# Success of Online Educational Interventions on the Evaluation and Management of Chronic Thromboembolic Pulmonary Hypertension

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# Purpose

Chronic thromboembolic pulmonary hypertension (CTEPH) is a life-threatening complication of acute pulmonary embolism (PE), although not all patients presenting with CTEPH have a history of clinically overt PE. Patients who do not receive a prompt and accurate diagnosis of CTEPH and are not appropriately treated are likely to experience profound functional disability and poor long-term survival.<sup>1</sup> CTEPH is an important entity to include in the differential diagnosis for patients with unexplained dyspnea and pulmonary hypertension, but misdiagnosis is common.<sup>2</sup> Pulmonary endarterectomy (PEA) is the treatment of choice for all eligible patients with CTEPH.<sup>3</sup> However, patients who are not candidates for PEA and those with residual pulmonary hypertension after surgery can benefit from medical therapy. A study was conducted to determine if online educational interventions could improve competence and performance of pulmonologists, cardiologists, and surgeons with respect to evaluation and management of CTEPH.

# Methods

The effect of 2 online educational interventions on evaluation and management of CTEPH was measured and analyzed to determine efficacy of the content and instructional format.

### INSTRUCTIONAL METHOD

Online educational activities were presented in the form of discussions among multidisciplinary experts in CTEPH.<sup>4,5</sup> The formats used to deliver the education included a video-based roundtable panel discussion and a video-based 2-person dialogue, both conducted by expert faculty using synchronized slides, with built-in peer response to encourage participant interactivity and feedback. The interventions highlighted problem-solving processes and identified practical strategies in CTEPH. For learners wishing to view the program offline, a transcript and slides were made available for downloading/printing. In addition, the activities were available on the Medscape Mobile application, ensuring real-time access by the many clinicians who rely on mobile devices for education.

# Assessment Method

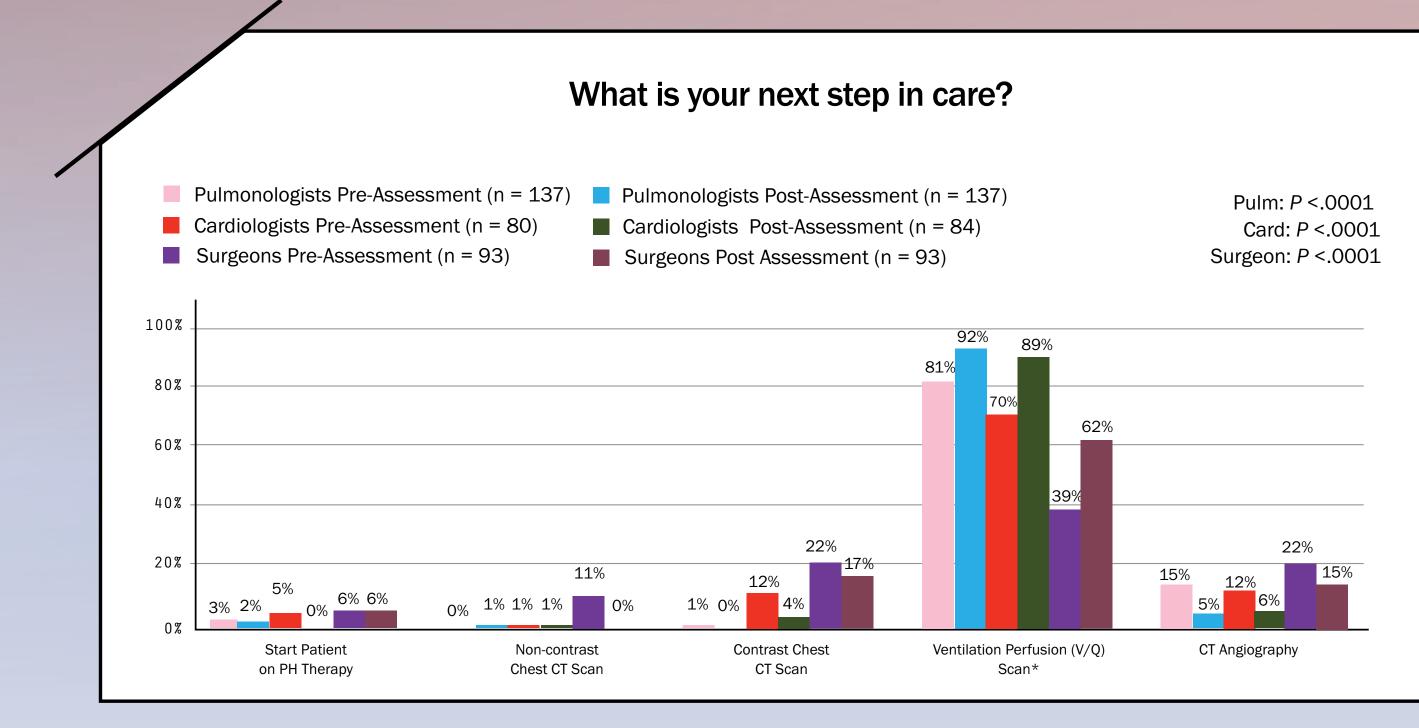
An online survey instrument -- previously validated to measure performance using knowledge- and casebased, multiple-choice questions -- was administered to compare the responses from the same cohort of participants to identical questions before (pre-assessment) and after the activity (post-assessment). The survey consisted of case-based scenarios and questions assessing performance and self-efficacy. McNemar's chi-squared test was used to determine statistical significance between linked learners from pre-assessment to post-assessment. A paired t-test was used to measure changes in confidence from pre-assessment to post-assessment. Descriptive statistics such as the mean and standard deviation were calculated for the change in confidence. Cramer's V was used to calculate the effect size of the intervention, based on the strength of association between the pre-assessment and post-assessment responses. *P* values <.05 were considered to be statistically significant in this evaluation.

# Results

#### FIGURE 1

#### Selection of chronologically appropriate diagnostic test to evaluate for cteph.

Case Scenario: BP is a 50-year-old woman presenting with progressing shortness of breath over the past 6 months. She has a history of type 2 diabetes and had pneumonia 3 years prior. The patient denies any chest pain, edema, dizziness, syncope, snoring, smoking, asthma symptoms, excessive drowsiness, or previous history of pulmonary embolism or deep vein thrombosis. Physical examination and laboratory findings are within normal limits. A chest radiograph shows mild cardiomegaly and pulmonary function test results are normal. You determine her dyspnea to be functional class III. An echocardiogram shows a moderately enlarged right ventricle with mild hypokinesis and a normal left ventricle. Her right ventricular systolic pressure is 70 mm Hg. The patient is suspected to have pulmonary hypertension. Right heart catheterization reveals pulmonary artery pressure 84/30 mm Hg (mean 56 mm Hg), pulmonary capillary wedge pressure 10 mm Hg, mean right artery pressure 10 mm Hg, and cardiac index 2.3 L/min/m<sup>2</sup>. The diagnosis of pulmonary hypertension is confirmed with no known underlying cause. Testing rules out parenchymal lung disease, left heart disease, connective tissue disease, liver disease, and congenital heart disease.

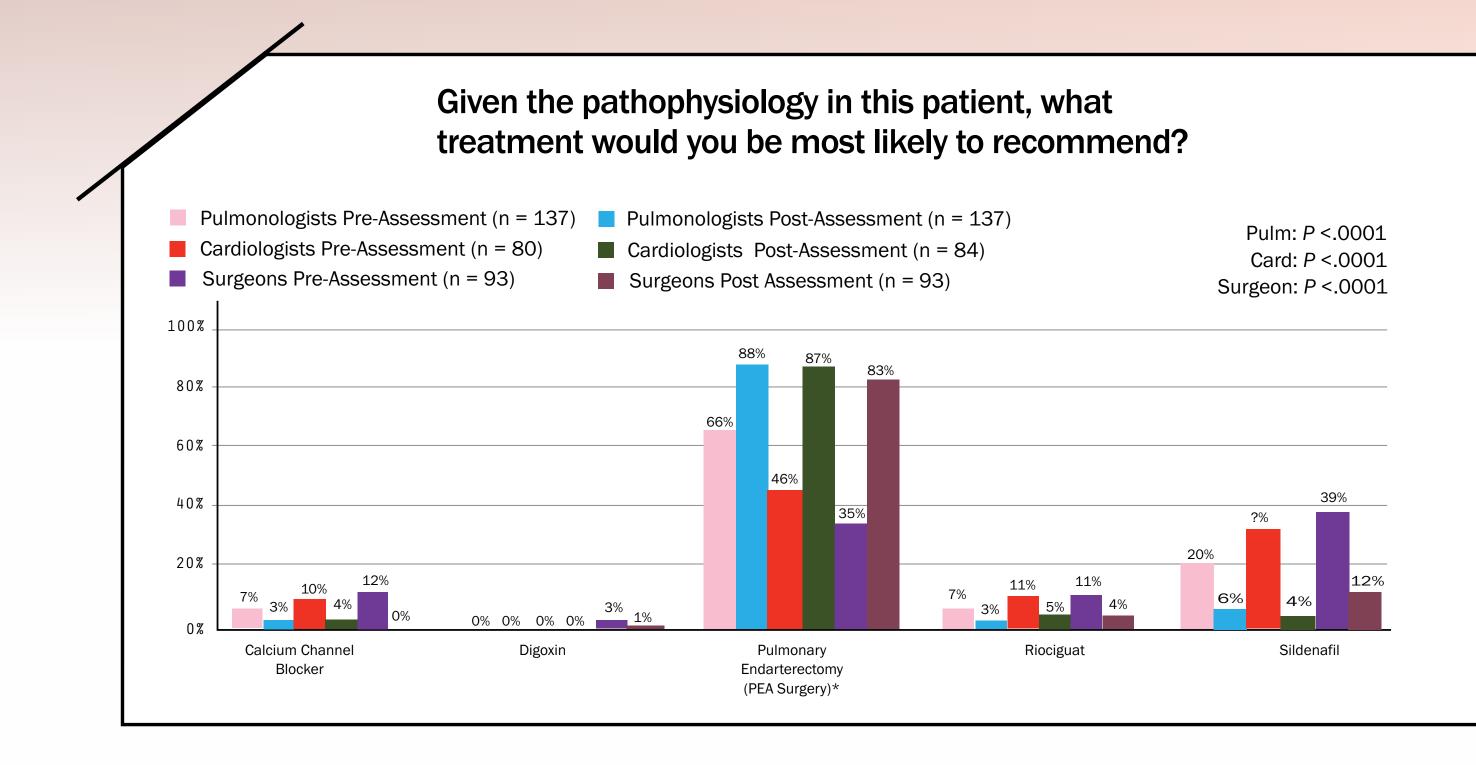


#### Figure **2**a

#### **Selection of pulmonary endarterectomy surgery in eligible patients.**

Case Scenario: MD is a 67-year-old man who presents with progressing shortness of breath, especially upon exertion, over the past 6 months despite treatment for chronic obstructive pulmonary disease. He has a history of hypertension (controlled) and pneumonia 1 year prior. He reports a sedentary lifestyle, including minimal exercise. Patient denies any chest pain, edema, dizziness, syncope, snoring, current smoking (quit 5 years prior), asthma symptoms, excessive drowsiness, or previous history of pulmonary embolism or deep vein thrombosis. Physical exam and laboratory testing show no evidence of any abnormalities. Additional studies produce a diagnosis of CTEPH with the following significant findings: · Right heart catheterization: pulmonary artery pressure 84/30 (mean 56) mm Hg, pulmonary capillary wedge pressure 9 mm Hg, mean right artery pressure 10 mm Hg, and cardiac index  $2.3 \text{ L/min/m}^2$ 

angiography and pulmonary arteriogram: evidence of abnormalities in multiple lobar vessels and the presence of mosaic perfusion, post-stenotic dilation, and intravascular webs



In total, 547 pulmonologists, cardiologists, and surgeons who participated in the activities and answered pre- and postassessment questions associated with the 2 activities were analyzed. Compared with the baseline assessment, significant improvements were found as a result of participation in the 2 educational interventions, with effect sizes of 0.45 (moderate impact, *P* < .0001) and 0.29 (relatively strong impact, *P* < .0001). Specific areas of improvements include:

FIGURE 2B

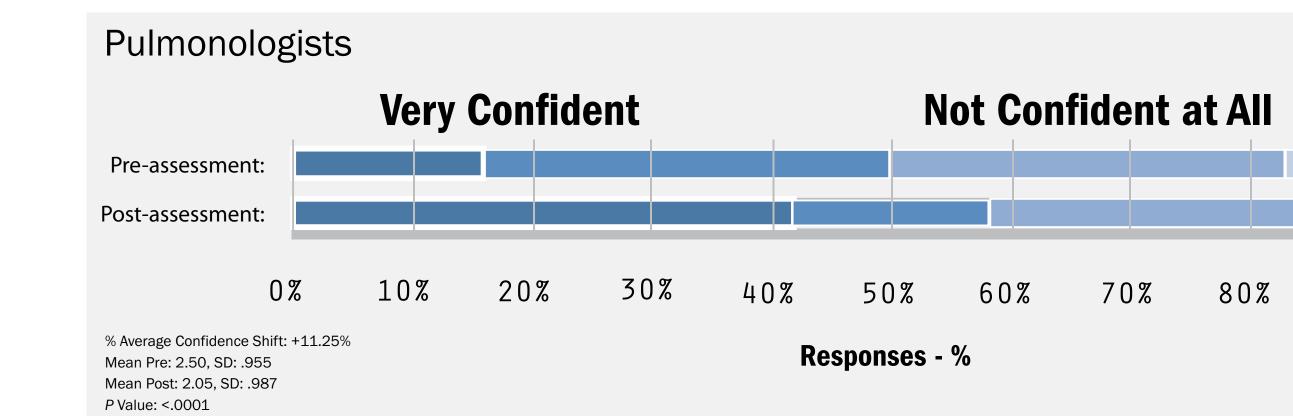
#### Selection of appropriate medical therapy in a patient with persistent pulmonary hypertension AFTER PULMONARY ENDARTERECTOMY.

# After the patient was treated with the approach selected previously, he continued to have significant pulmonary hypertension and exertional dyspnea. What treatment option would you be most likely to consider? ionologists Pre-Assessment (n = 137) 📃 Pulmonologists Post-Assessment (n = 137) Cardiologists Pre-Assessment (n = 80) Cardiologists Post-Assessment (n = 84) Surgeons Pre-Assessment (n = 93) Surgeons Post Assessment (n = 93) Bosental Epoprostenol available/necessary

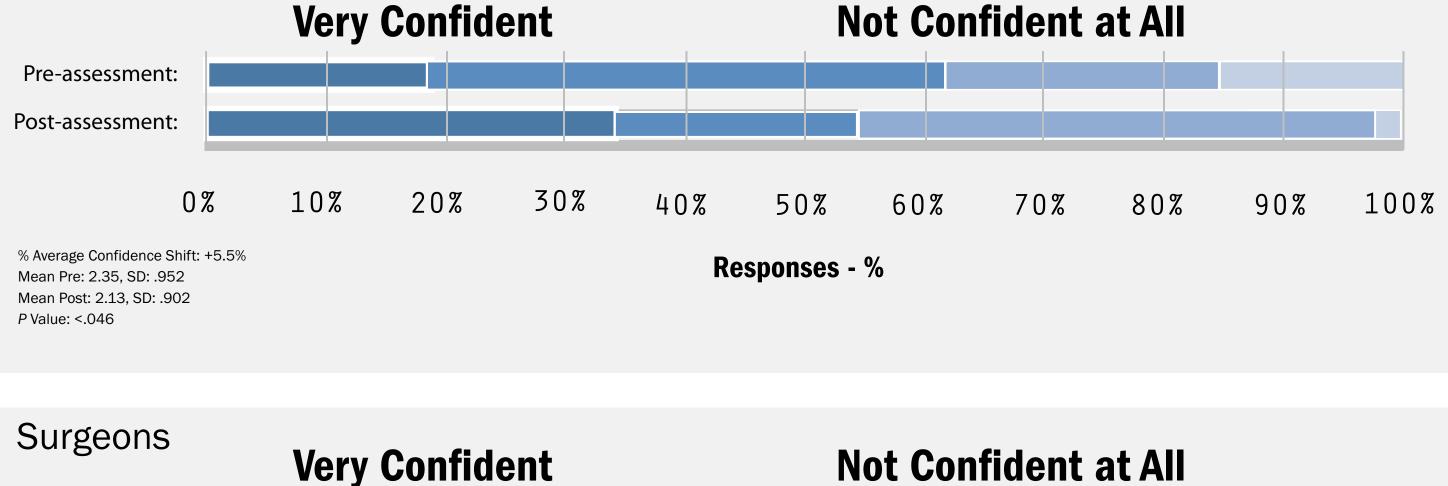
FIGURE 3

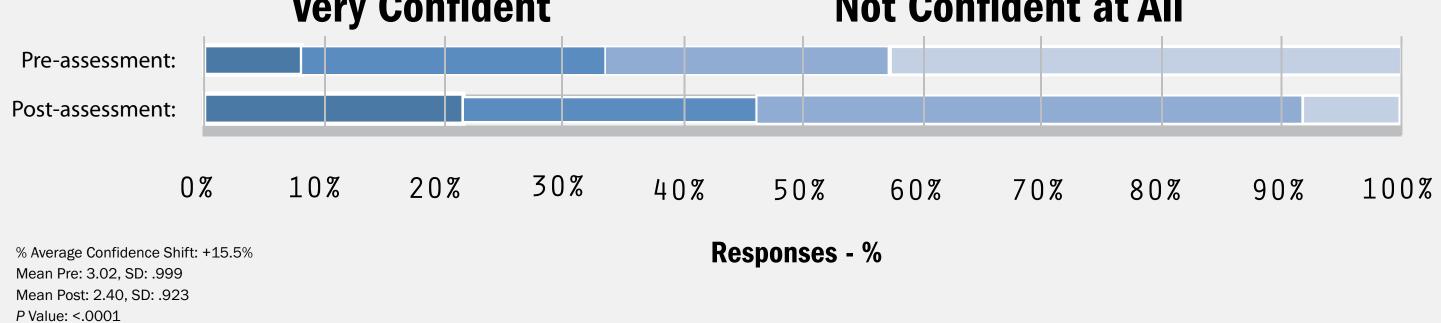
LEVEL OF CONFIDENCE IN MAKING CLINICAL DECISIONS.

How confident are you in the patient management decisions you have made for the clinical case scenarios? (Select ranking from 1 [Very confident] to 4 [Not confident at all])



Cardiologists

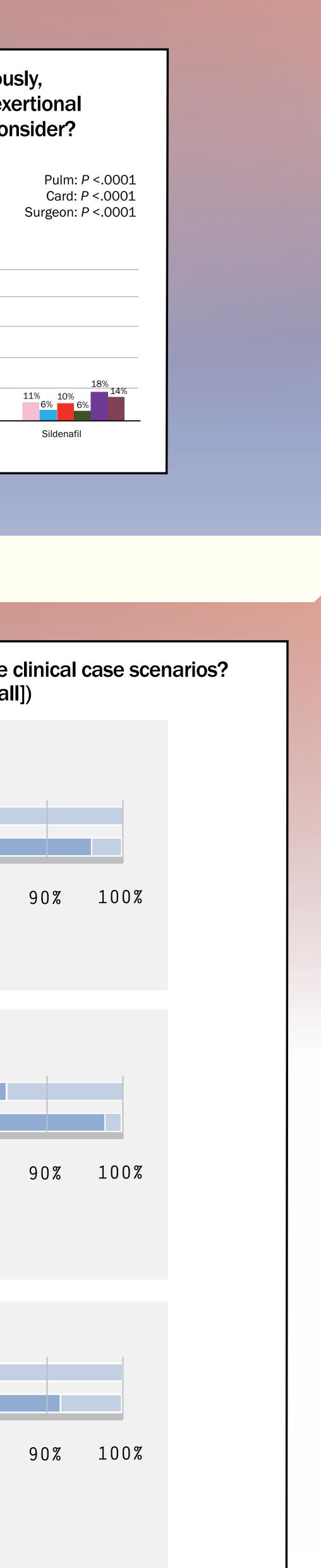






 In a patient with confirmed pulmonary hypertension, mo physicians appropriately selected ventilation-perfusion scan to identify CTEPH (11% pulmonologists, P < .0001; 19% cardiologists, *P* = .0011; 23% surgeons, *P* < .0275 [Figure 1]).

• Compared with baseline, 22% more pulmonologists (P < .0001), 41% more cardiologists (*P* < .0001), and 48% more surgeons (P < .0001) correctly identified pulmonary endarterectomy as the treatment of choice in a patient with CTEPH and suitable for surgery (Figure 2A).



- Compared with baseline, 35% more pulmonologists (*P* < .0001), 52% more cardiologists (*P* < .0001), and 47% more surgeons (P < .0001) correctly selected riociguat as an appropriate treatment for a patient with persistent pulmonary hypertension after pulmonary endarterectomy (Figure 2B).
- Physician confidence improved in making patient management decisions from pre-assessment to postassessment (pulmonologists: *P* < .0001, % average confidence shift: +11.25%; cardiologists: P <.046, % average confidence shift: +5.5%; surgeons: *P* <.0001, % average confidence shift: +15.5% [Figure 3]).

## CONCLUSIONS AND CLINICAL IMPLICATIONS:

This study demonstrated the success of targeted educational interventions on improving the practice patterns of pulmonologists, cardiologists, and surgeons in their approach to CTEPH. These metrics provide strong evidence that online, video-based instruction that includes problem-solving processes and identifies practical strategies leads to improvement in physician performance. Statistically significant improvements in management of CTEPH are expected to result in more evidence-based clinical decisions and improvements in patient care and outcomes.

#### References

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