81)
Beth Israel	4.9% (4/81)
Boston Children's	1.2% (1/81)
Boston Medical Center	3.7% (3/81)
Brigham and Women's	3.7% (3/81)
Brown	11.1% (9/81)
Dartmouth	11.1% (9/81)
Grand Rapids	1.2% (1/81)
Hartford Hospital	1.2% (1/81)
Lahey	1.2% (1/81)
Maine Medical	3.7% (3/81)
MD Anderson	1.2% (1/81)
MGH	14.8% (12/81)
New England Deaconess	1.2% (1/81)
St. Mary's	1.2% (1/81)
U Conn	7.4% (6/81)
U Mass	4.9% (4/81)
University of Vermont	8.6% (7/81)
Yale	11.1% (9/81)

Table 2. Trends among NESS presentation award winners

Trainee Level at Time of Award	Frequency % (n)
Student	2.6% (2/77)
Resident	74.0% (57/77)
Fellow	14.3% (11/77)
Researcher	7.8% (6/77)
Current Position	
Resident	11.7% (9/77)
Fellow	6.5% (5/77)
Attending Surgeon	71.4% (55/77)
Attending in Non-Surgical Specialty	2.6% (2/77)
Other	7.8% (6/77)
Surgical Specialty	
Breast	2.6% (2/77)
Cardiac	3.9% (3/77)
Colorectal	7.8% (6/77)
Critical Care	5.2% (4/77)
Endocrine	3.9% (3/77)
General	20.8% (16/77)
Vascular	9.1% (7/77)
Minimally Invasive	7.8% (6/77)
Pediatric Surgery	5.2% (4/77)
Plastics	1.3% (1/77)
Surgical Oncology	15.6% (12/77)
Thoracic	2.6% (2/77)
Transplant	3.9% (3/77)
Trauma	2.6% (2/77)
Other	7.8% (6/77)
Gender	
Male	59.7% (46/77)
Female	40.3% (31/77)

Compared to the estimated 18% attrition rate for surgical trainees nationally[3], NESS awardees demonstrated a relatively low attrition rate: 89.6% (69/77) continued their careers in a surgical field, 71.4% (55/77) as attendings and 18.2% (14/77) still in residency or fellowship training. They pursued 14 different surgical subspecialties, although only a minority pursued the same subspecialty as their winning abstract. Of the awardees who had completed residency at the time of this publication, only 35.9% (23/64) had pursued the field to which their abstract pertained.

Among the remaining awardees who do not practice surgery, 2.6% (2/77) each work in other medical specialties, in biomedical industry, or as post-doctoral researchers and one awardee (1.3%) retired after completing surgical fellowship to be a full-time parent.

Among those who became attendings in surgery and other medical fields, at least 57.6% (n=34/59) currently hold university-affiliated faculty positions. 44.2% (n=34/77) of awardees reside in New England.

DISCUSSION

Every year, NESS attracts a range of high-quality abstracts, and the winners of the top abstract presentation awards go on to a range of successful careers. Receiving a NESS Podium Presentation award likely reflects a propensity for academic surgery, as a majority of its recipients continue in surgical careers as university-affiliated faculty. We noted that many of these individuals eventually go on to settle in New England, suggesting that NESS provides a valuable opportunity for trainees to strengthen their regional professional network among potential collaborators and employers.

We noted that only a minority of award winners ultimately went into the same surgical subspecialty as the field of research they presented at NESS. This suggests that developing a solid foundation of research experience, and producing high quality academic work, is perhaps more valuable to trainees than conducting research in their ultimate field.

An optimistic finding was the high rate of female winners. To explain this, one would need the baseline proportion of women among training programs in New England during the study period, or at least among the authors submitting abstracts to NESS – both were outside the scope of this study. However, it is a notable contrast to a recent study showing female surgical trainees are disproportionately underrecognized by departmental awards. That study, which included 10 programs (out of 24 participating) from the Northeast, showed female trainees accounted for 36.6% of the resident population but only 31.4% of award winners.[4] It is unclear whether this difference is the result of any directed efforts by NESS leadership or perhaps a reflection of a more diverse and supportive culture within New England medical organizations. However, this study demonstrates the feasibility of evaluating organizations for evidence of gender bias and that there may be something to learn from those which achieve better gender parity.

In summary, the diversity among the winning abstracts seen over the last three decades of NESS is laudable, as evidenced by the diversity of award winners, the representation of research from 19 different regional institutions, and the breadth of research across 14 sub-specialties. Furthermore, the finding that many of the trainees recognized in this work have remained in New England highlights the value of regional conferences as potential opportunities for trainees to develop local professional relationships that may last their entire careers. Together, this study confirms that NESS continues to hold up ideals set forth by its great founding surgeons: the importance of getting to know one another, advancing each other's surgical knowledge, and the belief that great contributions come from across the whole of New England.

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A 38-year-old woman with Cerebral Venous Sinus Thrombosis

LINDSAY MILLER, MD; WILLIAM BINDER, MD

From the Case Records of the Alpert Medical School of Brown University Residency in Emergency Medicine

DR. LINDSAY MILLER: Today's patient is a 38-year-old woman who presents to the emergency department with a chief complaint of a headache. The patient states she suddenly awoke from sleep 3 days prior to her presentation with a severe headache. She took ibuprofen, and was able to get back to sleep, but she has had intermittent dull headaches over the past 48 hours. Her headache worsened beginning about 2–3 hours prior to her presentation to the emergency department. The patient states her headache is in the left frontal area, with radiation behind her left eye and toward the back of her head. She reports nausea over the last several hours, and describes photophobia. She denies vomiting and she has no neck stiffness, and reports no visual changes. She denies fever and reports no ill contacts. She denies anosmia. She has not been vaccinated against the SARS-CoV-2 virus.

The patient states she has had headaches in the past that were easily managed with acetaminophen, but that she has never had a headache this severe. Past medical history includes ovarian cysts and restless leg syndrome for which she takes ropinirole. She uses no other medications and has no other medical history. Family history is significant for factor V Leiden mutation in her mother, but the patient states she has been tested previously and was told she was negative for the mutation. Other family members have had venous thromboembolic events.

DR. THOMAS GERMANO: Can you describe the physical exam?

DR. MILLER: The patient was well appearing, although uncomfortable. Her vital signs were normal: blood pressure was 101/74 mm Hg, pulse 72, temperature 98.1°F, and she weighed 81.2 kg. Her pupils were 3 mm bilaterally, and round and reactive to light, and her extraocular motion was completely intact. Discs were not visualized. She had no meningismus, her cranial nerves were intact, her gait was normal, and her neurologic exam was otherwise unremarkable.

DR. THOMAS HARONIAN: Headache is a frequent chief complaint in the emergency department and in primary care. How did you evaluate this patient?

DR. MILLER: Approximately 3.5 million patients over the age of 15 present to US emergency departments with headache, and it is one of the leading causes for an emergency department visit.[1] Headaches can be categorized as either primary or secondary headaches. Primary headaches include migraine, tension-type, and cluster headaches and accounts for the vast majority of headaches presenting to the emergency department. Secondary headaches are defined as those with a distinct underlying etiology, such as trauma, infection, or malignancy.[2] Up to 5% of patients presenting to the US EDs have a secondary cause of headache (although in many series it is between 1%–2%), with some of these causes potentially life threatening.[3,4]

Differentiating a primary versus secondary headache can be challenging. The SNOOP mnemonic, later amended to SNNOOP10, can be used to screen for "red flags" in secondary headaches (**Table 1**).[5] Our patient exhibited several red flags in the history of her illness. She had sudden onset pain-a "thunderclap"- followed by partial resolution with non-steroidal anti-inflammatory medications, but her headache again became progressively worse. A "thunderclap" headache, is defined as a sudden onset headache peaking between seconds to minutes, may have benign origins or can suggest a sentinel (low volume hemorrhage) or significant bleed from a subarachnoid hemorrhage. In older adults it can also be related to parenchymal hemorrhage from hypertension. Less common causes of thunderclap headaches include unruptured cerebral aneurysm, cerebral artery dissection, cerebral venous sinus thrombosis (CVST), pituitary apoplexy, reversible cerebral vasoconstriction syndrome (RCVS), posterior reversible leukoencephalopathy syndrome (PRES),

Table 1.[5] SNNOOP10: Red Flags in headache presentation

Neoplasm	Papilledema
Neurologic deficit or dysfunction	Progressive headache
Onset: sudden or abrupt	Pregnancy/post-partum
Older age: >50 years old	Painful eye with autonomic features
Pattern change	Posttraumatic
Positional	Pathology of immune system
Precipitated by sneezing, coughing, exercise	Painkillers/new drug use at headache onset

hypertensive emergency and acute intracranial hypotension, colloid cyst of the 3rd ventricle, as well as other causes. [3,6,7]

DR. NAZ KARIM: Does responsiveness to pain medication help differentiate between a primary and a secondary cause of headache?

DR. MILLER: Primary and secondary headaches cannot be reliably differentiated by responsiveness to pain medications. Life threatening causes of secondary headache, including SAH, can respond to simple analgesic and anti-migraine medications.[8]

DR. ELIZABETH SUTTON: What is the utility of a non-contrast CT scan for some of these more concerning diagnoses?

DR. MILLER: This is an evolving area of study. In SAH, a non-contrast performed within 6 hours of headache onset has almost 99% sensitivity as long as the hematocrit is > 30%, the CT image is high quality, and it is an isolated thunderclap headache.[9,10,11] If imaging is completed after 6 hours, the sensitivity of a non-contrast CT decreases to about 85%, and a lumbar puncture can be performed looking for RBCs and xanthochromia.[11] Non-contrast CT is not sensitive for dissection, RCVS, PRES, and pituitary apoplexy, and can miss up to 30% of CVSTs.[12,13]

DR. CATHERINE CUMMINGS: Did laboratory studies provide insight into the cause of the headache?

DR. WILLIAM BINDER: The physical exam and laboratory studies were helpful in leading us toward the diagnosis and also in ruling out certain causes of secondary headache. Given the current pandemic, it was important to rule out COVID-19 as a cause of headache. Headache is a frequent clinical manifestation of COVID-19, with 12% of patients reporting headache in a meta-analysis, although the range extends up to 70% of patients in other studies.[14,15] COVID-19 is also associated with cerebral venous sinus thrombosis (CVST).[16] A rapidly performed RT-polymerase chain reaction (PCR) for SARS-CoV-2 was performed and was negative, however, in this patient.

Dopamine agonists are rarely associated with pituitary apoplexy. While our patient was using ropinirole, a non-ergoline dopamine agonist, for restless leg syndrome, she did not have the stigmata of endocrine dysfunction—her blood pressure was normal, as were her glucose, electrolytes, and TSH. ACTH hyposecretion, growth hormone deficits, and gonadotropin levels were not evaluated on initial presentation.[17,18]

Our patient was not immunocompromised, and had no fever, nor any physical exam signs of meningitis or systemic illness. She did have an elevated white blood cell (wbc) count of 14.8 (reference 3.5–11 x 10^9/L) but had no other laboratory abnormalities suggestive of infection. Additionally, her urinalysis and BHCG was negative. Without a clear infectious source, we felt it was probable her leukocytosis was reactive and due to catecholamine-induced demargination.[19]

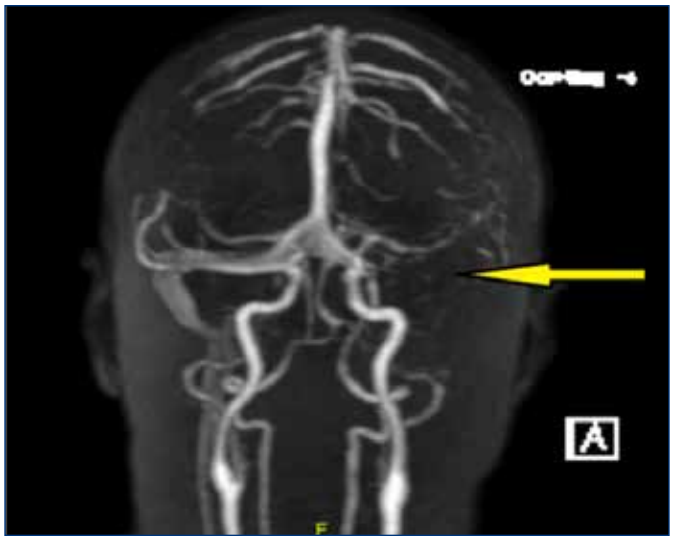
Thunderclap headache is associated with reversible cerebral vasoconstriction syndrome (RCVS) but the disorder is more common in pregnancy, after neurosurgical procedures, and with vasoactive drug use. As noted previously, the patient was not pregnant, and urine toxicology was negative.[20] Additionally, hypercalcemia is associated with RCVS, but our patient had a normal calcium. The diagnosis of RCVS is made primarily through neuroimaging, however.

Of note, our patient did have a family history of Factor V Leiden mutation, although she reported that she was negative for this coagulopathy. We obtained a d dimer, which was elevated (425 ng/ml, reference range 0–230 ng/ml). At present, the d-dimer is not reliable for ruling out CVST as it ranges in sensitivity from 58%–97%.[2,21] A positive d-dimer in the appropriate context, however, can provide supporting evidence for thrombosis, and we therefore elected to pursue this diagnosis.

DR. MARK GREVE: Did you proceed with diagnostic imaging?

DR. MILLER: Yes. A non-contrast CT scan was unremarkable. Because of the family history of Factor V Leiden mutation and an elevated d-dimer we were concerned about CVST and so we obtained a magnetic resonance venogram. While CT venography has an overall sensitivity of approximately 95%, MRI/MRV is the preferred diagnostic modality for CVST at our facility.[22] Imaging was performed and the patient was noted to have an acute left transverse-sigmoid

Figure 1: Sagittal 3D Reconstruction MR Venogram demonstrating the filling defect (yellow arrow) representing an acute left-sided thrombosis extending from the left transverse-sigmoid venous sinus to the left internal jugular vein.



venous sinus thrombosis extending into the left internal jugular vein without hemorrhage, infarct, or evidence of intracranial hypertension (see **Figure 1**).

DR. ERICA LASH: How common is CVST, and how frequently do patients with CVST present without neurologic findings? I would imagine that there could be a delay in making this diagnosis.

DR. MILLER: Autopsy series suggest the annual incidence of CVST is 3-4 cases/million in adults and in 7 per million in children. However, advanced imaging techniques and increasing awareness has lead to increased detection, with some studies suggesting up to 15 cases per million in adults.[23] The disorder more commonly occurs in women, with a median age range from 37–49 years. It accounts for about 0.5%–1% of all ischemic strokes.[22,23]

The most common sites of occlusion are the transverse and superior sagittal sinuses, and greater than 50% of patients have multiple sinuses involved. Infarcts are frequently present on imaging, with hemorrhagic infarcts occurring in 20%–30% of patients.[23,24,25]

CVST can present with a constellation of symptoms, but headache is the initial symptom in about 75% of cases, and is noted in about 90% of patients. It is an isolated finding in about 25%–45% of patients.[23,26] Headache location varies widely and does not contribute to the diagnosis. In about 10% of cases, the onset of headache is sudden and can be described as "thunderclap" in nature.[6] Because of the phenotypic indistinctiveness of the headache in CVST, diagnostic delay is often noted, ranging from 2–13 days.[2,23,27]

Other common findings include motor weakness, papilledema, and visual changes due to impaired extra ocular movement. Seizures are noted in up to 50% of patients with CVST, and patients can present with increased intracranial pressure and encephalopathy.[22,23]

DR. MATTHEW KOPP: Did this patient have repeat testing for factor V Leiden mutation? Did she have other risk factors for this disorder?

DR. BINDER: The patient was tested for factor V Leiden mutation and was negative. Subsequent additional testing was performed by the Hematology consult service and the patient was found to be negative for protein C and S deficiency, prothrombin gene mutation G20210A, anticardiolipin antibody, and antithrombin III deficiency. Risk factors for CVST include any of a number of thrombogenic causes (**Table 2**). It is possible that our patient has an uncharacterized mutation related to the factor V Leiden mutation, but this was not discerned.

DR. PATRICK SULLIVAN: What is the current treatment for CVST?

Table 2. Risk Factors for CSVT[22,23,28,29]

Risk Factor	Disorder
Prothrombotic: Hereditary	Factor V Leiden Mutation Antithrombin III deficiency Protein C/S deficiency G20210A Prothrombin gene mutation; JAK2V617F mutation
Prothrombotic: Acquired	Pregnancy, OCP use, hormone replacement therapy
Infections	Meningitis, Sepsis, HIV, TB, COVID-19, endocarditis Localized infections including OM, mastoiditis, head and neck infections
Mechanical	Head trauma, NS procedures, LP, Jugular vein catheterization
Vasculitis	SLE, temporal arteritis, APLA, Thromboangiitis obliterans, granulomatosis with polyangiitis
Intracranial Defects	AVMs, tumors, Dural fistula
Systemic diseases	Dehydration, malignancy, sarcoid, nephrotic syndrome, IBD
Hematologic malignancies	ET, myeloproliferative disorders, polycythemia, PNH
Drugs/Medications	Hormone therapy; thalidomide; hemostatic therapy; recreational drugs; chemotherapy; HIT; VITT

LP= Lumbar puncture
SLE= Systemic Lupus
APLA = antiphospholipid antibody
ET = essential thrombocytosis
PNH = paroxysmal nocturnal hemoglobinuria
HIT = heparin induced thrombocytopenia
VITT = Vaccine induced thrombotic thrombocytopenia

DR. MILLER: Like other thrombotic pathologies, the mainstay of treatment of CVST (after expeditious diagnosis, of course), is anticoagulation. Patients should be started on either unfractionated heparin (UFH) or low molecular weight heparin (LMWH). Work-up of contributing factors such as underlying pro-thrombotic states should be performed as well. After initiation of UFH/LMWH, the patient should be transitioned to oral anticoagulants. Warfarin remains the first-line treatment option, with direct oral anticoagulants (DOACs) being a reasonable, although not fully studied, alternative.[30] AHA/ASA guidelines recommend anticoagulation for 3–6 months in provoked CVST, and up to one year in unprovoked CVST.[22]

If there is concern that CVST is due to heparin-induced thrombocytopenia (HIT) or vaccine- induced immune thrombotic thrombocytopenia (VITT), these patients should not be treated with heparin unless testing has excluded heparin-dependent enhancement of platelet activation.[31,32]

In the future, mechanical or catheter-directed thrombectomy may become more of a mainstay of treatment; however, at present this is a therapeutic intervention primarily used in refractory cases.[33]

DR. KOPP: What is the prognosis for a patient with CVST? Do you have follow-up for this patient?

DR. MILLER: Mortality from CVST is approximately 4%–5% acutely, depending on the whether the patient presents with significant neurologic deficits. Over the course of follow- up it can almost double.[21] However, complete or partial recovery occurs in the vast majority of patients. Our patient was fortunate to present with an isolated headache and no focal neurologic signs. She was treated with heparin, and transitioned to enoxaparin followed by warfarin. The patient was unable to maintain a therapeutic INR and so was begun on apixaban for one year. A 1-year follow-up MRV showed trace residual linear hypo-enhancement at the left transverse/sigmoid sinus junction.

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Flip Your Perspective: Dextrocardia and its Effect on Monitoring and Management

KENNETH JOHN, MD; TAIF MUKHDOMI, MD; MARK C. KENDALL, MD; GEOFFREY HAYWARD, MD

ABSTRACT

Dextrocardia is a rare congenital disorder characterized by an anatomically flipped heart that is positioned in the right instead of the left side of the thorax. Anatomical variants, such as this, are vital to be aware of as they can alter patient monitoring and management. In this case report, we describe a patient with dextrocardia whose anatomy affected intraoperative monitoring while undergoing a successful aortic valve replacement surgery.

KEYWORDS: dextrocardia, SAVR, cardiothoracic surgery

ABBREVIATIONS: Transthoracic echocardiography (TTE), Transesophageal echocardiography (TEE), Electrocardiogram (EKG), Computed tomography (CT), Focused Assessment with Sonography in Trauma (FAST), Superior Vena Cava (SVC).

INTRODUCTION

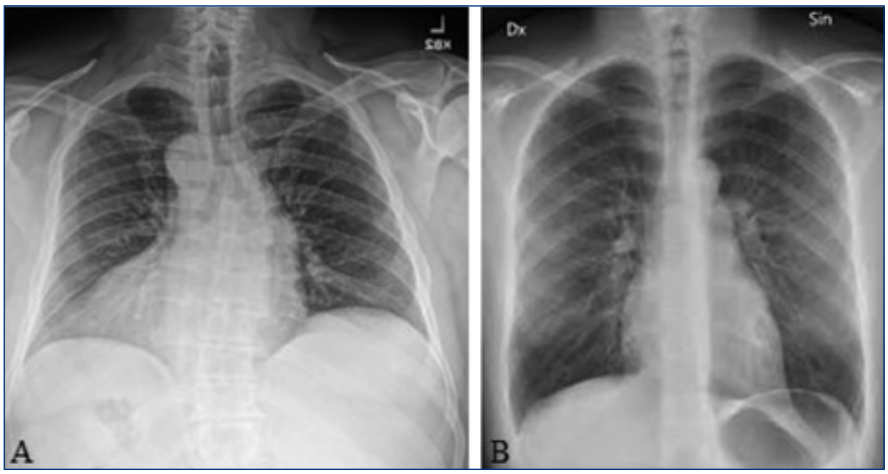
Dextrocardia is a rare congenital disorder characterized by an anatomically flipped heart, with its apex pointing towards the right side of the chest cavity. The incidence is 1 in 100 births with approximately 1 in 1,000 of these cases having dextrocardia and situs inversus – the reversal of organ positions in the chest and abdomen.[1] In this case report, we describe a patient with known dextrocardia with situs inversus and its effect on intraoperative monitoring during an aortic valve replacement surgery.

CASE PRESENTATION

A 54-year-old Caucasian male presented to Rhode Island Hospital for a Surgical Aortic Valve Replacement (SAVR) for severe aortic stenosis. His past medical history included dextrocardia with situs inversus, which was discovered three years prior during a routine TTE. Over the preceding year, the patient began experiencing worsening shortness of breath with exertion. Initial work-up included a chest X-ray which showed a flipped cardiac silhouette with the apex of the heart at the right 5th intercoastal space and a gastric air bubble located under the right diaphragm (**Figure 1A**). An EKG was performed and noted to have right-axis deviation, inverted p-waves and a negative QRS complex in leads I and aVL, and poor R-wave progression (**Figure 2**). The initial interpretation read "Right and left arm leads reversed". After not being able to tolerate an exercise stress test, a TTE examination revealed the presence of severe aortic stenosis and the patient was referred for a SAVR.

On the day of surgery, prior to the induction of anesthesia, the telemetry limb leads were applied in reverse orientation. During the operation, a TEE probe was utilized to provide real-time images of the heart. Due to the patient's dextrocardia, the mid-esophageal four chamber view of the heart was obtained at 180 degrees of omniplane instead of 0 degrees. Following a successful aortic valve replacement, the patient was transferred to the cardiothoracic intensive care unit for further post-operative care. The patient recovered well and was discharged home on post-operative day 8.

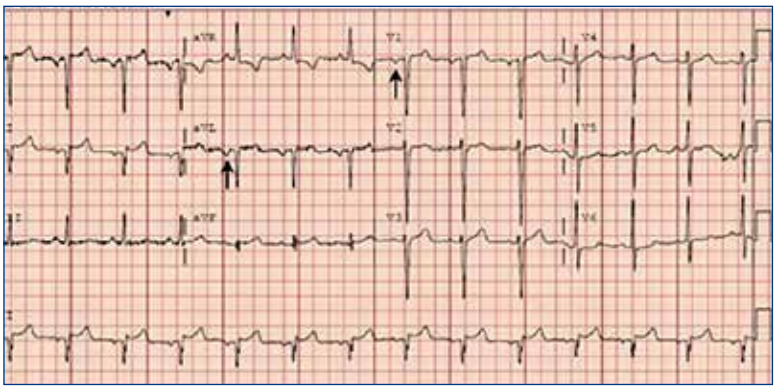
Figure 1. (**A**) A chest x-ray with a flipped cardiac silhouette and a gastric air bubble on the right side, compared side-by-side with (**B**) a normal chest x-ray.



DISCUSSION

Dextrocardia is a generally benign anatomical variant. The provider's first clue to consider dextrocardia is often physical examination. Cardiac sounds are heard on the right side of the chest and the maximum cardiac impulse is palpated at the right midclavicular line.[2] An abnormal EKG can also

Figure 2. A 12 lead EKG demonstrating right axis deviation and poor R-wave progression, which is frequently seen in patients with dextrocardia.



tip off a provider. Characteristic EKG findings in dextrocardia include right-axis deviation and poor R-wave progression which causes the EKG software to interpret these findings as "limb leads reversed".[3] Reversal of the limb leads and reorientation of the precordial leads to the right chest will resolve the cardiac axis and R-wave progression abnormalities, respectively.[4]

The mirrored anatomy in dextrocardia with situs inversus has implications for patient monitoring and management. Our patient had a CT scan showing the SVC on the left side of the thorax. In this case, it may be beneficial to use the left internal jugular vein as opposed to the right for pulmonary artery (PA) catheter placement. During placement of a PA catheter, the tip typically wedges in the pulmonary artery around the 45–55 cm markings on the catheter. In a patient with dextrocardia, the PA catheter may have to be advanced further than normal for proper placement.[5] In a trauma patient with situs inversus, sonographic imaging during a FAST exam would require pointing the transducer towards the left upper quadrant of the abdomen to visualize Morison's pouch and towards the right upper quadrant to see the spleen.[6]

This case emphasizes that routine studies may result in insidious findings suggestive of dextrocardia and how anatomical variants can impact your medical management and technique.

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Subdural Hygroma: A Rare Complication of a Common Brain Malformation

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ABSTRACT

INTRODUCTION: Arachnoid cysts are a common incidental finding on head imaging. While the natural history of these cysts in poorly described, hemorrhage with subdural hygroma formation is rare. We review the clinical course of a patient who developed a subdural hygroma following trauma.

CASE: The patient was a previously healthy 14-month-old male who presented to the Emergency Department with vomiting after a fall and was found to have esotropia without other focal neurological deficits and a CT scan consistent with a subdural cerebrospinal fluid collection with midline shift. The patient was treated conservatively and his symptoms resolved.

DISCUSSION: Arachnoid cyst rupture is a rare complication which can lead to increased intracranial pressure with devastating consequences. Clinical manifestation can be similar to that of other intracranial pathologies. Prompt diagnosis is required to avoid life-threatening symptoms.

CONCLUSION: Arachnoid cyst rupture should be considered when evaluating patients with non-specific neurological symptoms following trauma.

KEYWORDS: arachnoid cyst, subdural hygroma, pediatric, neurosurgery, spontaneous rupture, middle cranial fossa

INTRODUCTION

Arachnoid cysts are becoming an increasingly common incidental finding in both pediatric and adult populations through the use of CT and MRI.[1] However, the natural history of these lesions, especially in the pediatric population, is still poorly described. It has been estimated that the prevalence in children is 2.3%,[2] with between 0% and 2.7% of these patients developing symptoms that necessitate surgery.[3] In a large consecutive series, it was found that of 111 arachnoid cysts in children, 11 arachnoid cysts increased in size, 13 decreased, and 87 remained stable after a 3.5 year follow-up period.

In children, cyst enlargement can raise intracranial pressure, most commonly causing headache, macrocephaly, nausea and vomiting, and gait unsteadiness, although symptoms also depend on cyst location.[3-5] The most feared complication of these cysts is rupture causing a subdural hematoma or intracystic hemorrhage.[5] Less frequently, arachnoid cyst rupture results in a subdural hygromas.[6-12] We report a case of a male infant who developed a subdural hygroma secondary to a ruptured arachnoid cyst.

CASE REPORT

The patient was a previously healthy 14-month-old male who presented three hours after a fall from a 2-foot-high couch. The patient was inconsolably fussy for 30 minutes following the fall and was taken to his primary care provider for assessment. Shortly thereafter, the patient had three episodes of non-bloody, non-bilious emesis prompting the patient's guardian to go to the Emergency Department. The patient did not lose consciousness during or after the episode. Interestingly, the patient's guardian noted progressive right eye internal deviation in the child over recent weeks. Review of systems was also notable for intermittent vomiting, which the guardian attributed to a day care-related illnesses. Family history was notable for an aunt with a ruptured brain aneurysm at age 40.

On examination, the patient had stable vitals without any obvious outward signs of trauma. He was interactive and had a normal mental status but was noted to have mild esotropia of the right eye. A non-contrast Computed Tomography (CT) scan of the brain was ordered which revealed findings suspicious for a chronic subdural collection with possible acute hemorrhage and a left middle cranial fossa arachnoid cyst. There was significant mass effect, with significant herniation and shift of the midline to the right by approximately 8 mm (**Figure 1**). The patient received anti-emetics in the Emergency Department for persistent emesis and was started on prophylactic anti-epileptic medication. Neurosurgery was consulted, and the patient was admitted to the PICU for further monitoring. Ophthalmology was consulted and performed a dilated eye examination which was remarkable for left eye intraretinal hemorrhage (**Figure 2**).

Magnetic Resonance Imaging (MRI) revealed a collapsed arachnoid cyst in the left middle cranial fossa with overlying left holohemispheric subdural hygroma, consistent with rupture of the cyst into the subdural space. Mass effect was stable with no further evidence of hemorrhage (**Figures 3**

Figure 1. Axial non-contrast CT demonstrates extra-axial CSF density fluid in wide Sylvian fissure (*) with displacement of frontal and temporal lobes away from the skull inner table (arrowheads) and mild left to right midline shift (arrow). CSF speckled pattern is artifact of image retrieval.

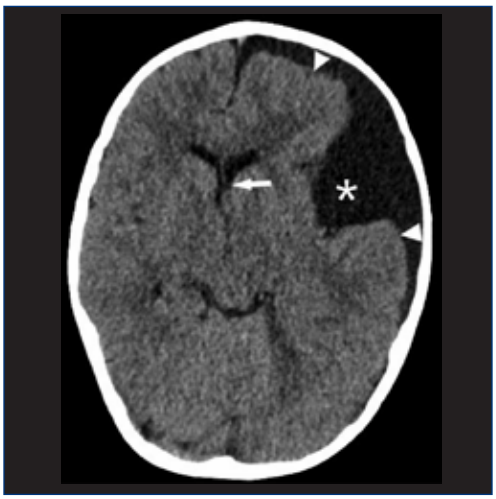


Figure 2. Fundus photograph of the left eye using an indirect ophthalmoscope and a 20D lens. There is no swelling of the optic disc (arrow) but flame hemorrhage is noted superotemporally off the disc (arrowhead). There are other scattered intraretinal hemorrhages noted in the retina (asterisk).

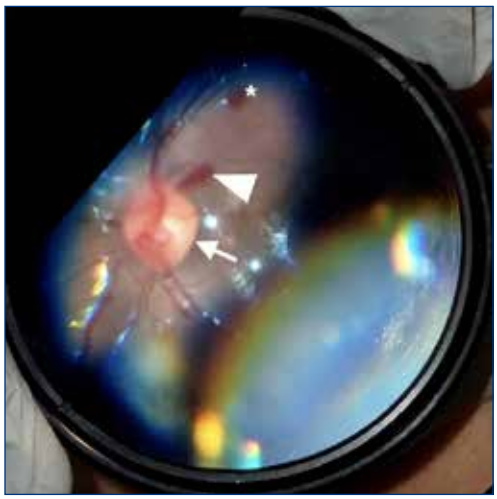
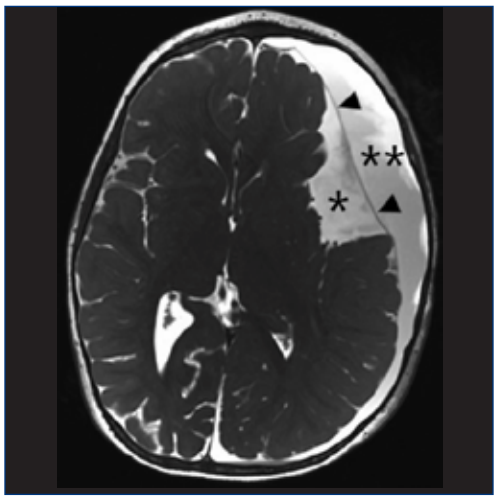
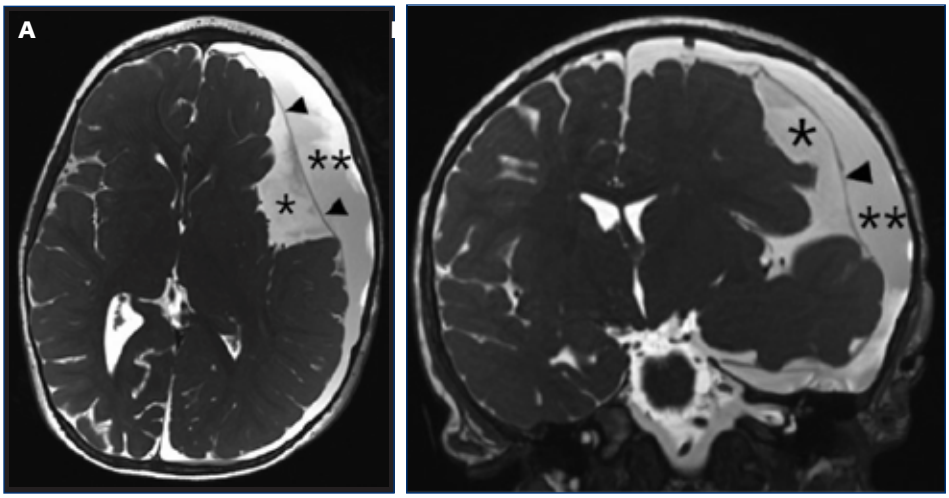


Figure 3. Axial FLAIR MRI (TR/TE: 9000/117.72) shows wide Sylvian fissure as well as frontal and temporal lobe mass effect similar to CT related to extra-axial low signal fluid isointense to right ventricular trigone CSF (arrow).



and 4). Incidental abnormal white matter signal was also appreciated consistent with periventricular leukomalacia. The patient remained hemodynamically stable throughout his admission, had resolution of his cranial nerve palsy and was ultimately discharged home three days following his admission. The patient received outpatient follow-up with Pediatric Neurosurgery and was found to be back to his baseline. Follow-up with ophthalmology also showed resolution of his cranial nerve IV palsy and esotropia without any required intervention.

Figure 4A & 4B. Fiesta 3D MPR in the (**A**) axial and (**B**) coronal plane. Thin arachnoid cyst membrane (arrowheads) draped over the frontal and temporal lobes after cyst rupture. CSF in subarachnoid space (*) and subdural space (**) outline membrane. Signal variation in the fluid is an artifact of the FIESTA sequence as fluid is uniformly hypodense on CT (Figure 1) and uniformly hypointense on FLAIR (Figure 2).



DISCUSSION

Arachnoid cysts are non-neoplastic, congenital, intracranial cerebrospinal fluid filled spaces surrounded by arachnoid membrane. These cysts comprise about 1% of all intracranial space occupying lesions.[11] Symptoms of arachnoid cysts depend on their size and location, with larger cysts having a greater effect on neurovascular structures and subsequently causing more symptoms.[13] Arachnoid cysts are most common in males,[14,15] and are often located in the supratentorial middle fossa.[2,13] While the progression of these lesions is poorly understood, it is generally accepted that these cysts can grow, shrink, or remain stable for extended periods of time.[17] More rarely, these cysts may rupture, leading to intracystic hemorrhage, subdural hematomas, or subdural hygromas.[6] Rupture is usually a result of minor head trauma, as seen in the present study, but spontaneous rupture has been described in case studies.[5,7,18] A recent review of 57 patients with a ruptured arachnoid cyst found that a fluid collection was most commonly blood from a subdural hematoma. Only a small minority of these patients were found to have a subdural hygroma, and these patients were generally younger than those

presenting with blood products in the subdural space.[19]

While it has been reported that up to one-third of patients with a ruptured arachnoid cyst have papilledema on dilated fundoscopic eye exam, there does not appear to be a correlation between papilledema and nausea and vomiting.[19] Symptoms are more likely a result of meningeal irritation rather than intracranial hypertension.[19] Our patient did not present with papilledema, but rather with retinal hemorrhages, a finding not previously described in the current body of literature.[1, 5, 6, 8-13,20] It is certainly possible that the retinal hemorrhaging seen in our patient was the result of his fall, rather than the ruptured arachnoid cyst.

The majority of adults and children do not have neurological deficits secondary to rupture.[3,19] About 10% of patients develop an ocular palsy, which was seen in our patient presenting with a cranial nerve IV palsy and esotropia.[19] Given the patient's history of acute on subacute symptomatology with weeks of vomiting and ocular palsy before his fall, it is likely that his cyst was expanding over time before traumatic rupture. This theory is supported by both chronic and acute hemorrhage observed on the patient's head CT scan.

Although arachnoid cysts are more frequently identified due to increased neuro-imaging, the natural history of the lesions remains poorly characterized.[3] Subsequently, when and how to treat arachnoid cysts continues to evolve.[19] Most cysts are asymptomatic, found incidentally, and do not require intervention.[1,2] However, it is generally accepted that surgical management of large symptomatic arachnoid cysts is warranted.[1,11,13,17] Two major surgical options exist for arachnoid cysts: cyst shunting or cyst fenestration surgery. Subdural hygromas, as seen in the present study, may require burr hole draining. Although previous literature has favored surgical management for arachnoid cysts associated with hygromas,[11,20-21] more recent evidence has favored conservative management given that the annual risk of hemorrhage is approximately 0.1%.[6,12] In a 2013 case series, 7 of 8 total patients with intracranial arachnoid cysts and an associated subdural hygroma were treated with conservative management. The researchers found that of the patients managed expectantly, all 7 experienced complete resolution of their symptoms at one year suggesting that these cysts can be conservatively managed with good effect.

CONCLUSION

Arachnoid cysts are benign, congenital lesions, which are often incidentally found in the middle cranial fossa on neuro-imaging. We present a unique case of a male infant found to have an arachnoid cyst complicated by hemorrhage, likely secondary to minor trauma causing a subdural hygroma. Arachnoid cysts may rupture, especially secondary to trauma, causing acute onset of life-threatening symptoms. As a result, providers should be aware of the possibility of arachnoid cyst rupture, especially in the setting of subacute onset of symptoms like vomiting and cranial nerve palsy, as observed in the present case. Current imaging surveillance is not yet standardized for these lesions, nor is treatment methodology for asymptomatic cysts. Our institution recommends imaging at 3 months following hemorrhage and yearly subsequent to that in order to track growth, midline shift, and new hemorrhage into the previously scarred territory. Repeat imaging for incidental findings of an unruptured arachnoid cyst is not recommended. Future research should be aimed at optimizing imaging surveillance and treatment strategies for both asymptomatic and symptomatic cysts.

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A Case of Multiple Organ Disseminated Cryptococcosis

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ABSTRACT

Cryptococcus neoformans is an encapsulated yeast found worldwide.[1] Patients with immunosuppression, including individuals with HIV/AIDS, transplant recipients and/or individuals with other T-cell mediated immunosuppression are more susceptible to becoming infected with *Cryptococcus neoformans* than immunocompetent individuals.[2] This is a case report of a 66-year-old woman who presented to the emergency department with an unsteady gait and urinary incontinence. Magnetic resonance imaging (MRI) on presentation showed a large C5-C6 central disc protrusion. The patient underwent surgical repair and was treated with five days of IV steroids. Later in the course of her hospitalization, she had an unexplained increasing leukocytosis and tachycardia with witnessed episodes of unresponsiveness. She subsequently had a pulseless electrical activity cardiac arrest and succumbed despite resuscitative efforts. A post-mortem diagnosis revealed *Cryptococcus neoformans* fungemia and disseminated cryptococcosis involving multiple organs. Disseminated cryptococcosis primarily affects the central nervous system[3], and thus this report presents a rare case of disseminated cryptococcosis involving multiple organs.

KEYWORDS: *Cryptococcus neoformans,* disseminated cryptococcosis, fungal infection, meningoencephalitis

BACKGROUND

Cryptococcus neoformans and *Cryptococcus gattii* are encapsulated yeast arising from the *Cryptococcus* genus and are found throughout the environment. While *Cryptococcus neoformans* is prevalent worldwide, *Cryptococcus gattii* is primarily found in tropical and subtropical areas. *Cryptococcus neoformans* commonly resides in bird droppings, nests and tree bark. Individuals are often infected by *Cryptococcus* through inhalation and infection can occasionally occur through the skin or ingestion.[1] An infection caused by *Cryptococcus neoformans* is classically known as an HIV/AIDS opportunistic infection. Additionally, transplant recipients and/or individuals with other T-cell mediated immunosuppression are susceptible to an infection from *Cryptococcus neoformans*.[2] On the other hand, *Cryptococcus gattii* primarily infects immunocompetent individuals.[4]

Individuals are often exposed to *Cryptococcus neoformans* in the environment.[4] Immunocompetent children living in urban environments have been shown to have positive antibodies to *Cryptococcus neoformans*. This is likely due to frequent environmental exposures.[5]

If infected by *Cryptococcus neoformans,* the yeast often resides in a latent phase or is spontaneously cleared by an immunocompetent host.[1,4] Both the presence of a latent infection and spontaneous resolution of an infection are likely the cause of positive *Cryptococcus* antibodies in immunocompetent individuals without an obvious preceding cryptococcosis infection. When an individual is infected by *Cryptococcus neoformans,* the clinical presentation can range from an asymptomatic and self-limited pulmonary colonization or infection to disseminated cryptococcosis involving any organ.[1] This is a case report of a patient with a post-mortem diagnosis of multiple organ disseminated cryptococcosis.

CASE REPORT

A 66-year-old woman with a past medical history of type 2 diabetes with retinopathy (recent hemoglobin A1c of 7.7%), hypertension, hyperlipidemia, vitamin B12 deficiency and a left eye pseudomonas corneal ulcer presented to the emergency department with recurrent falls in the setting of a progressive unsteady gait. The patient noted a generalized and unpredictable loss of muscle control with ambulation over the preceding 6–8 months. Her symptoms were not accompanied by dizziness, back pain, focal weakness or numbness. Additionally, she reported a new onset of urinary incontinence. She had recently been referred to a geneticist for evaluation of muscular dystrophy and initial testing was negative.

On presentation to the emergency department, the patient's vital signs were normal. Her physical exam was significant for intact muscle strength in all extremities, decreased sensation in bilateral legs to the knees and a wide-based gait. A non-contrast computed tomography (CT) scan was normal and an MRI of the brain demonstrated scattered small vessel ischemic changes without evidence of an acute infarct, hemorrhage or midline shift. MRI of the entire spine

Figure 1. T2-weighted MRI showing multilevel cervical disc disease

revealed multilevel disc disease in the cervical, thoracic and lumbar spine most pronounced at C5-C6 with a large central disc protrusion (**Figure 1**). Additional work-up on presentation was significant for a white blood cell count of $3.8x10^9$/L with lymphopenia, a platelet count of $135x10^9$/L, negative treponemal antibodies and normal vitamin B12, folate, and copper levels.

Neurology and Orthopedic Surgery services were consulted and the patient was started on high dose IV dexamethasone for a presumed radiculitis. She underwent an anterior cervical discectomy and fusion of C5-C7 and a C6 corpectomy followed by a posterior C3-T1 fusion. She tolerated the surgical procedures well and there were no operative findings to suggest an infection. IV dexamethasone was continued for a total of five days of treatment. Four days after the second surgical procedure, the patient had a witnessed brief episode of unresponsiveness while ambulating. Tonic-clonic movements were not observed during this episode. Due to an increasing leukocytosis, tachycardia, and an episode of unresponsiveness with behavioral changes, a repeat MRI of the cervical spine with and without IV contrast was obtained looking for a post-operative infection. Postsurgical changes with prevertebral and dorsal paraspinal fluid suggestive of seromas were noted. Additionally, a urinalysis was negative for an acute urinary tract infection and a chest X-ray showed no acute airspace disease. The patient received fluid resuscitation and was empirically started on ceftriaxone and vancomycin to cover for a surgical site infection as her white blood cell count increased to $27.4x10^9$/L with a mild increase in a lactic acid level to 2.7 mEq/L. Additionally, she was rescreened for COVID-19 and tested positive after a negative screen three days prior.

The Infectious Disease service was consulted for the increasing leukocytosis and new COVID-19 infection. Antibiotics were subsequently stopped as there was no obvious source of a bacterial infection. Later that day, the patient became hypotensive with a systolic blood pressure in the 80s and with persistent tachycardia. A lactic acid level increased to 6.0 mEq/L. Despite interventions, the patient went into a pulseless electrical activity cardiac arrest without return of spontaneous circulation.

One day after the patient died, the previously collected blood cultures demonstrated budding yeast that later grew *Cryptococcus neoformans.* Autopsy revealed disseminated cryptococcosis involving bilateral lungs, heart, spleen, liver, bilateral kidneys, bilateral adrenal glands, gastrointestinal tract, bone marrow, pancreas, thyroid, bladder, cervix, skeletal muscle and subcarinal lymph nodes. Neuropathology also showed the presence of yeast under a microscopic examination. On autopsy, the patient did not have acute or chronic lung features related to COVID-19. Though her autopsy revealed multiple organ disseminated cryptococcosis, a formal workup for immunosuppression was not completed during the hospitalization as blood cultures did not turn positive for budding yeast until after the patient passed away.

DISCUSSION

This is a case report of a patient who presented to the emergency department with subtle neurologic symptoms and was ultimately found to have multiple organ disseminated cryptococcosis on autopsy. In one study of 65 individuals diagnosed with *Cryptococcus neoformans* fungemia, 18.5% of the patients did not carry an immunosuppressive diagnosis. 11.32% of the 65 patients had diabetes without other known immunosuppressive etiologies as seen with the patient in this case report. Immunosuppressed individuals were more likely to be diagnosed with disseminated cryptococcosis compared to immunocompetent individuals.[6]

Upon dissemination from the respiratory tract, *Cryptococcus neoformans* favors travel to the central nervous system often resulting in a subacute meningoencephalitis. Patients with subacute cryptococcosis meningoencephalitis may present with a fever, headache, altered mental status, stiff neck, nausea and vomiting. Patients can also present with visual symptoms, hearing loss, ataxia, aphasia, seizures and chorea.[3] Immunocompetent individuals may present

with indolent cryptococcosis meningoencephalitis and it may take up to 8 months for a diagnosis to become apparent.[3,7] Additionally, only about 50% of non-HIV patients are febrile.[3]

The patient's progressive ataxic gait may have been a subtle presentation of a subacute cryptococcosis meningoencephalitis. In addition to the new leukocytosis and tachycardia, she developed personality changes, neck pain (though recently had neck surgery), somnolence and had episodes of unresponsiveness after receiving IV steroids. Since steroids can cause immunosuppression, it is possible that the IV steroids transitioned a subacute subtle meningoencephalitis to sepsis from multiple organ disseminated cryptococcosis. Additionally, the patient had lymphopenia at baseline, which may have been a contributing factor to the disseminated cryptococcosis diagnosis.

There is an increasing incidence and prevalence of fungal infections worldwide. An increase in the number of hematopoietic stem cell transplant recipients and more individuals treated with immune modifying agents have led to an increase in immunosuppressed patients. This patient population is more susceptible to fungi that were previously less prevalent, including *Histoplasma capsulatum* and *Fusarium*.[8]

Diagnosing an invasive fungal infection is difficult.[9] Patients often present without specific symptoms and histopathology and culture have low sensitivity, leading to diagnostic delay. Recently, techniques have been developed to aid in diagnosing fungal infections, such as the galactomannan antigen test for aspergillosis or the specific antigen and antibody test for detecting the *Cryptococcus* species. Additionally, new molecular methods to rapidly diagnose fungal infections have shown favorable potential, such as polymerase chain reaction (PCR) assays, matrix-assisted laser desorption/ionization time-of-flight mass spectrometry (MALDI-TOF MS) techniques and fluorescence *in situ* hybridization (FISH) techniques.[9,10]

Overall, the immune status of the individual with cryptococcosis determines the clinical manifestation. For individuals with cryptococcosis meningitis, immunocompetent individuals are less likely to also have fungemia or extra-neural involvement compared to immunosuppressed individuals. The presence of fungemia in patients with cryptococcosis often results in poor outcomes.[7] Given that disseminated cryptococcosis is most commonly found in the central nervous system[3], this case report presents a rare case of dissemination involving multiple organs. *Cryptococcus neoformans* can infect both immunocompetent and immunosuppressed individuals and a diagnosis is often delayed due to nonspecific symptoms at clinical presentation and the low sensitivity of histopathology and culture.

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Tension Pneumocephalus

RUSSELL G. PRICHARD, MD

ABSTRACT

Tension pneumocephalus (TPC) is a rare but devastating intracranial condition where increased intracranial pressure due to entrapped air causes compression of the brain leading to headache, seizures, altered mental status (AMS), and death. The author presents the case of patient with a past medical history of eye-enucleation who subsequently developed TPC in the setting of occult trauma. The diagnosis was made via commuted tomography (CT) scan and the patient underwent needle and burr-hole decompression in the emergency department (ED). TPC is a rare cause of altered mental status, which occurs most often secondary to trauma, and should be considered in patients with AMS and trauma.

KEYWORDS: tension pneumocephalus, trauma, altered mental status, Mount Fuji sign, radiology

CASE REPORT

A 92-year-old male with a past medical history of atrial fibrillation on warfarin, and skin cancer with eye enucleation surgery 3 years ago, presented with a Glasgow Coma Scale of 10 after an unwitnessed fall at home. From family members it was learned the patient had presented to an outside hospital 3 days earlier for a chronic wound at the site of the previous eye enucleation. Although it was not stated at the time, the patient had fallen several times without telling anyone, and only notified his son because the wound was now "bubbling." After the wound was cleaned, he was discharged without imaging and he continued to get weaker and less interactive until this morning, when he fell out of bed.

Upon arrival to the Emergency Department the patient was protecting his airway but not following commands. After stabilization, the patient underwent emergent imaging which demonstrated tension pneumocephalus, hemorrhagic contusion of the left occipital lobe, trace parafalcine hemorrhage, and bilateral subdural collections thought to be either empyemas or chronic subdural hematomas [**Figures 1,2**].

Neurosurgery and Ophthalmology were consulted. The patient received reversal of his anticoagulation and antibiotics, followed by emergent needle decompression and bilateral burr hole placement with reduction in his TPC [**Figures 3,4**]. He had a one-time seizure after decompression, which was treated with lorazepam and a levetiracetam load.

Consistent with a previously theorized mechanism,[1,2] it is likely that air was entering through the wound in the patient's eye and the skin flap there caused a valve effect – allowing air in but not out [**Figure 2**]. This was treated in the Emergency Department with iodine impregnated gauze and an occlusive dressing over the wound site. Despite the above

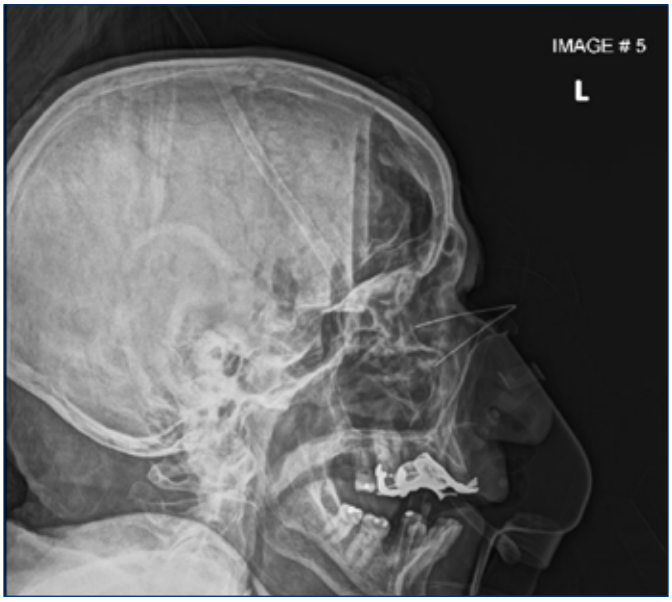
Figure 1. CT scan without contrast, transverse plane view showing extensive pneumocephalus, with effacement of the frontal lobes bilaterally (Mount Fuji Sign), as well as bilateral mixed-density collections.

Figure 2. CT scan without contrast, transverse plane view again showing extensive pneumocephalus, and also possible entry site of air with bone loss in the left orbit.

efforts, over the next 24 hours his mental status remained poor, he developed acute kidney injury and sepsis from central nervous system infection. He was made comfort measures only the following morning and subsequently passed away 1 day later.

Figure 3. Lateral Portable Skull X-ray showing extensive bilateral pneumocephalus with 2 distinct air-fluid levels.

Figure 4. Lateral Portable Skull X-ray (the fourth in the series) showing improved bilateral pneumocephalus after several needle decompression attempts, but prior to bedside external ventricular drain placement.



DISCUSSION

Pneumocephalus, or air in any of the intracranial spaces, is a rare event and is often caused by trauma as in our patient, or iatrogenically.[1] Diagnosis is made by CT scan, which is more sensitive and specific than cranial X-rays. Smaller volumes of air, 1–2 mL, usually resolve without intervention and monitoring is the mainstay of therapy in most patients with skull fracture and pneumocephalus.[1, 2] TPC is the extreme endpoint of air inside the skull, leading to compression of the brain with predominate effect exerted on the frontal lobes. Although it has its own radiographic sign, Mount Fuji Sign – so named because the frontal lobes resemble a lonely mountain silhouetted against the sky – very little data exists on its overall prevalence or mortality.[1,3]

Definitive treatment is with early surgical intervention,[1,4] and decompression of TPC should be paired with early antibiotic therapy for presumed CNS infection. Although exact statistics are unknown, progression to TPC seems to carry a very poor prognosis. Because it is a devastating injury, TPC should be considered in the differential of patients with head trauma and altered mental status.

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Tardive Dyskinesia due to Aripiprazole

JOSEPH H. FRIEDMAN, MD

Click to view video [01.21, https://vimeo.com/539672257]

This 66-year-old woman developed involuntary movements about two years prior to this video, after 6 months use of aripiprazole for refractory depression. The aripiprazole was the only dopamine receptor blocking drug she had ever taken, and had been stopped when the movements developed. The movements were probably exacerbated by her chemotherapy-induced dry mouth that began a year prior to the movements. She also had mild choreo-athetoid movements of her feet (not shown in video).The patient was taking cevimeline, valacyclovir, clonazepam, and vilazodone at the time of the video.

Aripiprazole is a second-generation antipsychotic drug that is FDA approved for treating refractory depression. It is known to cause parkinsonism, that is reversible, as well as tardive syndromes, which are usually permanent, and should be used with the same caution as all other antipsychotic drugs.[1]

Acknowledgment

Written informed consent provided by patient.

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Legend. Note the choreo-athethoid movements of jaw, lips, tongue and, to a lesser extent, face.

The **VIDEOS IN MEDICINE** section is open for submissions. Original, high-resolution images and videos which have not been published elsewhere will be considered. In a separate Word document please include a brief title, legend (150 words or less) providing relevant clinical information, findings, clinical course, and response to treatment if initiated. Any identifying information should be removed from the image, or written consent of the patient must be obtained.

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Implications of Sports on COVID-19 cases in Rhode Island School-aged Athletes

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INTRODUCTION

Participation in organized sports has physical and mental benefits for children and adolescents.[1] Sports can positively impact personal development, academic achievement, and mental health[2], but there are also risks involved with participation, including overtraining injuries.[3] Playing sports during the COVID-19 pandemic added the risk of becoming infected with COVID-19 or needing to quarantine as a result of exposure to someone with COVID-19. Many factors impact the risk of COVID-19 transmission in K–12 sports, such as the setting of play (indoor or outdoor), level of contact, and individual or team structure. To adhere to the Centers for Disease Control and Prevention (CDC) guidelines and minimize transmission, Rhode Island made changes to its sports regulations and guidelines for the 2020–2021 school year.

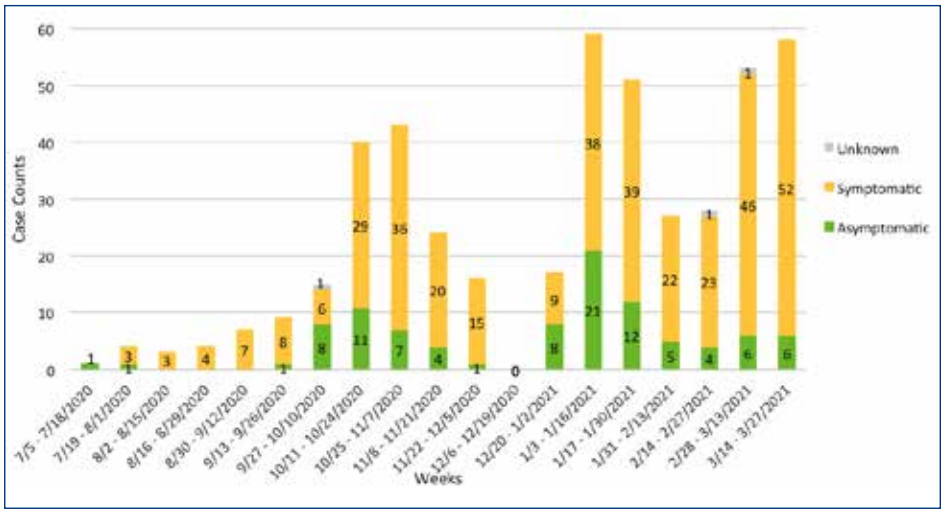
The Rhode Island Department of Health (RIDOH) investigates all COVID-19 cases and clusters to conduct contact tracing, make public health recommendations, and inform policy. RIDOH's COVID-19 unit examined implications of K–12 sports during the pandemic throughout the state during the 2020-2021 Summer, Fall, Winter and Fall II (fall sports that were canceled and played in early spring instead) seasons. Although there are several publications documenting sports-related COVID-19 clusters,[4,5] to our knowledge this is the first statewide, multi-sport and multi-season report on the implications of sports on COVID-19 cases in school-aged athletes.

METHODS

All laboratory positive (PCR or antigen) cases of COVID-19 are reportable to RIDOH. A K–12 case is defined as a positive case who is enrolled in or employed by a Rhode Island school. We analyzed data from RIDOH's COVID-19 surveillance system, Salesforce (Rhode Island COVID System, Health Cloud Application), to determine if K–12 cases participated in a game, practice, or both while infectious. Ninety-two percent (92%) of sports-related cases were in students aged 5–19; therefore, analyses focus on student athletes. A case is infectious two days prior to symptom onset or two days prior to specimen collection date, if asymptomatic. Both school and non-school (recreational) sports were included. School sports were divided into Fall, Winter and Fall II seasons.[6] Each positive COVID-19 case, or legal guardian, was interviewed to gather symptom status, places visited while infectious, and contacts. If a case attended a practice or game while infectious, all sports-related contacts were gathered according to RIDOH quarantine policies in effect at the time. All contacts were included in these analyses.

Frequencies were calculated using Microsoft Excel (Microsoft Office 365, Version 2008). A cluster is defined as two or more laboratory-positive cases in a 14-day period among athletes epidemiologically linked through sports. There were 12 spring sports cases associated with a boarding school, making it unclear whether transmission occurred in the congregate setting or sports. We conducted the analyses including and excluding these residential student athletes who potentially had increased exposure outside of sports. We found no difference in the results and we included these student athletes in analyses.

Figure 1. COVID-19 Cases Participating in K-12 Sports While Infectious, By Symptom Status,* Rhode Island, July 5, 2020–March 27, 2021, N=462



*A symptom status of symptomatic does not necessarily mean the case was at practice while showing symptoms.

RESULTS

From September 14, 2020–March 27, 2021, there were 6,040 K–12 cases, and 18,495 student athletes participated in the Fall, Winter and Fall II school sports season. During the same time period, there were 440 (7.3%) COVID-19 cases in student athletes who played a sport while infectious. An additional 22 sports cases from July 5, 2020–September 13, 2020 were included in the analysis. The largest number of cases reported was during the time frame of January 3–16, 2021 (**Figure 1**). Cases appeared to be increasing towards the end of March.

Seventy-nine percent of sports-related cases reported being symptomatic. Of the symptomatic cases, 39% attended practices or games while symptomatic. More cases were male (57%), participated in non-school sports (53%), and aged 15 to 18 years old (**Table 1**). For those who played a school sport, most cases occurred on high school teams (93%). Most cases played on only one team (94%), with a maximum number of three sports played while infectious.

The largest percent of cases was seen in hockey (20%), followed by soccer (15%), and basketball (15%) (**Table 2**). Most sports-related contacts were from practice (72%). There were 6,293 sports-related contacts quarantined during the analytic period. The average number of contacts per sports case was 13 (0 to 79 contacts) compared to 8 for K–12 overall (0 to 170 contacts). Hockey had the highest average number of contacts and the most clusters. Contacts most often tested positive after exposures from hockey, basketball, and soccer.

Table 1. K–12 Sports-Related COVID-19 Case Demographics, Rhode Island, July 5, 2020–March 27, 2021

Demographic	Count	Percent (%)
Gender		
Male	263	57%
Female	199	43%
Symptom Status		
Asymptomatic	96	21%
Symptomatic	363	79%
Unknown	<5	<1%
Age Group		
5 to 9 years old	63	14%
10 to 14 years old	159	34%
15 to 18 years old	239	52%
19 and older	<5	<1%
School versus Non-School Sport*		
School	233	47%
Non-school	264	53%
School Team Type		
Middle School	16	7%
High School	217	93%
Number of Sports Teams Participated in While Infectious		
One	429	93%
Two or more	33	7%
Sport Setting for Cases with Contacts**		
Practice	266	72%
Game	73	20%
Both Practice and Game	29	8%

* Total denominator is the total number of teams/facilities for all sports all cases attended (491).
**There were 364 cases with sports-related contacts.

Table 2. K–12 Sports-Related COVID-19 Cases and Associated Contacts, Rhode Island, July 5, 2020–March 27, 2021

Sport	Number of Cases	Average Number of Contacts per Case (Range)	Number of Sports-related Transmission Clusters
Baseball	22	12 (0–39)	2
Basketball	72	14 (0–78)	20
Boxing	<5	0 (0–1)	0
Cheerleading	12	5 (0–22)	0
Cross Country	6	4 (0–10)	1
Dance	33	4 (0–29)	3
Field Hockey	<5	3 (0–6)	0
Figure Skating	<5	0 (0)	0
Football	39	17 (0–60)	6
Golf	<5	2 (0–2)	0
Gymnastics	18	5 (0–29)	0
Hockey	103	20 (0–52)	22
Horseback Riding	<5	0 (0)	0
Lacrosse	8	14 (6–39)	2
Majorettes	<5	0 (0)	0
Martial Arts	21	1 (0–5)	0
Polo	<5	6 (0–6)	0
Rowing	<5	20 (20)	0
Sailing	<5	0 (0)	0
Skiing	<5	0 (0)	0
Soccer	75	15 (0–79)	17
Softball	6	3 (0–8)	2
Swim	23	11 (0–48)	2
Tennis	12	6 (0–17)	0
Track	17	5 (0–20)	0
Volleyball	16	16 (7–44)	3
Total	**530**	**12**	**80**

NOTE: Many cases were on several sports teams, accounting for the total being greater than the total case number.

DISCUSSION

Several outside factors contributed to fluctuations in sports-related cases. Cases appeared to peak while community transmission was higher in Rhode Island. There were no sports cases during the two-week pause on activities that occurred in late 2020.[7] In January 2021, school districts initiated asymptomatic screening, which may account for case increases at that time. More high school sports were allowed to begin in January than had occurred in the Fall. High school sports were regulated by the Rhode Island Interscholastic League (RIIL), who worked closely with RIDOH and other state agencies to create school sports guidelines. Non-school sports followed less restrictive general state recommendations, which may account for more cases associated with non-school sports than school sports.

More cases occurred in high school athletes than elementary and middle school, possibly because high school sports involvement may require more rigorous dedication. Missing practices or games could impact the opportunity to play in college, which may incentivize students to continue to play while symptomatic. High school athletes were also involved in tournaments, travel teams, multiple sports teams, and more social activities than younger athletes. Numerous cases attended practices or games while symptomatic, sometimes for several days after symptom onset. This highlights the importance of requiring symptom screenings before games and practices to prevent spread, with no penalty for symptomatic athletes who miss activities.

Several sports had the greatest impact on public health efforts. Hockey had the largest number of sport-related cases and the greatest numbers of contacts who tested positive after exposure. Transmission to an opposing team was seen in basketball and hockey, suggesting that there is a higher transmission risk in high-contact, indoor sports.[5]

Of the 6,293 total contacts, the majority (70%) were from moderate-risk level sports, which include sports such as hockey, soccer and lacrosse.[8] With strict quarantine procedures in place, teams may be quarantined more than once throughout the season, which can disrupt student learning but minimize likelihood of transmissions. There is currently no approved vaccine for younger student athletes, and therefore quarantine measures are the best method for reducing transmission. Vaccination of student athletes who are eligible should be encouraged, to allow athletes to participate in athletics while minimizing the risk of COVID-19 spread.[8] It is important for households and other non-athletic contacts of student athletes to understand this risk. Participating in sports increases the risk of contracting COVID-19 and transmitting it to teammates, school contacts, and household members.

Student athletes who participate in high- and moderate-contact sports where mitigation strategies like physical distancing are challenging should expect to be impacted by changes in COVID-19 prevalence.[8] Clusters among student athletes should be anticipated. Sports teams should work closely with public health agencies to implement mitigation measures and testing when there is apparent transmission. Sports-related cases account for 7% of overall K–12 cases but have a higher number of close contacts per case and more challenges with contact tracing compared to non-sports related K–12 cases. In the absence of widespread student vaccination, strict symptom screening and quarantine guidelines will allow athletes to benefit from sports while reducing the risk of COVID-19 infection.

LIMITATIONS

Sport participation may be undercounted, as it was self-reported by the case. Contact tracing was not possible for several cases, which may underestimate the number of contacts and contacts who tested positive. We could not confirm that contacts who tested positive had only sports-related transmission, as many also had social or school exposures. More analyses are needed to quantify the risk of spread in sports versus social gatherings. Although quarantine policies have changed throughout the analytic period, the average number of contacts per case has been consistent over time.

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Rhode Island Monthly Vital Statistics Report
Provisional Occurrence Data from the Division of Vital Records

VITAL EVENTS	REPORTING PERIOD		
	DECEMBER 2020	12 MONTHS ENDING WITH DECEMBER 2020	
	Number	Number	Rates
Live Births	813	11,029	10.4*
Deaths	1,379	12,148	11.5*
Infant Deaths	5	54	4.9#
Neonatal Deaths	4	38	3.4#
Marriages	285	4,739	4.5*
Divorces	177	2,022	1.9*

* Rates per 1,000 estimated population
# Rates per 1,000 live births

Underlying Cause of Death Category	REPORTING PERIOD			
	JUNE 2020	12 MONTHS ENDING WITH JUNE 2020		
	Number (a)	Number (a)	Rates (b)	YPLL (c)
Diseases of the Heart	194	2,422	228.6	3,619.5
Malignant Neoplasms	178	2,231	210.6	4,714.5
Cerebrovascular Disease	40	450	42.5	592.5
Injuries (Accident/Suicide/Homicide)	78	897	84.7	12,337.5
COPD	28	482	45.5	550.0

(a) Cause of death statistics were derived from the underlying cause of death reported by physicians on death certificates.
(b) Rates per 100,000 estimated population of 1,059,361 for 2019 (www.census.gov)
(c) Years of Potential Life Lost (YPLL).

NOTE: Totals represent vital events, which occurred in Rhode Island for the reporting periods listed above.
Monthly provisional totals should be analyzed with caution because the numbers may be small and subject to seasonal variation.

Healthcare and behavioral health professionals may refer patients ages 13-17 who smoke, vape nicotine, or use other tobacco products.

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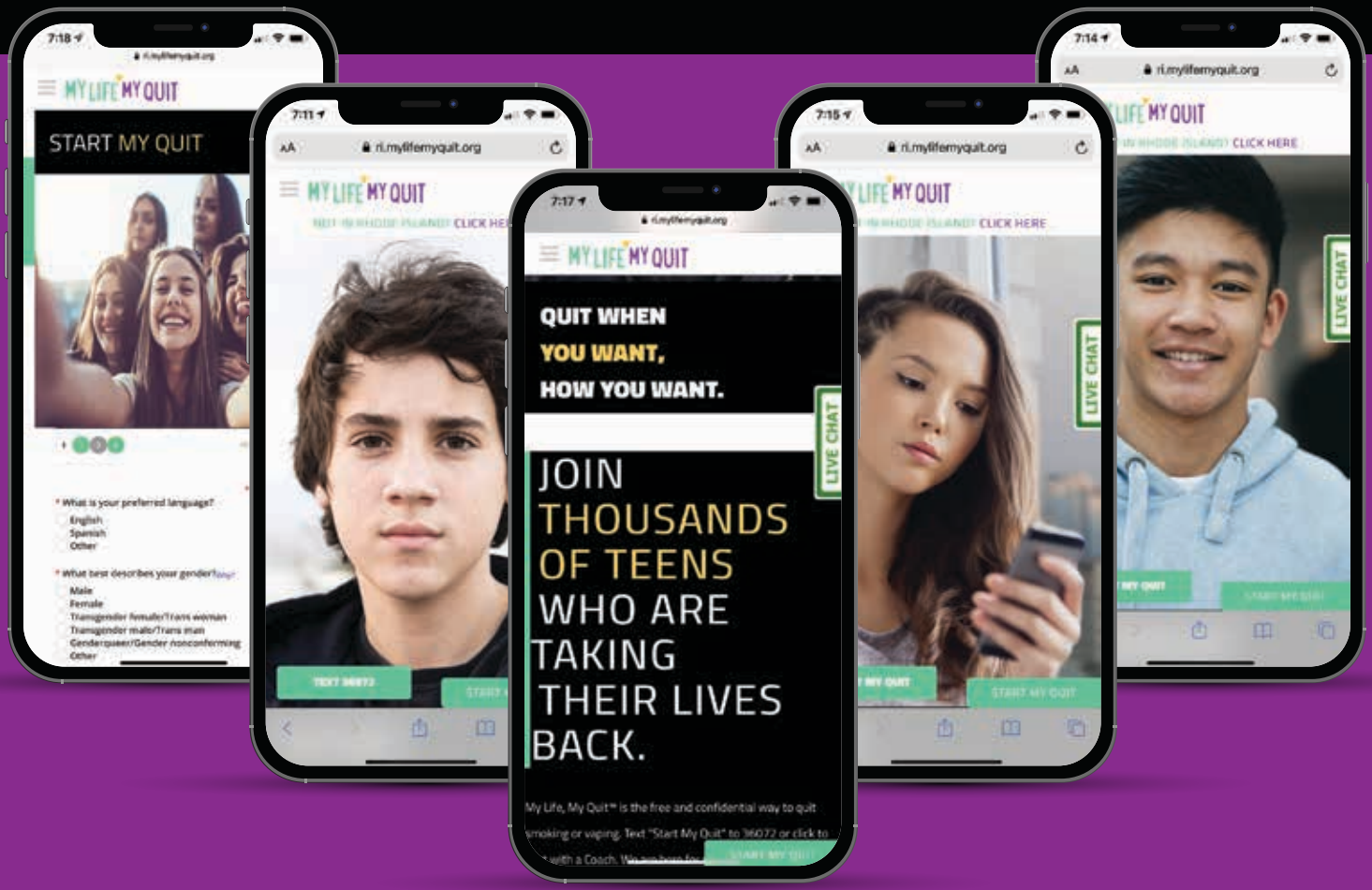

To refer teen patients for free tobacco cessation services, visit **mylifemyquit.com** and select "resources for healthcare professionals".

Teens may also text "**START MY QUIT**" to **36072.**

My Life My Quit promotional images and cessation services are provided by National Jewish Health, with support from the Rhode Island Department of Health.

RHODE ISLAND DEPARTMENT OF HEALTH

Reflections on the 2020–2021 IM residency interview season

DOMINICK TAMMARO, MD, MACP

The 2020–2021 Academic Year was unprecedented in experience for students, residents and fellows in all disciplines. In accordance with Association of American Medical Colleges (AAMC) guidelines, medical student clinical experiences were interrupted, with core clerkships truncated, converted to virtual experiences, or otherwise altered. Senior students found less opportunity for Acting Internships with which to practice the skills they would need as interns. Many senior students took the initiative to graduate early and become "pre-terns", working in the Alternate Hospital site at the Convention Center and on the wards at our hospitals, helping expand the clinical workforce in a manner that had substantial positive impact. In this way, many students restored their clinical experiences and, in our experience at Brown, all came to their internships prepared, eager to move on and fulfilled by their work.

Against that backdrop, the 2020–2021 interview season was unique and occurred after almost a year's experience with virtual meetings. Below, I share some of my observations:

- Residency applicants were able to apply to more programs and were able to interview at these programs without the need to spend money on travel and accommodations and without creating big gaps in their senior-year academic schedules. In this way, the residency interview process has leveled the playing field among students, independent of financial status or location. Programs and applicants were just a click away.
- With such ease of application, students applied to a record number of programs per applicant. This fact, coupled with the compressed interview season schedule, made it challenging to review all applications in a holistic manner.
- Residency programs found the virtual interview day more efficient to manage and organize.
- Cost savings realized by the absence of in-person lunches, dinners, and open houses, were redirected to online videos to present resident perspectives, program descriptions and virtual tours.
- In our program, we typically conduct one faculty interview per in-person applicant. Using a virtual interview, we were able to conduct two faculty interviews per applicant and include faculty from our partner institutions who previously were only infrequently able to participate in this important process.

The virtual season posed some challenges as well as opportunities.

- Some applicants reported that they were unable to assess the "culture" of a program virtually. Recorded sessions and panel discussions displaced the informality and spontaneity of time spent with residents in an unprogrammed manner. The nature of virtual meeting platforms required organization and structure to allow individuals to be heard without interruption or cacophony.
- Virtual interviews and program reviews do not substitute for exploring a new city – getting a feel for the cultural and recreational offerings by a stroll downtown between the interview day and the open house social with the residents. With the program presentations and interviews, some applicants did not feel that the cost of an in-person visit solely to take the pulse of the city was worth the expense or time out of their rotations.

There is no consensus among Graduate Medical Education leaders as to whether virtual residency interviews are here to stay. The Coalition for Physician Accountability, a task force created to explore the transition between Undergraduate and Graduate Medical Education, released proposals for public comment, which included the recommendation that residency interviews for the coming 2021–2022 interview season remain virtual. Many of us are flexing creative muscle in order to design hybrid systems which attempt to capture the best of both options. Of course, as of this writing, neither residency programs nor their matched applicants have fully experienced the outcome of the Virtual Match – that will have to wait until July 1 and beyond. I am optimistic that, once residency leadership and their new interns meet each other in person for the first time this summer (that sounds strange!), together we will be able to learn from this past year and develop a suitable Version 2.0 for the coming 2021–2022 Academic Year.

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Match reflections: looking back, looking ahead

The power of shared, collective experiences in residency

JENNIFER JEREMIAH, MD

Residency is HARD. Internship is particularly HARD for more reasons than I can write here. In a single year, an intern is transformed from a recently graduated medical student, likely with a sense of imposter syndrome, to a capable doctor caring for complex patients and who will soon lead other recently graduated medical students. This transformation requires tremendous mental and physical toughness, commitment and drive. But, I believe, it also requires the support, comradery, and shared experiences of their colleagues.

I vividly remember my internship. It was HARD, but when I think back many years to moments that year, I still smile. I remember being paired with PM for multiple months. Each morning, after a long call night, he would sing to me, inspiring me to start another day on the wards no matter how tired I was. I recall one of my residents, PB, who upon waking me after a middle-of-the-night nap, would say, "I have a new friend for you," reminding me of the privilege I had to learn from a new patient. I think of the conversations I had with LC, about how we'd help each other when we were old and gray. If it wasn't for the support of my residency family, I don't know how I would have made it through that year and be able to reflect so fondly on the experience.

When I think of this year's Match, I worry that future interns didn't get the opportunity to experience what it would be like to be a part of our residency family. I wonder: Did they sense the culture of the place they will call home for the next three years, will they be happy, will the program be the right fit for them, will they find the people who will help them not just finish, but flourish?

I understand more so than ever how important this is. Because of the isolation of COVID-19, my own intern advisees have mourned the loss of the connectedness they sought and expected. They hope the future holds opportunities to get to know their colleagues – the people they expected to bond with, to help them thrive and share the uniqueness of being an intern. They chose to join our program for many reasons, but many of them said it's the people who solidified their choice.

You may believe that it's not that important to visit a program since you're not meeting your future colleagues on the interview day. I firmly believe every place has its own culture and uniqueness. Medical students are looking for a place that will meet their individual educational needs and an environment where they will thrive. Program leadership can attend to educational needs but thriving is dependent on relationships with colleagues and becoming part of a residency family. Applicants choose programs where they feel they will belong. Our residents at Brown are true friends and colleagues. They stand up for each other, support each other, learn from each other, and become excellent physicians together, not trying to outshine each other. I believe prospective applicants choose us because they sense this. The culture continues year after year by attracting applicants looking for the same things.

Certainly, leveling the playing field is important. No one traveled this year. A lot of money was saved. This is particularly important for those with fewer financial resources. There are, however, other ways of leveling the playing field. Interventions like limiting the number of programs an individual can apply to and supporting travel scholarships could also work towards enhancing equity while helping applicants find the right home for the next three years. Another option would be to plan visits for after-interview days. The visit could be purely for the applicant to get a feeling for the culture of the program without having any bearing on the application process. Applicants would only visit those programs they are highly considering and would have the opportunity to interact with their future residency family.

I know, through technology, we did our best to put our best foot forward, to show who we are and highlight the "personality" and culture of our residency program. I just hope that was enough to provide prospective interns the sense of whether the place they chose is the place where they will thrive and find their residency family. ❖

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Assessing the ophthalmology match through a 'virtual lens'

MICHAEL E. MIGLIORI, MD, FACS

The COVID-19 pandemic was not the only thing that affected the 2020–2021 ophthalmology match at Brown/Rhode Island Hospital. Before 2020, applicants for an ophthalmology residency had to participate in two separate matches. Ophthalmology residency extends three years, beginning in the PGY-2 year, and the ophthalmology residency match is managed by the San Francisco Residency and Fellowship Matching Services (SFMatch). The PGY-1 year is in an accredited, direct patient care facility, and is conducted through the National Residency Matching Program (NRMP). The ophthalmology match is timed to allow applicants to know the results before submitting their rank list for their PGY-1 choices to the NRMP.

Recently, the Accreditation Council for Graduate Medical Education (ACGME) mandated that ophthalmology programs incorporate the PGY-1 year into the ophthalmology residency no later than the 2023 match cycle. Brown/Rhode Island Hospital's ophthalmology residency program integrated the PGY-1 year starting with the 2021 match cycle. Because of programmatic limitations, the applicants will still have to apply through SFMatch for ophthalmology and the NRMP for the PGY-1 year, but the NRMP match should be a pro forma exercise. The PGY-1 year will include three months of ophthalmology and at least six months of general medicine.

Ophthalmology is one of the most competitive residencies to obtain. The mean number of applications submitted per applicant has steadily increased from 48 in 2008, to 68 in 2017. In past years, we would start receiving applications in early August and accept them through the end of September. The interview season ran from mid-October through mid-December, and the match list was due the first week in January. We typically receive about 450 applications and interview 40 applicants for three positions over two consecutive full days.

Shift to virtual interviews

This year everything was pushed back a month because SFMatch had to create the virtual interview system. They imposed some significant restrictions this year. All interviews had to be scheduled through SFMatch. Programs submitted schedules for the number of applicants they would interview and the days they would hold interviews. There was no limit on how many interviews the programs could hold, but applicants were limited to no more than 20 interviews. It had been previously determined that the likelihood of matching did not increase if a US graduate ranked more than 13 programs, and this was one way to make sure that there were available spots for all applicants.

SFMatch offered an integrated video interview system through their website, which worked well and allowed the interviewers to have access to the entire application and allowed the use of private rooms for individual interviews and public rooms for interaction with the current residents and other applicants. Programs could use other virtual platforms if they wished, but scheduling had to be through SFMatch.

Video showcase of RI program, facilities

Applicants could not see the facilities in person, so we created a Vimeo video showcase, which included a video from the Program Director describing the program, and a video from the Internal Medicine Residency Program Director to describe the PGY-1 year. We posted several one- to two-minute videos by individual residents describing what they liked about the program and about living in Rhode Island, We also posted virtual tours of our Rhode Island Hospital and VA clinics hosted by a resident. Access credentials were sent in advance to all applicants scheduled for an interview. We asked them to review the videos before the interview to maximize the amount of time for direct interaction with the applicants on interview day.

Not knowing what to expect, we interviewed 60 applicants instead of our usual 40, and shifted the process of interviewing 10 applicants in the morning and 10 in the afternoon over two consecutive full days to six half-day sessions of 10 applicants over one week. We scheduled interviews on one full day, and on four half-day sessions, including a Saturday morning. During each half-day session, the 10 applicants had six 20-minute interviews each with one or two faculty members and two hours in an open forum with residents without faculty present. After the interviews were completed, we created our match list based on committee scoring.

Several applicants complimented us on the process, including making the videos available beforehand. They also felt that they had enough interaction with the residents to get a true sense of training here. Our faculty felt that they were able to assess the applicants about as well as they could in a live interview. We matched well at about our usual rank positions. Nationally,

there were 499 positions offered in 2021, up from 496 in 2020. Only one position in each year went unfilled. For comparative purposes:

- 547 US allopathic seniors participated and 435 matched this year (80%) compared to 498 participating and 428 matching in 2020 (86%).
- 29 of the 46 US allopathic graduates (at least 1 year out of school) matched this year (63%) compared to 18 of 35 (51%) last year.
- 53% of the 38 osteopathic seniors participating matched in 2021, while 55% of the 29 matched in 2020.
- 40 international applicants participated this year and 14 matched. In 2020, 61 international applicants participated and 29 matched.

Takeaways

There were more US applicants this year than last, and fewer international applicants. Even though the percentage of US seniors matching is a little lower, the absolute number of positions matched by US seniors has remained fairly constant over the past few years.

The process was very different this year, but our faculty did not think it was significantly more difficult to assess applicants. The applicants felt they had a good sense of the culture in this program. Although they were not able to personally view the facilities, they felt that the videos were sufficient. The biggest advantage to virtual interviews for the applicants is they did not have to travel. This not only saved them money on airfare and hotels (particularly an advantage to students of modest means), but they could also interview in California in the morning and Rhode Island in the afternoon. By limiting the number of interviews the applicants could accept, applicants had to prioritize the programs they were seriously considering and so most applicants were genuinely interested in the program.

SFMatch recently announced that the 2022 Match interviews will be virtual. It has limited the number of interviews an applicant may accept to 18, and this year, the deadline for programs to submit their rank lists is two weeks before the applicants must submit their lists. During those two weeks programs have the option of holding open houses for interviewed applicants, with the goal to give applicants a chance to see the programs in person before submitting their rank list, while making it entirely optional, as programs will have already submitted their rank lists before hosting these events. The general sentiment among programs and applicants is that virtual interviews worked well, were less expensive and time consuming, and made more programs available to more applicants. It remains to be seen if our virtual assessments of the candidates was accurate, but virtual interviews may be here to stay. ❖

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As medical school comes to a close

AMELIA B. WARSHAW, MD'21

"THE DAYS FEEL LIKE WEEKS BUT THE WEEKS feel like days," an older classmate told me during medical school orientation, reciting the familiar adage. While past years' graduating medical students must have felt a similar out-of-body experience as they prepared to matriculate to various residencies and research programs, I can't help but feel that there must be a unique sense of compression for those of us who spent our fourth year in the thick of the COVID pandemic.

Between truncated clerkships and modified electives, time spent volunteering on COVID phone hotlines or at testing sites, and the isolating experience of lockdown, looking back on this year evokes an even greater feeling of condensed time – and space – than anticipated. It is a certainty of life that a recollection is an abridged version of events. I can remember my first cut in anatomy, the first code I attended, and the first delivery I rushed to on my NICU overnight, but I know that in conjuring these memories I have abbreviated them, intensified them, creating a snapshot of what was, in reality, more like a film reel.

But what is entirely surreal about this past year is that the everyday experiencing of things somehow felt curtailed and artificial. I saw hospital facades and facilities as pixels and viewed my future co-residents as tiny squares on a computer screen during interview days and post-interview social hours. Everything that I expected to experience in vivid color was reduced to a two-dimensional version, viewed from the same nondescript white desk chair, in the same room, in the same suit. From within the same four walls I was expected to determine my "fit" in a community that I could not fully engage with.

Of course, the Match process can be disorienting and artificial in one sense. Programs often cater to an audience of elite medical students, who themselves are groomed to present a certain image of competence and confidence. The stereotypes of specialties and programs and cities may influence which programs students apply to and how they create their rank order list.

Certainly there have been advantages to this unprecedented application cycle: students who would not be able to travel to certain programs (either due to logistics or the often egregious financial burden imposed by the Match process) were able to entertain the possibility of matching on their opposite coast or in cities like Seattle, New York, Los Angeles, Chicago, and San Francisco, where they would have faced the choice of shelling out hundreds of dollars for a hotel room or sleeping on a friend's sofa to attend an interview day.

I hope that in the future the medical community can incorporate the benefits of virtual interviewing with the obvious advantages of in-person interviews, and that the significant financial burden of applying to dozens of schools will be offset by more virtual information sessions and digital interviews, with options to travel for in-person meet-ups, physical tours, and welcome weekends.

The objective seems to be balancing the importance of finding that intangible "fit" in a community while combating the embedded bias of the academic medical system, which continues to select a racially and socio-economically similar group of residents every year. Appreciating that while there may be a "je ne sais quoi" or specific "culture" of a program, there are also tangible indications of a program's and applicant's shared values, whatever those may be. How can programs demonstrate their allocation of resources to resident wellness and support, or their relationship with the local community? There must be ways to do this in person and virtually.

From my own vantage point, it seems that this year has brought more guesswork into what starting residency will be like. I can only hope it's a bit like Dorothy's experience going from Kansas to Oz: I've seen the programs on paper and in greyscale (and on ZOOM) and hope they will actualize in technicolor as everything I have hoped for. "You were there, and you, and you," I'll say to my co-residents who I met on ZOOM calls and virtual happy hours, to the program coordinator who might as well be AI software for all I know, and the department chair who seemed friendly enough

when I watched the recorded welcome video the night before my interview as I applied zit cream and ironed my suit.

While I understand that residency programs will always be a bit like the Wizard – presenting themselves as omniscient benefactors who can ensure our futures as successful physicians, rather than fallible humans working within a limited system with ingrained biases and flaws – this year it feels like there are even more barriers up between the graduating students and the programs we will be joining come July; for instance, I have never stepped foot in the hospital I will be spending 80 hours each week in for the next three years.

As I unpacked my cap and gown from a cardboard shipping box casually dropped at my doorstep, I thought about what I had expected graduating medical school to look and feel like. What has been most strange about this year has been the lack of ceremony that has accompanied major milestones. There was no Match Day gathering at our medical school and my parents will be watching me take the Physician's Oath via ZOOM. I won't get to shake my Deans' hands when they hand me my diploma, or take pictures with my friends in the medical school. Many of my classmates have forgone the idea of an in-person graduation to go home early and spend more time with family before starting their respective residencies. The gratitude I feel to have Matched at my dream program and to pursue my vocation is tinged with sadness and a sense of loss. A moment that I expected to feel so monumental already feels a bit compressed. Perhaps that is a product of graduating during the pandemic, or maybe it's just the reality of something intense and all-consuming coming to a close. ❖

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Bedside learning in the time of Corona

Voices of student, fellow and faculty

GIORGINA GIAMPAOLO, MD'23; LEWENA MAHER, MD; KATARZYNA GILEK-SEIBERT, MD

INTRODUCTION

Katarzyna Gilek-Seibert, MD, Fellowship Director: As the COVID pandemic unfolded in early 2020, challenges for physicians as well as educators became a novel, taxing reality. There was an early, clear indication that we had to transition busy outpatient ambulatory clinics with (suddenly dangerous) waiting rooms hosting multitude of patients, translators and visitors, to telemedicine visits.

We also had to adjust our clinical and bedside teaching, didactics and conferences. It was simpler to transition to ZOOM conferences than to patient-care visits, the latter more complex, in order to provide safe and effective telehealth. After figuring out the technical logistics, in an accelerated and often-stressful manner, (apparently two decades of clinical hands-on experience is handy for faculty), but how about for clinicians in training? I worried about how this change was going to affect residents, fellows and medical students. In addition, it was ethically imperative that we quickly return all the levels of learners back to clinics, because diseases and patients do not wait for us to catch up with pandemic-related challenges.

Dr. Lewena Maher, Fellow: As a new fellow entering rheumatology, there is an endless list of things to learn and digest. New labs, medications, and a new view of the physical examination are what most fellows expect. However, given the COVID pandemic and our need to keep numbers in clinics small to reduce virus spread, we have had fewer in-person patient interactions, which has made things challenging, but interesting. It has necessitated ingenuity in terms of learning opportunities, needing to find different ways of conducting patient encounters and getting a little more creative with the way that histories are taken to make a diagnosis via telephone. In the same way that, as a new fellow trying to soak up as much information as possible in this new field, we have medical students who are trying to learn the basics in a technology-driven world, often without patients. Educating in this alternate reality has become part of our clinic life. Videos and photos are used in lieu of real patients and history taking via telephone using the speaker function.

Video call applications have been a saving grace in some instances. Recently, we had a patient scheduled for telephone follow-up but who described a persistent rash on a known background of granulomatosis with polyangiitis (a type of vascular inflammation). Given the resource of the video we were able to quickly change modality so that I was able to see her complaint in real time. It was easy to bring the video chat to my attending, who was also able to see and corroborate my findings. The addition of video conferencing in telemedicine is of unmistakable importance. This patient had a long history of difficulty getting to our clinic and management via telehealth bridged the care gap in someone with a serious rheumatic illness.

As a student, seeing diseases manifested in a patient helped me to solidify my grasp on what I was learning; for our student, each patient coming in needs to be seized as a learning opportunity. When you teach you learn twice, and having a medical student has been a wonderful addition to our clinic, and my learning experiences, during this unique time.

Giorgina Giampaolo, MD'23: When the pandemic shut down began, my medical school class was learning the musculoskeletal block, including upper- and lower-body extremity anatomy, rheumatologic and orthopedic disorders, and the musculoskeletal physical exam. The online transition pushed back our physical exam experience until our second year. When I began my community-mentor learning at an outpatient rheumatology clinic this year, I worried about my lack of experience with the exam, a major part of their practice. Partnering with a fellow at the clinic, with an attending, provided the opportunities to practice the exam. The fellow oversaw fewer patients than the attending, and she kindly devoted time to reviewing patients' diagnoses and helped me improve my physical exam skills. When a patient arrived, I was able to enter the room first, obtain a history, and perform a physical exam. I would step out and present to the fellow, who would then go into the room with me and ask more questions, complete additional exam skills, and discuss the plan for moving forward. The fellow and I together presented to the attending and reviewed the plan and potential changes or factors we had not considered. Working with two different physician levels provided valuable glimpses of the transitions from classroom student to clinical student to resident to fellow to attending. As a student, I deeply appreciated the fellow and experienced attending who so willingly shared their expertise with me, allowing me to expand skills and envision my future professional life in a clinical setting.

CONCLUSION

Dr. Gilek-Seibert: The pandemic-driven initiative of change-of-teaching platform and design required a lot of brainstorming and collaboration, with a keen eye on innovation, to adjust to a new delivery system of medical learning. The medical behemoth is generally very structured and antiquated and innovations in teaching, while welcomed, are perhaps easier to deploy on an individual-program level, whereas more testing on a broad national (systemic) or international level is needed as well. In our BU-affiliated Roger Williams Medical Center (RWMC) and the Brown University program, we created a hybrid model of the teaching service with patients being seen in person as well as triaged by fellows to be seen either on the phone or video platform. There was a learning curve on the part of the fellow, to do it well, and have some imagination about phone or video clinical examination skills. It was also very important to understand and give fellows supervised autonomy on a doubt encounter that such patient should be/and will be brought in for face-to-face examination (F2FE) and that it would be accommodated fast.

When I became a rheumatology fellowship program director, it became very clear to me, compared to my work as associate internal medicine program director, that residents and fellows are two different learners. Fellows are more mature students and ready to deploy teaching skills, meticulously acquired during their years of education. Time to give back? Rheumatology fellow-as-a-teacher concept has been studied, with multiple articles reflecting that.[1,2] A few years ago I conducted an internal comparison study between a quality of lectures delivered to students by fellows versus faculty from various specialties. Our small internal investigation showed that lectures delivered by fellows were equal in quality to those of faculty as observed by medical students, based on a survey.

Since then I have been incorporating the fellow-as-a-teacher initiative within the structure of our program and fellows are currently responsible to deliver didactics to medical residents and students. When the pandemic hit, I was assigned to the mentorship of Brown's Gina Giampaolo. Trying to teach her the skills like the pandemic was not around and at the same time register with every single encounter that we cannot completely forget about it: just look at us! [**Images 1, 2**]. I also sent Gina home each week with a mini-assignment: write a History of Present Illness (HPI) for my review in the e-mail. Next time - please write physical exam as attachment to the e-mail, then record video of HPI presentation and send for review. Gina took it all like a champ with the last task to record the video of her interview with model patient – that was a testimony of her dedication to her own learning and open-mindedness augmented by technology know-how.

I also realized that rheumatology-care interactions could be supplemented for Gina by the fellow-as-a-teacher concept.

Image 1. Giorgina Giampaolo and Dr. Katarzyna Gilek-Seibert in the ambulatory clinic at the Roger Williams Medical Center in Providence.

Image 2. Dr. Lewena Maher in the MSUS class at the Providence VAMC, and Dr. Anthony Reginato.

I assigned her to a fellow who had demonstrated not only skills in teaching, possessed a teacher "personality", but also expressed an interest in that subject. With that in mind, connecting Gina with Lewena was very intuitive and worked wonderful, as you see in the paragraphs listed above. This had mutual interest for both: continued inclination of becoming a better doctor, being innovative and persistent and learning skills with the goal to advance to the next stage of either learning or practice.

The model of our singular experience in this three-tier educator model: from faculty via fellow to student, may possibly be safely deployed in a multitude of clinical settings,

while the faculty time may be split between telemedicine and face-to-face appointments. Such distribution of learning may be beneficial for both fellow and for student and support feedback from diversified sources interacting with the patient as a learner/teacher unit. From these experiences, I think we gathered some answers on how to continue in this learning model now and for the future, with the aim of fostering the next generation of efficient, skilled and effective physicians.

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The Rights of Older Adolescents to Consent to Vaccination in Rhode Island

MATTHEW LORENZ, MD

The Rhode Island Department of Health's (RIDOH) vaccination campaign against COVID-19, recently expanded to adolescents, highlights the important issue of minor consent. RI General Law 23-4.6-1 describes minor consent in our state: "Any person of the age of 16 or over or married may consent to routine, emergency, medical or surgical care."[1] Clinicians should be familiar with this law, and should know that it underwent a subtle but important update in July 2018.

Specifically, the law previously used essentially the same wording but differed in punctuation: "Any person age of 16 or over or married may consent to routine emergency medical or surgical care."[1] The lack of commas in this statement served as a potential source of confusion for clinicians, who may have interpreted the law to mean that older adolescents could only consent to emergency care. The added punctuation in the 2018 update clearly defines the right of older adolescents to give informed consent for routine care and emergency care as separate entities.

Following the Food and Drug Administration's recent authorization of the Pfizer-BioNTech COVID-19 vaccine for emergency use in adolescents who are 16 years of age or older, RIDOH began citing RI General Law 23-4.6-1 in justifying that older adolescents may self-consent to vaccination.[2] Given that the law does not explicitly mention vaccination, RIDOH's reasoning effectively argues that vaccination falls within the purview of routine medical care. This approach has facilitated the establishment of high school vaccination clinics across RI, extending the state's reach in vaccinating more individuals against COVID-19.

Beyond COVID-19, the updated law has implications for other routine vaccinations in adolescents. Vaccination coverage rates for adolescents in RI generally exceed national averages (**Table 1**) – a testament, at least in part, to RI being a "universal purchase" state (i.e., childhood vaccines are free on account of state funding), but rates for the human papillomavirus (HPV) vaccine remain below the national target of 80%.[3] Multiple factors contribute to disparities in HPV vaccination rates, including parental hesitation and resistance to vaccination. Additionally, older adolescents are more likely to present on their own for routine medical care. As such, recognizing the ability of older adolescents to self-consent may be a meaningful step towards improving HPV vaccination rates across RI.

Table 1. 2019 vaccination coverage rates among adolescents aged 13–17 years.[3]

Vaccination coverage rate	United States	Rhode Island
Hepatitis B virus (≥3 doses)	91.6%	97%
Human papillomavirus (HPV; up-to-date status)	54.2%	78.9%
Measles, mumps, and rubella (MMR; ≥2 doses)	91.9%	96.1%
Meningococcal conjugate (MenACWY; ≥1 dose)	88.9%	98.2%
Tetanus, diphtheria, and pertussis (Tdap; ≥1 dose)	90.2%	96.4%
Varicella (≥2 doses or history of disease)	91.5%	95.9%

Multiple medical societies support the ability of mature minors to consent to vaccination, including the American Medical Association and the Society for Adolescent Health and Medicine.[4,5] Nevertheless, parental involvement in vaccination decisions remains important in this population, particularly in light of adolescents' evolving developmental maturation. Indeed, adolescent decision-making depends on multiple factors, including cognitive ability and judgment. It is essential that clinicians consider these factors when providing care for older adolescents.

Vaccination is one of many clinical interventions that falls within the scope of routine care, for which RI General Law 23-4.6-1 allows older adolescents to self-consent. Understanding the implications of minor consent law is essential for clinicians to provide optimal care to this unique population.

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Tu Fu, Uncle Jack, and Doctoring Epidemics

JOHN McGONIGLE, MD

In the Unicorn Gallery of this age
what person is first in merit?
— Tu Fu, circa 755 C.E.

There are those who survived, and those who've seen
a black spreading lesion go way too far.
Jack burned those things off in Dermatology,
and the last ones he forgot were those who died.
Death took him far away, beyond good-byes,
and the kids got to live what he was living through.
The doctor died demented; Uncle Jack: surrounded,
his familiar overrun, underground.
Uncle Jack stared straight ahead.
Uncle Jack stared straight ahead.
He raised them dying to the mysteries of grief.

Tu Fu, also exiled, also fled away.
Panic swept everything off that was familiar.
The court was devastated. Tu Fu sulked
and wrote out almost every line he walked.
He dreamt of dragons, trudged through snow uphill;
Tu Fu saw crevasses filled with more than snow.
Still, he dragged the bodies North. Invaders infiltrated,
and they all arrived at a lasting peace,
Tu Fu and his enemies.

He wondered at the skin in epidemics.
The first to show up was the COVID toe.
A guy in South County saw it coming.
He sent a text, picture attached. The doctor made
a doctored image inside out of him –
antigen-antibody complex, its odd expression,
toenail green and purple – unroof the pressure?
Serosanguineous forces lurking dormant – let them go?
A painful freedom. Proud flesh. The barbaric alternative
was to bleed the bloodstream in its course,
hope against hope, and watch lest sepsis
go straight through the heart of the river's source.
Systemic Inflammatory Response Syndrome.
This COVID had a name, and not much else.
Would every organ system just shut right down?
The way was straight ahead. The way was perilous.
He texted back: "Come see me in the morning".

At night he read to her from Tu Fu's version
of the story: seems barbarians are always at the gate.
Civilizations live, die, and live again.
It is the fear of death that was the epidemic.

Author's note

Tu Fu is the great Tang Dynasty Chinese poet, active during the devastating Lushan Rebellion of 755. Jack McGonigle was the poet's uncle, and a local dermatologist for many years; he died in 2011. The poet, a Family Doctor in East Providence, recalls his experience in the early days of 2020 from the vantage point of 2021, and history. This is one of a series of poems written over the course of 2020–2021.

Acknowledgment

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Disclosures

None

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Coronavirus Mutation Tactics: An Illustrative Hypothesis

BENJAMIN C. GILLER; DAVID E. MANDELBAUM, MD, PhD

Mutations of the COVID-19 Virus have resulted in the virus becoming more transmissible, but not more virulent. The mechanism of this change appears to be due to changes in the Spike Protein.[1,2] We offer a hypothesis for this selective change in the virus in **Figure 1**.

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Figure 1. Coronavirus mutation tactics

Virtual Surgical Observation (VSO) at South County Hospital expands during pandemic

Robert Marchand, MD, livestreams on robotic surgery techniques to worldwide participants

MARY KORR
RIMJ MANAGING EDITOR

WAKEFIELD – Spurred by the COVID-19 pandemic, Virtual Surgical Observations (VSOs) have accelerated. South County Hospital's **ROBERT MARCHAND, MD**, an orthopedic surgeon with Ortho Rhode Island, has livestreamed about 140 VSOs in the past year on the use of robotic arm-assisted surgeries for knee and hip procedures.

Although he has been doing VSOs since 2015, "previously, surgeons new to robotic technology usually would fly in to learn and observe for two or three days," he said. When the pandemic first hit, and operating rooms shut down for a time, "surgeons took the downtime opportunity to learn something new and virtual blossomed."

Dr. Marchand shares his expertise operating with the Stryker technology company's Mako SmartRobotics™, one of three telesurgery systems at South County Hospital. Stryker sets up the VSOs through its medical education training program, which has also grown exponentially during the pandemic, according to the company website.

"At first I worried about the sound going off, but so far it has gone smoothly," Dr. Marchand said. "The challenges in VSOs are more logistical – keeping the workflow coordinated, efficient and on time – while doing VSOs with surgeons in different time zones."

While many surgeons around the world are English-speaking, he recently welcomed two orthopedic surgeons from Madrid, Spain, who observed a Mako total hip full anterior approach replacement on a patient. During the hour-long procedure they watched as he guided the Mako's robotic arm within the predefined area, following the patient's personalized preoperative plan based on a CT scan and 3D model. An interpreter in Madrid translated and relayed the Spanish surgeons' questions during the procedure.

A Virtual Surgical Observation (VSO) livestreamed on May 25th of a full anterior hip replacement at South County Hospital. Observers viewed, at left, a 3D model of the patient's pre-operative plan. At right, **Dr. Robert Marchand** guides the Mako robotic arm. [SCREEN CAPTURE BY MARY KORR]

Dr. Marchand explained the benefits of the robotic technology and his step-by-step process, as he guided the robotic arm to remove diseased bone and cartilage and replace it with an implant. He highlighted the pinpoint accuracy, precision sculpting and customized fit and alignment robotics-assisted surgeries provide. "I always thought I was good," he told his Spanish counterparts somewhat humorously, "but I can't match the precision of using this technology."

At a nationwide VSO held May 25, RIMJ watched as Dr. Marchand introduced the patient's virtual model developed through the initial CT scan. Throughout the live hour-long anterior hip replacement procedure, he checked the level of accuracy, confirming it to the 3D model.

He described how to place the pins and pelvic array, collect patient landmarks and register and verify checkpoints and demonstrated the intraoperative changes possible to adjust hip length and offset goals.

A moderator relayed questions from the Chat room and targeted questions to specifics, such as what would happen if the array moves. The VSO provided remarkable close-up views of the entire procedure, and the insertion of the robotic arm guided by Dr. Marchand.

In addition to surgeons, the worldwide virtual audiences include hospital and healthcare administrators, PAs, nurses and other healthcare workers. Attendees have come from China, Thailand, Japan, Singapore, India, Australia, Turkey, Brazil, Argentina, Norway, Austria, Ukraine, Austria, Germany, France, Romania, Italy, the United Kingdom, Sweden, and Canada.

As the pandemic ebbs, Dr. Marchand, who serves as an adviser/consultant to Stryker, expects VSOs as an educational tool will continue, especially as the technology, software and applications evolve, and more hospital systems purchase or lease the systems. Recently, a California surgeon training in the technology attended a South County Hospital VSO, and then flew to Hawaii on vacation, where he tuned in for a second one. In hospital systems

COURTESY OF SOUTH COUNTY HEALTH

Orthopedic surgeon **Dr. Robert Marchand** inside one of the seven operating rooms featuring the Mako SmartRobotics™ system at South County Hospital in Wakefield.

affiliated with medical schools, VSO rotations have been implemented, and there are VSO national and international conferences.

When asked how patients respond when they are introduced to the idea of their surgery being livestreamed and recorded, which, of course, they sign consent forms for (none are identifiable during the procedures), Dr. Marchand said, "Most of the patients have been asking me: 'How can I get a video copy?'" ❖

Kent Hospital's Drs. Laura Forman and Jinen Thakkar collect medical donations to send to India

WARWICK – Having spent years doing disaster relief work in war zones, refugee camps, and impoverished areas around the globe, **DR. JINEN THAKKAR**, Hospitalist, and **DR. LAURA FORMAN**, Chief of Emergency Medicine at Kent Hospital, are now determined to do what they can to help their colleagues in India by organizing a cargo flight of critical medical supplies. They have received more than $65,000 in donations and 45,000 N95 masks.

Dr. Jinen Thakkar

Dr. Laura Forman

Early on while working on the front lines of the COVID-19 pandemic, Drs. Thakkar and Forman said they were fortunate hospitals in Rhode Island were rapidly able to obtain supplies. Patients never had to go without oxygen, or a bed. And staff never had to go without gloves and masks.

When Drs. Thakkar and Forman learned of patients in India being treated on the floors with no oxygen, and scarce or no PPE for the health care workers, they knew they had to act by coordinating a mass donation of needed supplies.

"Having worked on the front lines in Rhode Island when we had the highest per capita number of COVID-19 cases in the world (at least among countries that were able to test and report them), we've been struck by the situation facing our colleagues and patients in India. We wanted to do something to help, and have gotten a flight donated," said Dr. Forman.

Drs. Forman and Thakkar are working with the World Health Organization's South-East Asia Regional Office (WHO SEARO), which is coordinating the donation distribution in India. ❖

Medical supplies collected for India await transport at Kent Hospital. [PHOTO COURTESY OF KENT HOSPITAL]

'Poetry and the Doctors'

MARY KORR
RIMJ MANAGING EDITOR

The title of this Heritage piece is borrowed from a compilation of the same title by **CHARLES L. DANA, MD**, and published in 1916 in Vermont. In his introduction to the catalogue of poetical works written by physicians, accompanied by illustrations, (**Figures 1,2,3**) Dr. Dana writes of his avocation: "There are some lines of extra-professional activity which I presume appear especially arid and unresponsive to attack. Probably an interest in the poetry of physicians seems like one of those lines, and yet I do not consider that such is the case. The interest in any pursuit is, after all, mainly in the associations it arouses and not in the object of the search. One does not collect books or spoons or china just to look at them, but for the story that attaches to each possession."

He noted that his pursuit into medical poetic history "throws new lights on some famous characters and reveals unexpected forms of linguistic expression as well as medical activity." Among the illustrious physician poets chronicled includes **OLIVER WENDELL HOLMES, MD**, first recognized in 1829 for his poem, "Old Ironsides," and later on for "A Ballad of the Boston Tea Party."

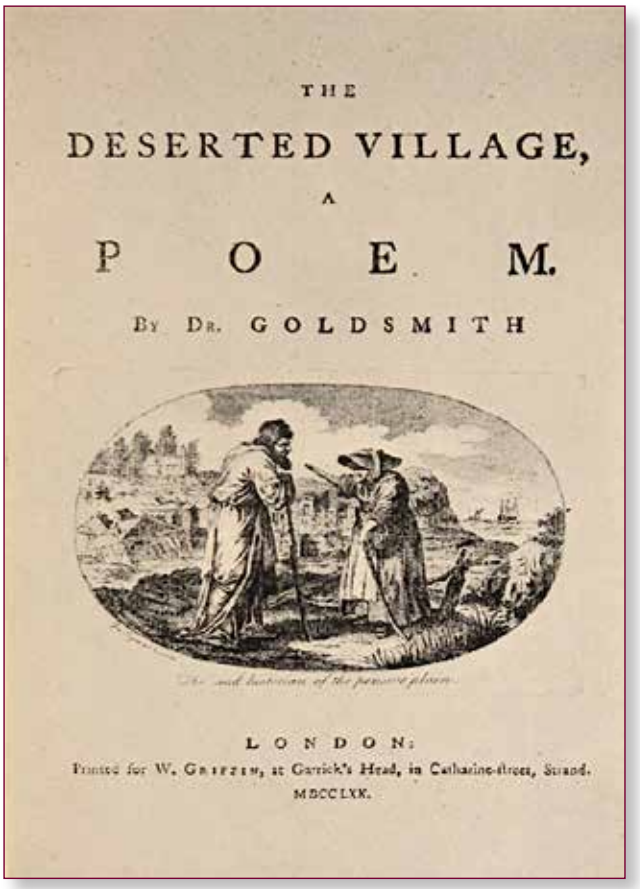

Figure 2. (at right) Dr. Oliver Goldsmith (1728–1774) left this country to study medicine in Edinburgh. "The Deserted Village" is one of seven illustrations by H.W. Bicknell, which appeared in Dr. Goldsmith's compilation of poetry. A monument to Dr. Goldsmith is in Westminster Abbey.

[SOURCE: NATIONAL LIBRARY OF MEDICINE; HTTP://RESOURCE.NLM.NIH.GOV/60130620R]

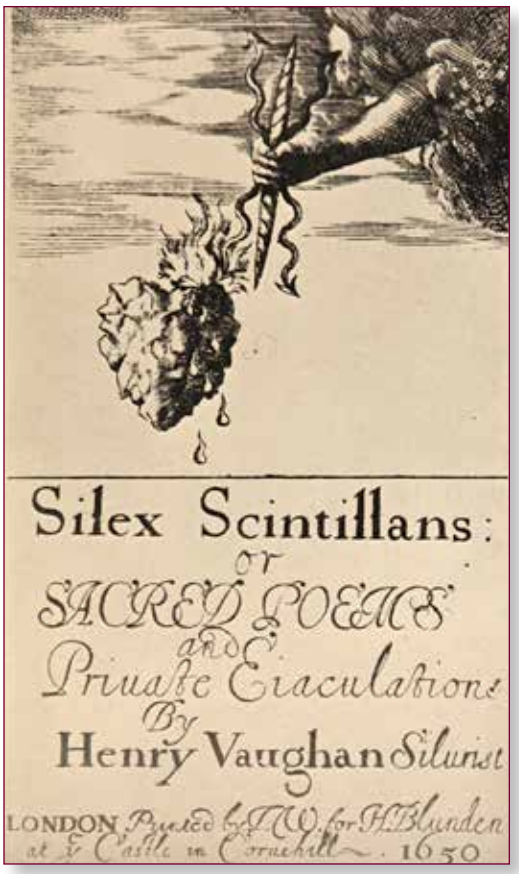

Figure 1. Title page of a volume of poetry by Dr. Henry Vaughan, a British physician.

Rhode Island poets

Early editions of the *Rhode Island Medical Journal* (RIMJ), beginning with Volume 1 in 1917, illuminate the verses of the state's physician poets at the same time Dr. Dana published his catalogue. **WILLIAM R. WHITE, MD**, who served as president of the Rhode Island Medical Society (RIMS) from 1903-05, frequently read his poems at annual meetings and social gatherings of the Providence Medical Association and RIMS. This following is an excerpt from a series of Cantos published in the March 1917 edition of RIMJ, from Canto 4.

Interlude in Feet

A poem stirs the hearts of men
Who read it once and oft again.
One's soul it may and does inspire
As one sits musing by one's fire…

But to you all I'll say this word,
Advice perhaps you've never heard;
If you get nervous, cross and tired,
If hopes and plans seem badly mired,
Just set aside a quiet time
And think your thoughts in simple rhyme.

The May1927 edition of RIMJ contained a poem Dr. White delivered at an annual meeting. He described it as allegorically portraying "the four mechanical epochs in cardiac activity."

The Heart's Song

Systole-diastole the whole day through
In a never-ending sequence while you live by what I do
With your life blood passing through me in a cadence like a song
Systole-diastole the whole day long.

Systole-diastole the long night hours
While you rest I still am working, I'm garnering my powers
For the efforts of the morrow, for the travail and the fight
Systole-diastole through all the night.

SYSTOLE! DIASTOLE! You are prostrate on your bed
And the poisoned torrent rushes, clouding brain and aching head,
I, your ally in extremis, fighting foetid fever's powers
SYSTOLE! DIASTOLE! Oh the long hours!

Systole-diastole now the race is almost run
Long the years we've toiled together in the shadow and the sun
the germ cells of our offspring carry what of us is best
Systole-diastole systole-diastole systole-diastole REST!

Tributes

Poems also served as elegies. The following appeared in the Feb. 1922 edition of RIMJ, written by **WILLIAM JAMES BURGE, MD**, who had passed away the previous year. In a tribute to Dr. Burge, it mentions his poetic prowess, and reprinted his elegy to **DR. GEORGE CAPRON**, who died in 1882, at the age of 82.

In Memoriam: Dr. George Capron

Dead; didst thou say? Such men can never die!
His work has wearied him, so let him lie,
And take the sweet God-given rest
Prepared for those whose deeds are blest.
Long has he toiled, and earnestly as long,
To heal the sick and make the feeble strong.
His task is nobly done; so let him sleep
Till he awakens, his reward to reap.

A final homage to another physician, published in the June 1939 edition, recounts the role the poetic and musical muses occupied in the life of **ARTHUR HUDSON HARRINGTON, MD**, a psychiatrist and former superintendent of the State Hospital for Mental Diseases, who has passed away in March of that year. The tribute concludes with his final day, when he read a sequence of four poems titled "Everlasting Life" at his home. It told the story of the origin of life on this planet and its seasonal ebbs and flows. Dr. Harrington composed 20 musical scores to accompany it.

Figure 3. Cover illustration of a collection by Johann Joachim Becher, 1635-'82, a German chemist and physician. "Parnassus Medicinalis" was published in 1663, and was a treatise in verse on the medicinal properties of the animal, vegetable and mineral kingdoms.

His obituary in RIMJ recounted his final day. "On Sunday, March 12, Dr. Harrington had been about the house and in good spirits all day. In the early evening, after reading his completed poem to some friends in the house, he sat down at the piano and began playing one of his own scores, but bad played only a few bars when he complained of feeling sick, lay down upon his bed and in two or three minutes passed away. He had really died at the piano with his beloved music."

The tribute to Dr. Harrington affirms Dr. Dana's introduction in "Poetry and the Doctors": "Occasionally one is introduced to the charms of a long-forgotten or a new voice, singing beautiful songs." This echoes in the tribute to Dr. Harrington, who spent his last moments reciting "Everlasting Life" to his friends, and playing the composition on his piano. ❖

We are read everywhere

In 2021 to date, approximately, more than **22,000** unique viewers from **90** countries have read articles in the *Rhode Island Medical Journal* (RIMJ) or researched topics in its archives.

Top 10 countries in 2021:

1. US
2. Canada
3. UK
4. Australia
5. India
6. China
7. Germany
8. Italy
9. Brazil
10. Spain

MEDICAL TRAINING IN THE PACIFIC OCEAN

The Navy Office of Community Outreach sent this photo, taken in April, to the *Rhode Island Medical Journal*. They wrote: "We travel the globe to collect sailor photos, so that we can share them with their hometown media." They informed us that more than 95 percent of the world's international phone and Internet traffic are carried through fiber optic cables lying on the ocean floor.

In the photo, **Hospital Corpsman 1st Class Erica Reiter**, right, from North Smithfield, RI, applies grease paint to Mineman 3rd Class Steven Dye, from McLoud, Okla., during a medical training evolution aboard Independence-variant littoral combat ship USS Charleston (LCS 18). Charleston is currently operating in the U.S. 3rd Fleet.

[U.S. NAVY PHOTO BY MASS COMMUNICATION SPECIALIST 3RD CLASS ADAM BUTLER]

Wherever you happen to be quarantining or social distancing, visit the Journal on your mobile device, and send us a photo: **mkorr@rimed.org**.

Working for You: RIMS advocacy activities

May 3, Monday

RIMS Board of Directors meeting: **Catherine A. Cummings, MD**, President

Legislative hearings

May 4, Tuesday

Meeting with RI-ACEP leadership regarding legislation

RIMS Physician Health Committee (PHC): **Herbert Rakatansky, MD**, Chair (via teleconference)

Legislative hearings

May 5, Wednesday

Diabetes Prevention Programs (DPP) Stakeholder's call

Legislative hearings

May 6, Thursday

RI-ACP Advocacy Committee: **Michael Migliori, MD**, RIMS Public Laws Chair

Call with the Office of the Health Insurance Commissioner (OHIC) regarding telemedicine legislation

Legislative hearings

May 7, Friday

Virtual meeting with RI Public Health Institute regarding legislation

Legislative hearings

May 10, Monday

COBRE (Center of Biological Research Excellence) webinar regarding mental health and substance use disorder

American Medical Association (AMA)/ New England Delegation meeting: **Peter Hollmann, MD**, Senior Delegate; **Alyn Adrain, MD**, Delegate; **Sarah Fessler, MD**, Alternate Delegate; **Catherine Cummings, MD**, President, Alternate Delegate; RIMS staff

Legislative hearings

May 11, Tuesday

Medical Malpractice Joint Underwriting Association of RI (MMJUARI) Finance Committee: Newell Warde, PhD

Legislative hearings

May 12, Wednesday

RI Department of Health (RIDOH) Board of Medical Licensure and Discipline full Board meeting

Governor's Overdose Intervention and Prevention Task Force: **Sarah Fessler, MD**, RIMS Past President

Briefing on AMA's Strategic Plan to Embed Racial Justice and Advance Health Equity

Legislative hearings: **Catherine Cummings, MD**, RIMS President

May 13, Thursday

Legislative hearings

May 14, Friday

Virtual meeting with RI Public Health Institute regarding legislation

Legislative hearings

May 17, Monday

Monthly meeting with Blue Cross & Blue Shield of Rhode Island (BCBSRI): **Catherine Cummings, MD**, RIMS President

AMA call with State Medical Societies (SMS) Public Health Leads – Update/ Discussion on COVID-19 Vaccine Distribution plus Administration

State House Update: **Michael Migliori, MD**, Chair, Public laws Committee

Legislative hearings

May 18, Tuesday

IQVIA webinar on Global Medicine Spending and Usage Trends: Outlook to 2025

Legislative hearings

May 19, Wednesday

RI DOH Primary Care Physician Advisory Committee (PCPAC): **Elizabeth Lange, MD**, RIMS President-elect

Legislative hearings: **Bradley Collins, MD**, RIMS Past President

May 20, Thursday

Medical Malpractice Joint Underwriting Association of RI (MMJUARI) Annual Meeting and Board of Directors: Newell Warde, PhD

Meeting with RI Health Policy Alliance regarding legislation

Office of the Health Insurance Commissioner (OHIC) Health Insurance Advisory Council (HIAC): **Catherine A. Cummings, MD**, RIMS President

Legislative hearings: **Elizabeth Lange, MD**, RIMS President-elect

May 21, Friday

Legislative hearings

May 24, Monday

Legislative hearings

May 25, Tuesday

AMA Advocacy Resource Center (ARC) call to discuss AMA Managed Care Legal Database

AMA webinar: Measuring the value of Virtual Healthcare

RI Public Health Institute: Nourish RI (Sugary Beverage Tax Legislation) Press Conference

May 27, Thursday

Prevent Overdose RI/Racial Equity Working Group

RI Public Health Institute Communications & Strategy virtual meeting – Sugary Drink Tax Bill

Legislative hearings

RIMS NOTES: ***News You Can Use***

Our biweekly e-newsletter is published on alternate Fridays exclusively for RIMS members. Contact Dulce Cosme if you've missed an issue, dcosme@rimed.org.

RIMS CORPORATE AFFILIATES

The Rhode Island Medical Society continues to drive forward into the future with the implementation of various new programs. As such, RIMS is expanded its Affinity Program to allow for more of our colleagues in healthcare and related business to work with our membership. RIMS thanks these participants for their support of our membership.

Contact Marc Bialek for more information: 401-331-3207 or mbialek@rimed.org

www.nhpri.org

Neighborhood Health Plan of Rhode Island is a non-profit HMO founded in 1993 in partnership with Rhode Island's Community Health Centers. Serving over 185,000 members, Neighborhood has doubled in membership, revenue and staff since November 2013. In January 2014, Neighborhood extended its service, benefits and value through the HealthSource RI health insurance exchange, serving 49% the RI exchange market. Neighborhood has been rated by National Committee for Quality Assurance (NCQA) as one of the Top 10 Medicaid health plans in America, every year since ratings began twelve years ago.

www.ripcpc.com

RIPCPC is an independent practice association (IPA) of primary care physicians located throughout the state of Rhode Island. The IPA, originally formed in 1994, represent 150 physicians from Family Practice, Internal Medicine and Pediatrics. RIPCPC also has an affiliation with over 200 specialty-care member physicians. Our PCP's act as primary care providers for over 340,000 patients throughout the state of Rhode Island. The IPA was formed to provide a venue for the smaller independent practices to work together with the ultimate goal of improving quality of care for our patients.

RIMS gratefully acknowledges the practices who participate in our discounted Group Membership Program

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AMA releases plan dedicated to embedding racial justice and advancing health equity

New strategy represents three-year roadmap for action, historical reflections on past harms, and accountability in operationalizing equity and justice

CHICAGO – The American Medical Association (AMA) today released an ambitious strategic plan to dismantle structural racism starting from within the organization, acknowledging that equity work requires recognition of past harms and critical examination of institutional roles upholding these structures.

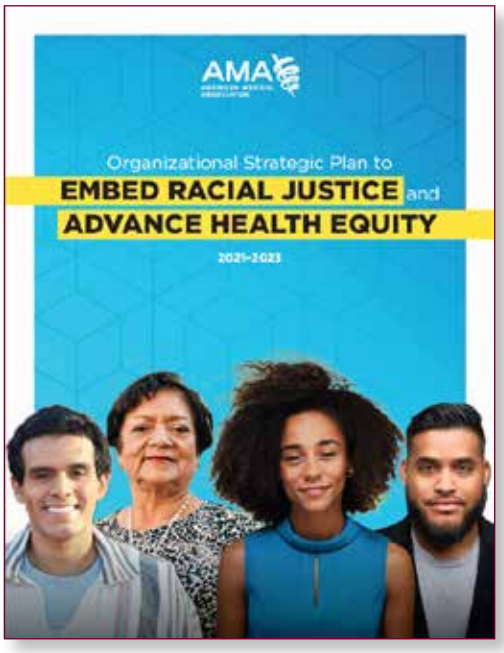
The framework of the plan – which is central to the work of the AMA Center for Health Equity and the responsibility of AMA leadership, membership, and external stakeholders – is driven by the immense need for equity-centered solutions to confront harms produced by systemic racism and other forms of oppression for Black, Latinx, Indigenous, Asian, and other people of color, as well as people who identify as LGBTQ+ and people with disabilities. The groundwork for the plan began in 2019 when the AMA Center for Health Equity was launched as a result of a resolution passed by the AMA's House of Delegates. Its urgency is underscored by ongoing circumstances including inequities exacerbated by the COVID-19 pandemic, ongoing police brutality, and hate crimes targeting Asian, Black, and Brown communities.

"This strategic plan represents a step forward in a much longer journey to ground the AMA, health care, and our nation's health care system around equity with a vision of achieving optimal health for all," said AMA President-Elect **GERALD E. HARMON, MD**. "As leaders in medicine, we commit to accountability toward the goal of eliminating inequities – systemic, preventable, and unjust differences – in the health of our patients. Fulfilling the AMA's mission of promoting the art and science of medicine and the betterment of public health requires us to use our resources, influence, and power to push toward a more equitable future, which also means reversing the historic harms we caused and forging paths towards truth, reconciliation, racial healing, and transformation."

The plan outlines five strategic approaches to begin tackling these challenges:

- Embed equity and racial justice throughout the AMA by expanding capacity for understanding and implementing anti-racist equity strategies via practices, programming, policies, and culture.
- Build alliances with marginalized physicians and other stakeholders through developing structures and coalitions to elevate the experiences and ideas of historically marginalized and minoritized health care leaders.
- Push upstream to address all determinants of health and root causes of inequities by strengthening, empowering, and equipping physicians with the knowledge of and tools for dismantling structural and social drivers of health inequities.
- Ensure equitable structures and opportunities in innovation through embedding and advancing racial justice and health equity within existing AMA efforts to advance digital health.
- Foster pathways for truth, racial healing, reconciliation, and transformation for AMA's past by accounting for how policies and processes excluded, discriminated, and harmed communities, and by amplifying and integrating the narratives of historically marginalized physicians and patients.

"With this blueprint for embedding racial and social justice, we are dedicated to comprehensively analyzing the structures, systems, policies, and practices that have had harmful impacts within our organization and beyond," said AMA Chief Health Equity Officer **ALETHA MAYBANK, MD**, MPH. "Achieving equitable solutions requires disruption and dismantling of existing norms and taking collective action. It also requires a sense of urgency and ambition, and the time is now."



The plan is centered around an overarching, aspirational vision of a nation in which all people live in thriving communities where resources work well; systems are equitable and do not create or exacerbate harm; everyone has the power, conditions, resources, and opportunities to achieve optimal health; and all physicians are equipped with the consciousness, tools, and resources to confront inequities. Several guiding principles have been set to ensure equitable practices in carrying out the plan, and internal performance indicators and evaluation metrics and tools will be used to measure success and impact while maintaining transparency and accountability.

"Embedding equity is an all-hands-on-deck effort that will enable AMA to further our impact on behalf of all

people in our country – but especially those who have historically been marginalized. AMA leaders are creating opportunities to embed equity into our ongoing work so that equity serves as an accelerator of everything we do to improve the health of our nation," said AMA CEO and EVP **JAMES L. MADARA, MD**.

In 2008, the AMA issued a public apology for its past discriminatory actions against Black physicians as a modest first step toward healing and reconciliation. In 2019, the AMA launched its Center for Health Equity following a Board-approved recommendation from the Health Equity Task Force. The Center remains the anchor for facilitating, strengthening, and amplifying the AMA's work to eliminate health inequities and their root causes. Through research, collaborations, advocacy, and leadership, the AMA believes in supporting system-level solutions and identifying and addressing root causes of inequities while elevating their importance to patients, communities, and stakeholders. Within the past year, some of these actions include: passing AMA policies that acknowledge racism as a public health threat, rids race as a proxy for biology, eliminates racial essentialism in medicine, and recognizes police brutality as a product of structural racism; launching the Medical Justice in Advocacy fellowship to advance equity in medicine; removing the name of AMA founder Dr. Nathan Davis from an annual award and display in recognition of his contribution to explicit racist exclusion practices; calling on the federal government to collect and release COVID-19 race/ethnicity data; and investing financially in Chicago's West Side neighborhoods. ❖

New AMA effort reenvisions a value framework for virtual care

Return on Health will help define and measure all the benefits generated by digitally enabled care

CHICAGO – The American Medical Association (AMA) recently announced an effort to reenvison the way we assess the full range of benefits generated by virtual care. The *Return on Health* initiative proposes a new framework to better understand the comprehensive value of digitally enabled care models as decisions are made that will establish the future role of virtual care.

Spurred by the COVID-19 pandemic and the adoption of innovative technologies, the U.S. health care system is transitioning to a new era of digitally enabled care characterized by delivery models that fully integrate in-person care and virtual care. Yet the full range of benefits generated by virtual care are often misunderstood due to the lack of a comprehensive value framework.

The *Return on Health* initiative and its comprehensive framework for assessing the value of digitally enabled care was developed by the AMA and Manatt Health with input from experts representing a cross section of health care stakeholders. Building on existing literature and AMA digital health research, the framework accounts for the various ways in which virtual care programs may increase the overall "return on health" by generating positive impact for patients, clinicians, payers and society going forward.

"Understanding the value of virtual care is vital to inform decision making that facilitates the shift to digitally enabled care models that blend the best features of in-person care with those of virtual care," said AMA Board Member **JACK RESNECK Jr., MD**. "The AMA's framework fills a critical need to inclusively define and measure the various benefits generated by virtual care as decision makers design new care models, prioritize investments, and determine appropriate coverage and payment policies in the future."

To move beyond dollars and cents in realizing the value of virtual care, the Return on Health envisions framing the benefits of virtual care according to six value streams: clinical outcome, quality and safety, access to care, patient and family experience, clinician experience, financial and operational impact, and health equity.

The framework also incorporates environmental variables that impact the six value streams: practice type, payment arrangements, patient population, clinical use case, and virtual care modality. These environmental variables provide flexibility to the framework and acknowledge that different health care organizations will have different clinical, business or infrastructure demands that fundamentally shape their approach to virtual care. ❖

RIH researchers partner in AHEAD study to help prevent early memory loss in AD

PROVIDENCE – Rhode Island Hospital's first infusion of an investigational treatment that aims to help prevent the earliest memory loss due to Alzheimer's disease took place in mid-April, researchers announced.

Funded by the National Institutes of Health (NIH) and Eisai Inc., a U.S. subsidiary of Eisai Co., Ltd. (Headquarters: Tokyo), the AHEAD Study is the first Alzheimer's research effort to recruit people as young as 55 years old who are at risk of developing symptoms of the disease as they get older. It introduces a personalized approach that will tailor treatment dosing levels to a participant's particular risk of memory loss related to Alzheimer's disease.

"We know that changes in the brains of people with Alzheimer's disease begin up to 20 years before a person notices symptoms but until now most clinical trials have included older patients who already have symptoms," said **REISA SPERLING, MD**, director of the Center for Alzheimer's Research and Treatment at Brigham and Women's Hospital, Harvard Medical School and co-principal investigator for the AHEAD Study. "By inviting younger participants without symptoms, we hope to help individuals who are at higher risk – such as people with family history – get ahead of the disease with early intervention. We also want to reach diverse communities to learn more about why people of color may be at higher risk of cognitive decline."

The AHEAD Study consists of two different clinical trials testing the same investigational treatment (known as BAN2401 (lecanemab)). Participants are enrolled in one of the two trials based on the level of amyloid in their brain. Amyloid is a protein that builds up in people who can go on to have memory problems and develop Alzheimer's disease.

"The tailored approach of this study, starting treatment years before memory loss has begun, has the potential to be a breakthrough in our aim to prevent Alzheimer's disease," said **JONATHAN DRAKE, MD**, associate director of the Alzheimer's Disease and Memory Disorders Center at Rhode Island Hospital. "It can potentially serve as a model to improve clinical trials in Alzheimer's research and other diseases."

The AHEAD Study seeks 1,165 participants from North America. The study has more than 100 study locations worldwide, including North America, Japan, Singapore, Australia, and Europe.

The trial is led by experts at the University of Southern California's Alzheimer's Therapeutic Research Institute, the Alzheimer's Clinical Trials Consortium, Brigham and Women's Hospital, Massachusetts General Hospital, and Harvard Medical School. ❖

Westerly Hospital expands services with robot-assisted surgical system

WESTERLY – Westerly Hospital is expanding its surgical capabilities with the acquisition of the da Vinci Xi Surgical System to treat urologic cancers, prostate enlargement, male infertility and kidney stone management. In addition, this new technology will be utilized for hysterectomies as well as many general surgical procedures, such as thyroid cancer removal, colorectal procedures, and hernia repair.

"We are proud to offer the latest and most advanced robotic surgical techniques to our patients at Westerly Hospital," said **PATRICK GREEN**, president and CEO, Westerly Hospital. "Our investment in this world-class technology will enhance the care we provide to our community and allows our patients to return more quickly to their day-to-day lives." ❖

Providence VA Medical Center increases availability of telehealth services through launch of Digital Divide Consult, continued partnerships

PROVIDENCE – The Providence VA Medical Center announced it has expanded opportunities for Veterans enrolled in the VA health care system to access their care by telehealth through the launch of its Digital Divide Consult and continued partnerships with private-sector companies facilitated by the VA's Secretary's Center for Strategic Partnerships.

This effort is to ensure all Veterans, regardless of where they live, have convenient access to VA care and these initiatives do just that.

"During the pandemic, VA's telehealth services have been of critical importance, enhancing options for Veterans in Rhode Island and Massachusetts to connect with the high-quality care they deserve," said **LAWRENCE CONNELL**, Director of the Providence VA Medical Center. "VA's Digital Divide Consult assists qualifying Veterans who do not have the internet or technology needed to access telehealth services from home by loaning them internet-connected devices or helping them apply for federal subsidies for their needed technology."

Since January 2021, the Providence VA Medical Center has conducted approximately 49,000 video telehealth visits into Veterans' homes. Nationally, VA regularly provides over 41,000 video telehealth visits into Veterans' homes on a typical single business day, exceeding the number of visits VA previously offered over an entire month. ❖

Bradley Hospital receives $10M to establish sleep, circadian rhythms center

RIVERSIDE – Bradley Hospital has received a $10 million award from the National Institutes of Health (NIH) to create the first and only research center focused on pediatric sleep patterns, circadian rhythms, and mental health.

The new Center for Sleep and Circadian Rhythms in Child and Adolescent Mental Health will study the linkages between sleep, circadian rhythms, and mental illness in children and adolescents.

Bradley Hospital received an NIH institutional development award through its Center of Biomedical Research Excellence (COBRE) program, which supports innovative multi-year studies in themed areas that strengthen institutional biomedical research capacity.

The Center will be led by **MARY A. CARSKADON, PhD**, director of chronobiology and sleep research at Bradley Hospital. The Center's leadership team includes Bradley Hospital faculty members **JENNIFER FREEMAN, PhD**; **JENNIFER WOLFF, PhD**; and **DAVID BARKER, PhD**; as well as **JOHN McGEARY, PhD**, of Brown University.

"Links between mental illness and sleep are indisputable; probing and identifying the links from sleep and circadian rhythms to pediatric mental illness and mental health can identify important pathways to prevention and early intervention, not the least because these factors are amenable to behavioral change and to defined therapeutic targeting," said Carskadon, past president of the Sleep Research Society current editor-in-chief of the Society's journal, *Sleep Advances*.

The COBRE program provides awards for three sequential five-year phases; Bradley Hospital received $10 million for the first five-year period of the award. Initial research initiatives at the Center for Sleep and Circadian Rhythms in Child and Adolescent Mental Health will include:

- Project 1 – assess in primary school children from a range of socio-economic backgrounds how green space use impacts sleep and mental health.
- Project 2 – use an intensive sleep and chronobiology approach along with neuroimaging to determine how sleepiness and memory in early adolescents with attention deficit hyperactivity disorder (ADHD) are affected by sleep bioregulatory factors.
- Project 3 – use a prospective approach to query the roles of sleep patterns and circadian timing in the progression of Bipolar Illness in children and early adolescents.

The Center for Sleep and Circadian Rhythms in Child and Adolescent Mental Health will host training in the assessment of pediatric mental health and in sleep and circadian theory, science, and methods for research project leaders, pilot project applicants, and research staff. The Center will also provide mentorship of diverse research project leaders to achieve expertise in this field, to bring this knowledge to their clinical work, and to transition to independent scientific careers with external funding.

Research conducted under this award will be supported by the NIH National Institute of General Medical Sciences, Institutional Development Award project number 1P20GM139743-01. ❖

Etiometry and the Brown-Lifespan Center for Digital Health announce research partnership in adult critical care patients

Collaborative effort will collect data within Rhode Island Hospital and The Miriam Hospital to advance clinical decision-support algorithms

BOSTON AND PROVIDENCE – Etiometry Inc. and the Brown-Lifespan Center for Digital Health (CDH) announce an agreement for joint clinical research and validation of the Etiometry Platform to collect data about the care of critically ill adult patients. The research partnership is expected to lead to groundbreaking advancements in Etiometry's algorithms that assist clinicians in making data-driven decisions, providing better care for future patients.

Founded in 2020, the CDH leverages innovative technology to maximize health and eliminate health disparities at both a patient and population level. The CDH is designed to rapidly implement and scale digital treatment modalities in order to have broad and direct impact.

"This collaboration is a demonstration of the power of co-operation between clinicians, researchers, and industry partners to help patients," according to **MEGAN RANNEY, MD**, Founding Director of the Brown-Lifespan Center for Digital Health.

Etiometry, a leader in clinical decision-support software, aids clinicians providing care to critically ill patients by using FDA-cleared algorithms to provide risk estimations of deterioration for each patient. By using data collected over time about the treatment and outcomes of patients, Etiometry will be able to advance its algorithms with information from eight adult units within Rhode Island Hospital and The Miriam Hospital.

"The new research partnership will allow Etiometry to build upon the hundreds of millions of hours of data collected with our platform," said **SHANE COOKE**, CEO and President of Etiometry. "Collaborating with the Brown-Lifespan Center for Digital Health will enable new and exciting clinical research pathways as well as validation of risk algorithms currently utilized in the pediatric critical care population. This partnership is vital to the growth of our platform and enables us to impact more patients across the continuum of care." ❖

South County Health capital improvement projects underway

WAKEFIELD – A series of capital improvement projects are underway at South County Health, each designed to meet the diverse needs of a changing community and utilize the most advanced medical technology. An online construction timeline – upgrades.southcountyhealth.org – has been developed to inform the public.

The projects, scheduled through 2022, will result in strategic renovations and upgrades to South County Hospital and the adjacent Medical Office Building, as well as expansion of its medical practices and ancillary services into Narragansett and Warwick to facilitate patient access.

"Bringing innovation and technology to patient care has always been a part of South County Health's DNA," said **AARON ROBINSON**, CEO. "These additions to our hospital campus and our extended community campuses demonstrate our sharp focus on patient care and our unparalleled commitment to quality, service, and innovation."

In February 2021, South County Hospital opened a seventh operating room, OR-7, designed to accommodate its growing robotic surgery program.

Current project

- **Emergency Department – Renovations to improve patient care and safety:** Improvements to the 13,204 sf area will result in optimized emergency care for patients. Upon entering the Emergency Department, the triage process will be much quicker, allowing nurses to fast track patients based on the level of care needed. Serious medical needs will be prioritized and patients will be treated in a setting equipped for a higher level of care.

Ongoing/upcoming projects

- **South County Primary Care:** South County Primary Care-Wakefield will relocate to 14 Woodruff Avenue in Narragansett. The 5,000 sf construction project at Woodruff Plaza will bring South County Primary Care practice closer to the community, providing patients with easier access and more parking to alleviate current challenges on the Hospital campus.
- **Cardiac Rehab and Wound Care Center:** The Cardiac Rehab Center will be condensed and relocated into vacated areas in the Medical Office Building lower level to pave the way for a new a Cardiovascular Center. Here, it will continue to accommodate patients who need medical monitoring during their rehabilitation. Other patients who do not need provider-level of monitoring will receive prescribed rehabilitation activities they can continue at-home or at their neighborhood gym. The Wound Care Center will also be relocated to the MOB lower level, adjacent to Cardiology and Cardiac Rehab. Upon completion, the Wound Care Center will be equipped and redesigned to accommodate bariatric patients and those with decreased mobility. Among the enhancements, the Wound Care Center will install a patient lift, enabling patients with limited mobility to be transferred easily during exams and treatments.
- **South County Health Medical & Wellness Center-Warwick:** South County Health's expansion includes establishing a Medical and Wellness Center located at 120 Centerville Road in Warwick. The 14,000 sf leased space will become home to South County Medical Group's Primary Care, General Surgery, Urology, Women's Health, Pulmonology, Express Care, Radiology, and Lab practices and services.
- **Center for Advanced Heart & Vascular Care:** In what is planned as a two-phased project, patients will soon have access to a variety of diagnostic and treatment resources of a new South County Health Center for Advanced Heart & Vascular Care.

  Phase 1 of the project calls for the build-out of space occupied by the Cardiac Rehab gym in the lower level of the Medical Office Building in preparation for the new Cardiovascular Center.

  During Phase 2, South County Cardiology will relocate from its current offices on the third floor of the Medical Office Building to the lower level area renovated during Phase 1. An additional 4,000 sf space will be redesigned to accommodate the Wound Care Center so it is adjacent to Cardiology and Cardiac Rehab, becoming part of the Cardiovascular Center.
- **Center for Advanced Orthopedic Surgery:** Building on a 10-year partnership between South County Health and Ortho Rhode Island, a new Center for Advanced Orthopedic Surgery will be the cornerstone of the renovated Medical Office Building. The partnership with Ortho Rhode Island will require a build-out to create a 14,000 sf space, relocating existing outpatient clinics to more appropriate areas within the Medical Office Building.
- **Hospital West Entrance Renovation:** In preparation for a large-scale construction phase, the West Entrance to the Hospital will be redesigned. This area will temporarily be used as the Hospital's Main Entrance when the current Main Entrance is temporarily closed to allow renovations to the Main Lobby and more extensive construction to the building's façade.
- **Medical Office Building/Hospital Connector:** The new Center for Advanced Orthopedic Surgery will connect directly to South County Hospital's orthopedic wing by a glass-enclosed skywalk. ❖

NAACP launches 'COVID. KNOW MORE,' initiative empowering Black Americans with the latest information, resources and updates on COVID-19

BALTIMORE – With the country showing increasing signs of reopening each day, the tendency exists among some to forget the most devastating impacts of COVID-19. In many of our most vulnerable communities, the battle against the disease continues to rage on as Americans contend with not just high infection rates, but also the pandemic's long term health implications and unprecedented economic setbacks.

Derrick Johnson, NAACP president and CEO

The NAACP, the nation's largest and most pre-eminent civil rights organization, in seeking to ensure that our communities continue to stay informed and get the facts they need to make best decisions for their families and communities, recently announced the creation and launch of an essential and exciting new national initiative, 'COVID. K**NO**W MORE.'

The mainstay of the NAACP's 'COVID. K**NO**W MORE' effort is a now live, multifaceted online information hub housing a broad array of features designed to empower African Americans' decision making as they navigate the pandemic—at their own convenience. The hub, which can be accessed at naacp.org/covidknowmore, stands as one user-friendly, central place for individuals, community groups, partners and NAACP branches alike to find the latest news and information, research, resources, science-based guidance and updates from medical experts. The platform further reinforces the NAACP as the most visible and trusted resource for African Americans on the health crisis.

"The NAACP is continuing its work to help our most vulnerable citizens and communities safely navigate back to normalcy while countering the ongoing devastation of COVID-19," said **DERRICK JOHNSON**, NAACP president and CEO. Through our pioneering 'COVID Unmasked' virtual town hall series, local mask distributions and other COVID education efforts, the NAACP has been dedicated to fighting this pandemic from the outset. COVID. K**NO**W MORE is the natural evolution to continue to expand not only the information provided to our communities, but also to address the long term implications and impacts of the pandemic and systemic disparities."

Other specific highlights to be found on the branded site are a running news feed, infographics illustrating proprietary NAACP COVID-19 research, an information-rich video series, public service announcements and testimonials plus a customizable messaging toolkit which partners, NAACP branches and units can use to pique awareness of the 'COVID. K**NO**W MORE' initiative in the organization's key regions across the country. Among the partners who will be engaged in facilitating the rollout of the national campaign are J.P. Morgan Chase and international rideshare operator Lyft.

Lyft has launched a Universal Vaccine Access initiative in partnership with the NAACP with the goal of providing a total of 60M rides to help get people vaccinated. Lyft users can easily secure transportation to and from their vaccine appointments by requesting a promo code, and then adding that code to the Rewards section of their Lyft app before requesting a ride to the location. ❖

RI to receive $11.4M to bolster mental health & substance use disorder programs

WASHINGTON, DC – In an effort to improve access to mental health and substance use disorder treatment and address behavioral health challenges, U.S. Senator **JACK REED** announced in May that Rhode Island will receive $11,453,580 to support mental health services and substance use disorder needs.

Rhode Island will receive $5,302,664 in supplemental funding from the Community Mental Health Services Block Grant (MHBG) Program to provide comprehensive community mental health services and address needs and gaps in existing treatment services for those with serious mental illness.

The state is also being awarded $6,150,916 from the Substance Abuse Prevention and Treatment Block Grant Program (SABG) to help the state plan, implement, and evaluate activities to prevent, treat, and help more people recover from substance use disorder.

This federal funding will flow to Rhode Island as a result of a $1.5 billion provision included in the American Rescue Plan, which Rhode Island's entire Congressional delegation supported. The federal funds will be distributed through the Substance Abuse and Mental Health Services Administration (SAMHSA) in the U.S. Department of Health and Human Services (HHS). ❖

Appointments

Joseph F. Matthews

Dennis Lynch

South County Health announces two to leadership roles

South County Health reported on the progress made to fulfill its five-year Strategic Plan at the organization's Annual Meeting on Monday, April 26, including the introduction of its new chairman of the Board of Trustees, and new Chief Philanthropy Officer.

The meeting, held publicly via video conferencing, drew approximately 185 participants, the highest number to ever attend. Participants included members of the board, hospital administrators and staff, medical staff, volunteers, donors, media and the general public.

Wakefield resident **JOSEPH F. MATTHEWS** was named chairman of South County Health's Board of Trustees, succeeding the position formerly held by outgoing chairman **DENNIS LYNCH**.

Matthews, a third generation of family ownership of Maxson Automatic Machinery Company based in Westerly, RI, previously served as a member of the South County Health Board of Trustees from 2006–2015 and South County Home Health's Board of Directors from 2003–2008.

Matthews will serve a three-year term as chairman of South County Health's Board of Trustees.

Additional new members of the Board of Trustees include **ROBERT J. BIERWIRTH, MD** (ex officio), Steve Blazejewski, **SANDRA COLETTA**, **JOHN WARDLE**, and **AARON WEISBORD, MD**.

After an extensive, national candidate search and numerous interviews of highly-qualified candidates by members of South County Health's Leadership Team, Board of Trustees, and Development Team, **JAY LOCKABY** was introduced as the newest member of South County Health's Executive Leadership Team as Vice President of Development and Chief Philanthropy Officer.

In his role, Lockaby will also serve as the newly established Foundation's Executive Director, working closely with its board members to engage support for key programs and services within South County Health.

Lockaby brings 20 years of fundraising leadership to this position, having directed successful capital campaigns, provided strategic planning, and worked collaboratively with board governance to exceed goals and bring numerous organizations' capital projects to fruition. ❖

Melissa M. Murphy, MD, named CNE's Executive Chief of Surgery

Care New England has announced the appointment of **MELISSA M. MURPHY, MD**, to Executive Chief of Surgery for Care New England.

Previous to this appointment, Dr. Murphy served as Chief of Surgery for Kent Hospital since July of 2020 and was formerly Assistant Chief of Surgery, and Medical Director, Surgical Quality and Operations at Kent Hospital from 2018 to 2020.

As the Executive Chief of Surgery for Care New England, Dr. Murphy will be collaborating with Care New England surgeons and departments system-wide to continue to grow and expand access to meet the needs of patients. She will also support CNE's existing programs and centers of excellence and work to develop new programs incorporating CNE's mission of expanding diversity, inclusion, and equity. ❖

Cain Hayes named CEO of Tufts Health Plan and Harvard Pilgrim Health Care

WATERTOWN/WELLESLEY – The combined organization of Tufts Health Plan and Harvard Pilgrim Health Care today announced that its board of directors has appointed **CAIN HAYES** as the organization's next chief executive officer effective July 5, 2021.

Hayes joins the organization from Gateway Health located in Pittsburgh, Pennsylvania, where he currently serves as president and CEO and is responsible for the strategy and day to day operations of one of the nation's top-ranked managed care organizations. Prior to joining Gateway Health, Hayes served as president and COO of the Health Business at Blue Cross and Blue Shield of Minnesota. Prior to joining Blue Cross, he was president of National Accounts, president of the Mid-America region and president of the Government-sector and Labor division for Aetna.

"I would like to congratulate Cain on his appointment and welcome him to our organization," said Tom Croswell, CEO of the Tufts Health Plan and Harvard Pilgrim organization. "I look forward to working with him to ensure an effective and smooth leadership transition."

The appointment of Mr. Hayes follows a thorough recruitment process overseen by a selection committee of the board, which vetted and interviewed a diverse slate of experienced internal and external candidates. The committee retained a national executive search firm to provide support through the search process. ❖

Appointments

Anne Schmidt, DNP, appointed Senior Vice President Patient Care Services and Chief Nursing Officer of The Miriam Hospital

PROVIDENCE – **ANNE SCHMIDT, DNP, APRN-BC, CENP, CPHQ**, has been appointed Senior Vice President Patient Care Services and Chief Nursing Officer of The Miriam Hospital.

Schmidt, who has had a 30-year nursing career, comes from a regional hospital system in Virginia and previously held nursing leadership posts at other hospitals in Rhode Island. She began on May 10.

"We conducted an extensive national search for this vital position and are pleased to have such a highly qualified individual join us. Dr. Schmidt is an exceptional nurse leader who throughout her career has demonstrated a commitment to elevating patient care and advancing the practice of nursing. She is passionate about her work and a great fit for The Miriam Hospital team," said **MARIA DUCHARME, DNP, RN, NEA-BC**, president of The Miriam Hospital.

Schmidt succeeds Ducharme, who became president of the hospital at the beginning of 2021.

Schmidt comes to The Miriam from Novant Health University of Virginia Health System, a three-hospital regional health system in northern Virginia. She was responsible for all nursing and support departments for a combined 190 beds at two hospitals. She led COVID-19 emergency preparations and response, established staffing models, oversaw training for staff, and identified equipment and supply needs.

Previously, Schmidt served as vice president of patient care services and chief nursing officer at South County Health in Wakefield. Prior to that position, she was director of nursing operations at St. Joseph Health Services of Rhode Island and Our Lady of Fatima Hospital.

"I'm excited to return to Rhode Island and am proud to be joining The Miriam Hospital, which has a longstanding and well-deserved reputation for excellence," said Schmidt. "We are emerging from an extremely challenging pandemic and my top priority will be ensuring the health and well-being of our patients and our staff."

Schmidt earned a Doctor of Nursing Practice degree focused on healthcare quality from George Washington University in Washington, D.C. She also has a post-master's certificate in nursing administration from Medical University of South Carolina in Charleston, S.C. She earned a master's degree in adult nurse practitioner/geriatric nursing from the University of San Diego. She is a Lean Six Sigma green belt.

Schmidt serves on the American Organization for Nursing Leadership's Region 1 Board of Directors. Her certifications include the American Organization of Nurse Executives Certified Executive of Nursing Practice, Certified Professional in Healthcare Quality, and the American Nurse Credentialing Center Adult Nurse Practitioner Certification. She is also a member of the American College of Healthcare Executives and the National Association for Healthcare Quality, as well as several other national organizations.

Schmidt first came to Rhode Island with the Navy, where she began her nursing career. She is a resident of Middletown. ❖

Recognition

South County Health receives two five-star ratings from CMS

The Centers for Medicare and Medicaid Services (CMS) recently released its hospital ranking for 2021, giving South County Hospital two 5-Star ratings – Overall Hospital Quality and Patient Experience.

No other hospital in Rhode Island received a 5-Star ranking in either category.

Only 455 hospitals across the country earned 5-Stars in at least one category.

The CMS Hospital Quality Star rating system was created by Medicare in July 2016 to help healthcare consumers make informed decisions by simplifying complex criteria that measures healthcare quality.

Overall Hospital Quality

The Hospital Quality rating is calculated by CMS, the federal agency that runs the Medicare program, using data from hospital industry and public sector stakeholders, including The Joint Commission (TJC), the National Quality Forum (NQF), and the Agency for Healthcare Research and Quality (AHRQ). These stakeholders collaborate to publicly report results of hospital performance data in such areas as:

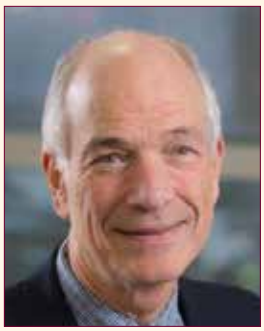
- Mortality
- Safety of care
- Readmission
- Patient experience
- Effectiveness of care
- Timeliness of care
- Efficient use of medical imaging

Patient Experience

Patient Experience is measured using a national survey that asks patients about their experiences during a recent hospital stay. The survey is administered by Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS).

South County Hospital is the only hospital in Rhode Island to have been awarded 5-Star rankings in Hospital Quality and Patient Experience since CMS implemented the system, earning the distinction in 2021, 2020, 2019, and 2017. ❖

Recognition



Dr. Vincent Mor honored by Brown University

PROVIDENCE – During the May 2021 Commencement of at Brown University, **DR. VINCENT MOR**, a Research Health Scientist working in the Center of Innovation on Long-term Services and Supports for Vulnerable Veterans (LTSS-COIN) at the Providence VA Medical Center and a Professor of Medical Science at Brown University was honored with the Susan Colver Rosenberger Medal of Honor.

The medal is the highest honor the Brown faculty can bestow, and past honorees include Nobel laureates, university presidents, and esteemed public servants.

"We are extremely proud of Dr. Mor not just specifically for this award but also for the continuing groundbreaking research and public health solutions his research has led to for our Veteran population," said **LAWRENCE CONNELL**, Director of the Providence VA Medical Center.

As an investigator at the Providence VA Medical Center, Dr. Mor has been instrumental in the development of the VA Center of Innovation in Long Term Services and Supports, where he is now directing several independent investigator-initiated research projects.

Dr. Mor was a key developer of the critical component of nursing home quality – the Minimum Data Set, a comprehensive assessment of patient characteristics that is completed on regular intervals for all nursing home patients. These data sets form the basis for the Centers for Medicare and Medicaid Service 5-Star Nursing Home rating system. ❖

Paari Gopalakrishnan, MD, receives honorary degree at Bryant commencement

SMITHFIELD – **PAARI GOPALAKRISHNAN, MD, MBA**, Chief Medical Officer at Kent Hospital, who led the effort to establish Rhode Island's COVID field hospital in Cranston, received an Honorary Doctor of Letters degree at the Bryant University Graduate 2021 commencement ceremony on May 20th. He was among seven awardees who were recognized for career achievements and mission-driven contributions to the region and their fields.

Dr. Gopalakrishnan received his medical degree from the University of Texas Health Science Center at San Antonio and completed his internal medicine residency at Brown University. He received his MBA with honors from Bryant University. ❖

ASRA names Taif Mukhdomi, MD, 2021 Resident/Fellow of the Year

The American Society of Regional Anesthesia and Pain Medicine (ASRA) has named **TAIF MUKHDOMI, MD, MBS, MHA**, the 2021 Resident/Fellow of the Year.

Dr. Mukhdomi is a resident in anesthesiology at Brown University, Rhode Island Hospital where he has been chief resident since 2020.

In July 2021, he will begin fellowship at the New York Presbyterian/Weill-Cornell Medical Center, Memorial Sloan Cancer Center, and Hospital for Special Surgery, Tri-Institutional Pain Fellowship. He earned his MD from Chicago Medical School at Rosalind Franklin University and his undergraduate degree from The Ohio State University in Columbus.

Dr. Mukhdomi has served on the ASRA Resident Section Committee since 2019. He has co-authored 19 articles including one manuscript and three correspondence letters in *Regional Anesthesia & Pain Medicine,* covering topics such as safety in outpatient total knee arthroplasty, use of psychedelics in chronic pain, and explant rates of neuromodulation devices.

ALEXANDER COHEN, MD, director of Regional Anesthesia and Pain Medicine and Acute Pain Resident Rotation director at the Warren Alpert Medical School of Brown University, nominated Dr. Mukhdomi for the award. He cited Dr. Mukhdomi's participation in ASRA's Resident Section Committee and dedication to coordinating with other leaders to troubleshoot resident/fellowship involvement in ASRA during the COVID-19 crisis. Dr. Mukhdomi also created a pain medicine interest group at Brown University and has actively encouraged medical students to join ASRA.

"Dr. Mukhdomi is an exceptional physician, educator, researcher, and (most importantly) advocate for [ASRA]," Dr. Cohen said. "I anticipate he will continue to persevere in his endeavors to promote our field of regional anesthesia and pain medicine, and we will likely see him as a future leader in our specialty."

ASRA's Resident/Fellow of the Year Award is given annually to a resident or fellow member of ASRA who has demonstrated outstanding contributions to regional anesthesia or pain medicine; has contributed to the advancement of the profession, welfare of residents, or quality of residency education; serves as a role model and mentor to his or her peers; and embodies the values of ASRA.

"I am humbled to accept this award from ASRA," Dr. Mukhdomi said. "I have truly enjoyed my involvement with ASRA throughout my medical education, and I hope to have continued involvement as I progress through my career."

Dr. Mukhdomi accepted the award at the 46th Annual Regional Anesthesiology and Acute Pain Medicine Meeting held May 13–15 in Lake Buena Vista, FL and virtually. ❖

Obituaries

WILLIAM F. GARRAHAN, MD, 91, of Narragansett, a husband, father, grandfather, and great-grandfather, passed away peacefully in his sleep on April 11, 2021. He was the devoted husband to Geraldine Sauvageau Garrahan for more than 66 years.

Dr. Garrahan attended LaSalle Academy in Providence, before receiving his BA from St. Anselm's College in Manchester, NH. He received his MD from Georgetown Medical School in Washington, DC, in 1955, and would go on to do his internship and residency at Worcester City Hospital, and his specialization in orthopedics at the Peter Bent Brigham and the Children's Medical Center in Boston.

William was in private practice, in orthopedics for 55 years, in Warwick; during that time he also served as Chief of the Kent Country Medical Staff, President of the Kent County Medical Society and President of the Rhode Island Orthopedic Society. He became a Fellow in the American Academy of Orthopedic Surgeons, and a Fellow of the American College of Surgeons. He served as the physician for the sports teams at CCRI, where he married his passion for sports with medicine. Always a passionate athlete himself, he competed in Senior Track and Field with the Master Olympics, both nationally and internationally, for 30 years, winning several US Gold Medals. He served as President of the Rhode Island Senior Olympics.

He was the devoted father of Thomas, Pawler, Jennifer (Ron Ferro), Kristin and Gretchen. He was grandfather to Garrett (Jackie) and Hunter McIntyre, and Rachel, Selena and Taylor Garrahan and great-grandfather to Margot McIntrye. He is also survived by his sister Geraldine Crowley, and predeceased by his sister Dorothy Shunney.

Memorial contributions may be made to Christian Brothers/Ocean Tides, 635 Ocean Rd., Narragansett RI 02882. Visit NardolilloFH.com for online condolences. ❖

CARL LEVICK, MD, 68, passed away at home on May 8, in Bristol, surrounded by loved ones after a courageous battle with aggressive brain cancer.

Carl was born on Oct. 23,1952, to Cora and Dwight Levick and raised in Andover, Mass. He excelled in music and math, making all state band for his trumpet playing abilities, achieving the rank of Eagle Scout, and earning a scholarship to study undergraduate psychology at Dartmouth College in Hannover, New Hampshire.

Upon graduating summa cum laude from the Dartmouth, Class of 1974, Carl continued his studies at the University of Massachusetts School of Medicine, culminating in the completion of medical residency at the Miriam Hospital in Providence. Upon meeting his wife, Rebecca Primiano of Barrington, a respiratory therapist, they moved to Vancouver, British Columbia, returning two years later to start a family in Concord, NH.

He worked for nearly 30 years as a cardiologist, managing Cardiology Associates of New Hampshire, before moving to Bermuda to work a 3 1/2-year stint at King Edward VII Memorial Hospital. Having left Bermuda to settle in Bristol, Rhode Island, but too restless to retire, he took his final cardiology post at Newport Hospital, before finally retiring at the end of 2016.

Carl was an avid hiker, completing all of New Hampshire's 4,000-foot peaks, a passionate skier, serving on the Wildcat ski patrol, recreational cyclist, prolific artist, and capable sailor.

He leaves behind his loving wife of 40 years, Rebecca, two devoted sons, Scott and Andrew, brother Bruce, sister Marilyn, his parents Dwight and Cora, extended family, and many friends, colleagues, and patients whose lives he greatly impacted. He will be missed by many.

In his memory, donations to the dedicated staff of Hope Hospice, 1085 North Main St., Providence, Rhode Island, 02904, would be greatly appreciated. ❖

JOHN H. MORAN, MD, 78, of Providence, passed away peacefully at Miriam Hospital on May 5, 2021. Although diagnosed with leukemia a few years ago, he had been successfully treated and lived a full and active life until very recently. He was born December 27, 1942 in Bridgeport CT, the son of John F. and Helen I. Robinson Moran. In his youth he attained the rank of Eagle Scout. While an undergraduate student at the University of Massachusetts at Amherst, he played bass guitar in a rock and roll band fronted by Taj Mahal, who went on to become a well-known blues musician.

Music in many genres remained a passion throughout John's life. He was a gifted pianist and enjoyed performing for others at the Review Club and with Brown medical student musicians.

He graduated from Temple University School of Medicine in 1968 and completed his residency in pediatrics at the University of Rochester School of Medicine and Dentistry and Strong Memorial Hospital in Rochester, NY. Following two years of service in the United States Navy, stationed at Annapolis, MD, he joined the staff at Providence Community Health Centers (PCHC), where he was the first physician to accept a fulltime position working at the health center in 1973. His desire to improve the health of the city's children paved the way for generations of physicians to make their careers working in community

health. During his forty-seven years at PCHC, he was the pediatrician for generations of children who lived in the neighborhoods around Smith Hill.

He was also Clinical Associate Professor of Pediatrics at the Warren Alpert Medical School of Brown University, where he was recognized with the Dean's Excellence in Teaching Award in numerous years. Rhode Island Hospital likewise recognized his teaching talent with multiple awards. The Rhode Island chapter of the American Academy of Pediatrics presented him with a Special Achievement Award for developing, with the Brown University Cross-Cultural Health Affinity Group, a guide for interviewing Spanish-speaking patients.

He was a member of the American Academy of Pediatrics, the First Unitarian Church of Providence, Review Club, the Providence Athenaeum, Ski Wheelers Ski Club of North Conway, NH, a former member of the Worcester Ski Club of Wilmington, VT, and a devoted supporter of Community Music Works. He sang for many years with the Providence Civic Chorale. An avid sailor, he kept a boat at Apponaug Harbor Marina and crewed on yacht races in the summer months. He was a season-ticket holder to Brown University football games and hosted many tailgate parties for friends and family. He was famous for his annual Super Bowl party, and for his clambakes. The Providence Community Health Centers will be naming the new addition to the Capitol Hill clinic in his honor, and a memorial service will be arranged for a later time.

He is survived by his sisters, Patricia Moran Bombardier (Richard G.) of Granby, MA and Mary H. Moran (Jordan Kerber) of Hamilton NY, three nephews, Richard Bombardier Jr. (Gizele) and son Jack of Belmont, MA, Michael Bombardier (Patricia) and daughter Kerry, of Granby, MA, and John Kerber of Philadelphia, PA, and a niece, Pearl Kerber (Liam Barry) of Silverdale, WA.

For online condolences, visit boyleandsonfuneralhome.com ❖