REAL MEASURE

Recognizing Pulmonary Arterial Hypertension in the Primary Care Setting - Outcomes Report

Curriculum Activities Measured:	**Launch Date**
A Breath of Fresh Air: Improving outcomes and quality of life in patients with pulmonary arterial hypertension	Oct 7, 2011
Post Curriculum Assessment	Oct 27, 2011

Date of Final Outcomes Report: Feb 11, 2013

Background: This curriculum consists of one online "virtual grand rounds" educational activity, *A Breath of Fresh Air: Improving Outcomes and Quality of Life in Patients with Pulmonary Arterial Hypertension.* The principal audience for this curriculum includes primary care providers (PCPs) and other healthcare professionals who manage patients with pulmonary arterial hypertension (PAH).

Method: To establish a baseline Performance score, curriculum participants were presented with the RealIndex at the beginning of the activity. The RealIndex includes a clinical vignette followed by a series of statements for learners to categorize as either consistent or non-consistent with their current clinical approach. Learners were also presented with this measure at the end of the activity and in the Post Curriculum Assessment (PCA), which was delivered to learners eight weeks after activity completion. In addition, the activity includes a unique matched set of Pre-Test and Post-Test questions assessing Knowledge, Competence, and Confidence domains, as well as learner practice patterns. Retention data was measured by the PCA, which includes the RealIndex in addition to questions previously presented in the activity.

Results: Statistically significant learner improvement was measured across the activity over all learner-domains: Knowledge, Competence, Confidence, and Performance (as measured by the RealIndex and practice questions). Increases in the activity translated to improvement on all items mapped to the Learning Objectives and subject areas identified by the curriculum. The PCA showed net gains from Pre-Test in Knowledge, Competence, Confidence, and on the practice question eight weeks after activity completion; a net gain from baseline was also demonstrated on the RealIndex.

Conclusions: The results support the effectiveness of this curriculum for improving and sustaining learner Knowledge, Competence, Confidence, and Performance. Learners who participated in the PCA demonstrated a significant net gain on the RealIndex from baseline through follow-up. Increases on the RealIndex correlate with learners' self-reported changes in practice strategy at follow-up (PCA), and are indicative of the curriculum's positive impact on how participants manage their patients with pulmonary arterial hypertension.

Performance Score: RealIndex®

The RealIndex is a composite score based on a multidimensional situation-based question that addresses the Learning Objectives of the curriculum. Participants in this curriculum were presented with a real-to-life clinical scenario, which was followed by a series of statements that they assessed as either consistent with, or inconsistent with, their current practice approach. This multidimensional question assesses learners' knowledge of the latest published data, assessment and diagnostic tools, pertinent clinical guidelines, and their ability to actively apply this knowledge to the scenario presented. It is administered prior to the first activity of the curriculum (baseline), following each activity of the curriculum, and then in a follow-up assessment (administered 6 to 8 weeks after curriculum completion). For each subsequent administration of the RealIndex question, learners were given the opportunity to refine their responses based on their progressive learning. The RealIndex Model is designed to align the progression of a learner's RealIndex from baseline through the multiple activities of a curriculum with the changes that the learner is making in their practice. Reliability analysis (Cronbach's alpha) was conducted on the RealIndex to assess the internal consistency of the items in the measure; results indicate a high level of reliability with alpha coefficients ranging from .715 to .838 (on a scale of 0 to 1.0).

Learner-Domain Analysis

In addition, each activity contains a variety of question types that focus on specific learner-domains:

1. Knowledge questions
2. Competence (case-based) questions
3. Confidence questions
4. Practice questions

All questions presented to the learner in the Pre-Test section are paired with the identical question in the Post-Test and Evaluation sections. All questions in the Pre-Test and Post-Test sections are tagged in the RealMeasure platform by question type and for particular Learning Objectives and subject areas. All learner-domains are measured cumulatively, across the curriculum, and in every activity.

Statistical Analysis

The data were analyzed using the *Statistical Package for Social Sciences* version 19.0 (*SPSS 19*; IBM Corporation, Somers NY). The data were first arrayed using frequencies. Questions were then reported and analyzed for Pre-Test and Post-Test comparisons employing a matched-pair methodology. Both dependent and independent samples t-tests were used to assess the differences between the mean evidence-based Pre-Test and Post-Test responses of the participants; differences were considered significant for *p*-values reaching .05 or less. Dependent t-test calculations were only conducted on matched-pairs of participant scores. Analyses of variance (ANOVAs) were carried out to assess differences between groups of learners (cohorts). Effect size was calculated using Cohen's *d* formula, and is expressed as a non-overlap percent or the percentage achieved by Post-Test compared to baseline performance. The Grubbs' test, also called the ESD (extreme studentized deviate) method, was used to determine the presence of statistically significant outliers or extreme scores to be considered for removal from the final data analysis.

Curriculum Report: Level 1 - Participation

Engagement

Intervention	Participants Started	Completed Content		Completed Post-Test		Certs Issued	
	N	N	%	N	%	N	%
A Breath of Fresh Air: Improving outcomes and quality of life in patients with pulmonary arterial hypertension	2672	1100	41	1045	39	877	32

General Participation:
- In total, there were 2,672 activity starts in the curriculum, which was an online educational activity that provided a grand rounds experience on pulmonary arterial hypertension, consisting of topic reviews and issue-based discussions by the activity's faculty.
- The activity was available on the Epocrates CME website and mobile application.
- An average of 41% of the participants completed the activity's content, 39% finished the Post-Test, and 33% claimed certificates.
  - The activity completion rate was higher for primary care providers (51%) compared to specialty groups (40%).
  - Among learners who started the Pre-Test, 67% completed the activity content, 66% finished the Post-Test, and 54% claimed a certificate.
- 56% of the total learner population identified themselves as primary care providers, 9% indicated their specialty as emergency medicine, 8% as cardiology, 4% as pulmonology, 4% as anesthesiology, 3% as general surgery, 2% as geriatrics, 2% as pediatrics, 2% as psychiatry, and the remaining 8% of learners identified a variety of other specialties.
- 49% of the total learner population indicated their profession as medical doctor (MD), 16% as physician assistant (PA), 14% as nurse practitioner (NP), 10% as nurse, 7% as medical student, 3% as doctor of osteopathic medicine (DO), and 1% as pharmacist.

Post Curriculum Assessment Participation:
- 158 participants started the PCA and 115 completed it.
- On average, participants completed the PCA 69 days after completing the activity.

Participants indicated that they were satisfied with the activity and the overall educational experience.

Sample comments include:

- "Detailed, comprehensive, and useful for primary practice. Thank you!"
- "Excellent, informative, and current evidence-based discussion."
- "Good case with a clear demonstration of the pathophysiology."
- "Great description of evaluation and treatment."
- "Helpful explanation of a very poorly understood disease."
- "Important subject matter – good article."
- "Good reminder of things I had forgotten."
- "Valuable CME for differential diagnosis."

The complete list of learner comments is available in the RealCME Reporting Tool.

Learners also indicated their satisfaction in the curriculum evaluation:

- On average, 89% of participants (N = 939) reported that the activity was relevant to their practice, and 77% indicated a high level of interest in the content presented.

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Curriculum Report: Level 3 - Knowledge

Curriculum Knowledge Questions

A Breath of Fresh Air: Improving outcomes and quality of life in patients with PAH
- Pathophysiologic mechanisms of pulmonary arterial hypertension include all of the following EXCEPT:
- Which of the following is a hallmark symptom of pulmonary arterial hypertension?
- Which of the following correctly identifies recommended follow-up for a patient with pulmonary arterial hypertension?

Change in Knowledge

Measures the change between the average score on Pre-Test Knowledge questions and the average score on Post-Test Knowledge questions across the activity.

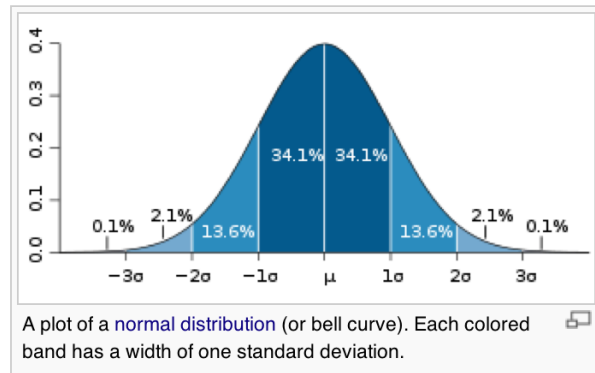| N	Pre-Test Average Score (SD)	Post-Test Average Score (SD)	% Change	P Value
1045	57.77% (28.93)	78.18% (23.30)	35.34	< .0005

SD = Standard Deviation
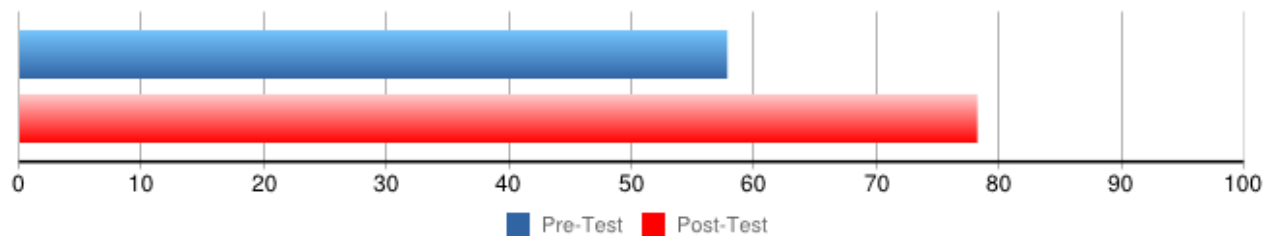
- When measured across the activity, from Pre-Test (58%) to Post-Test (78%), average scores on Knowledge questions (*N* = 1,045) increased by 35%; the change met statistical significance (*p* < .0005).

- Learner score dispersion, as indicated by the standard deviation statistics, improved from a high Pre-Test level (29) to a moderate level at Post-Test (23).

Statistical Note

Standard deviation is a widely used measure of variability or diversity in statistics and probability theory. It shows how much dispersion there is from the average (or mean). A low standard deviation indicates that the individual data points (scores) are very close to the mean, whereas a high standard deviation indicates that the data are spread out over a large range of values and suggests the presence of outliers or extreme scores. In a normal distribution, 68% of the scores fall within one standard deviation of the mean and

A plot of a normal distribution (or bell curve). Each colored band has a width of one standard deviation.

95% of the scores fall within 2 standard deviations. Often, educational measures are skewed with the majority of learners attaining lower scores at Pre-Test (a positive skew) and higher scores by Post-Test (a negative skew); thus, statistical methods standardize or normalize raw scores to assess significant differences between different distributions (e.g., Pre-Test vs. Post-Test).

In the case of the Knowledge domain, approximately 68% of learners' scores fell between 67% and 90% of the sum total score (100%) or within 23 points of the average Post-Test score (78%), which indicates a moderate level of individual score scatter around the reported mean (average score).

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Learning Objective Report

Measures the success of the curriculum in achieving each of the Learning Objectives of the curriculum. For each Learning Objective, the change between the average score on all Pre-Test and Post-Test questions that address that Learning Objective is measured across the activity.

- **Learning Objective 1:** Explain the pathophysiology of PAH
- **Learning Objective 2:** Determine when and how to screen patients for PAH
- **Learning Objective 3:** Describe current therapies in the management of PAH
- **Learning Objective 4:** Appropriately monitor patients receiving treatment for PAH

Parameter	N	Pre-Test Average Score	Post-Test Average Score	% Change	*P* Value
Learning Objective 1	1045	50.53% (50.02)	65.55% (47.54)	29.73	< .0005
Learning Objective 2	1045	79.38% (30.69)	87.75% (22.81)	10.55	< .0005
Learning Objective 3	1045	59.04% (29.31)	82.25% (26.41)	39.30	< .0005
Learning Objective 4	1045	41.05% (34.17)	79.00% (29.55)	92.42	< .0005

- Pre-Test to Post-Test average score changes on Knowledge and Competence items within the activity that were mapped to the Learning Objectives of the curriculum showed gains ranging from 11% to 92% that met statistical significance at the $p < .0005$ level ($N = 1,045$).

- Learners demonstrated average Pre-Test scores across the Learning Objectives that ranged from 41% to 79%, and average Post-Test scores that ranged from 66% to 88%.

- Questions associated with Learning Objective 4 demonstrated the greatest gain (92%) over the activity, increasing from 41% at Pre-Test to 79% at Post-Test.

- Questions associated with Learning Objective 2 demonstrated the least amount of gain (11%) and the highest average scores at Pre-Test (79%) and Post-Test (88%).

- Standard deviations improved but remained elevated across the activity, indicating a high level of individual score scatter.

Curriculum Competence Questions

**A Breath of Fresh Air: Improving outcomes and quality of life in patients with PAH**
- A 57-year-old woman presents to your office complaining of dyspnea on exertion, fatigue, and swelling in her feet. She is obese (BMI 31 kg/m2) and has a history of hypertension, controlled with medication (hydrochlorothiazide 25 mg/d). On physical examination, blood pressure is 134/78 mmHg, chest is clear to auscultation, and heart sounds and rhythm are normal. Chest X-ray is clear and ECG and cardiac stress test are WNL. Pulmonary function tests identify slightly reduced total lung capacity and DLCO; other findings are WNL. What might be an appropriate next step in the management of this patient?
- The patient from the previous question (57-year-old woman with dyspnea on exertion, fatigue, and swelling in her feet) returns following referral for echocardiography and right heart catheterization. Echocardiogram suggested PAH and right heart catheterization findings included mean pulmonary artery pressure 28 mmHg, pulmonary capillary wedge pressure 12 mmHg, and negative vasodilator response. Based on results of these tests, a pulmonary hypertension specialist diagnoses her with PAH. Any of the following medications may be appropriate at this time EXCEPT:

Change in Competence

Measures the change between the average score on the Pre-Test Competence question and the average score on the Post-Test Competence question across the activity.

N	Pre-Test Average Score (SD)	Post-Test Average Score (SD)	% Change	*P* Value
1045	59.04% (29.31)	82.25% (26.41)	39.30	< .0005

SD = Standard Deviation
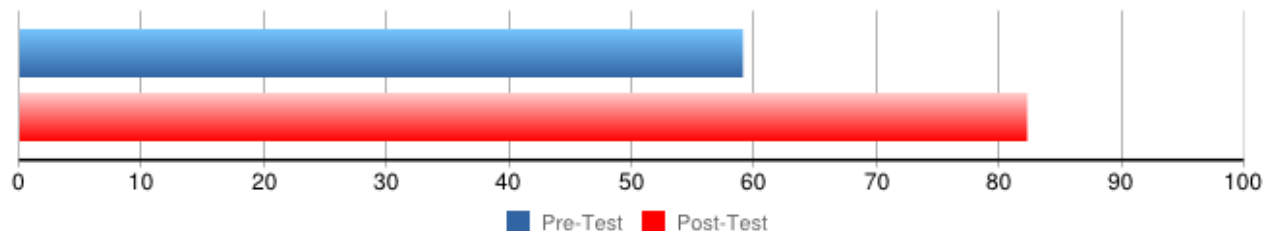
- The average score improvement on the case-based Competence items across the activity was 39%; this increase was statistically significant at the *p* < .0005 level (*N* = 1,045).
- Learner scores improved over the activity from a Pre-Test average of 59% to a Post-Test average of 82%.
- Standard deviations improved but remained high across the activity due to individual score dispersion.

Curriculum Confidence Question

A Breath of Fresh Air: Improving outcomes and quality of life in patients with PAH
- Please rate your confidence in your ability to recognize features that suggest pulmonary arterial hypertension (based on a scale of 1 to 5, with 1= "Not at all confident" and 5= "Very confident"). - Confidence level

Change in Confidence

Measures the change between the average score on the Pre-Test Confidence question and the average score on the Post-Test Confidence question across the activity.

N	Pre-Test Average Score (SD)	Post-Test Average Score (SD)	% Change	*P* Value
961	2.65 (1.03)	3.85 (0.86)	45.37	< .0005

SD = Standard Deviation
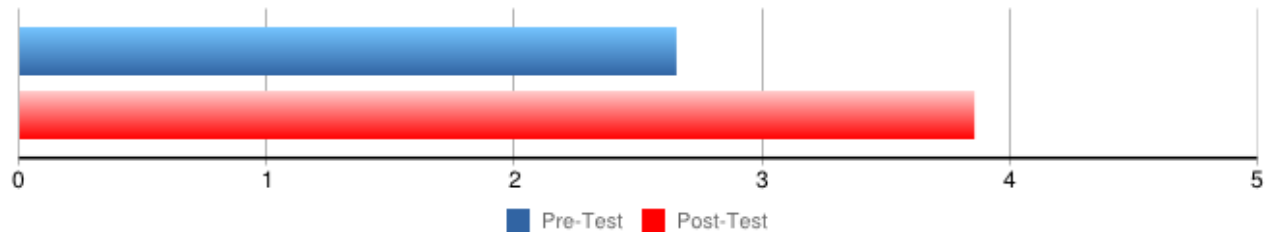
- The substantial 45% average increase on the learner-reported Confidence item (*N* = 961) over the activity was statistically significant (*p* < .0005).
- Learner ratings improved from a 2.7 Pre-Test average (on a Likert scale that ranges from 1 = *Not confident* to 5 = *Very confident*) to a Post-Test average of 3.9.
- Standard deviations improved from a moderate Pre-Test level to a low level at Post-Test.

Performance: RealIndex®

A 52-year-old Caucasian man presents to your office complaining of shortness of breath and dyspnea on exertion. On questioning, he also reports occasional syncope when exerting himself. His medical history is significant for hypertension, dyslipidemia, and previous smoking (12 pack-years, quit 10 years ago). His BMI is 29 kg/m^2 and blood pressure, 134/88 mmHg. Physical examination finds lungs clear to auscultation and normal heart sounds. Current medications include lisinopril 20 mg qd and simvastatin 20 mg qd.

Consistent	Not Consistent
Order chest X-ray	If PFTs suggest pulmonary arterial hypertension, then initiate empiric therapy with calcium channel blockers
Order ECG and exercise stress test	Order screening echocardiogram based on history and presenting symptoms
Perform pulmonary function tests	If echocardiogram suggests pulmonary arterial hypertension, then initiate empiric therapy with calcium channel blockers
If initial workup does not identify definitive etiology of symptoms, then order echocardiogram with pulmonary pressures	Initiate trial of a long-acting bronchodilator and inhaled corticosteroid
If echocardiogram suggests pulmonary arterial hypertension, then refer for right heart catheterization	

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Performance Change

Measures the change and difference (effect size) between the average RealIndex score of curriculum participants at baseline (before participating in the activity) and the average RealIndex score of participants after the activity.

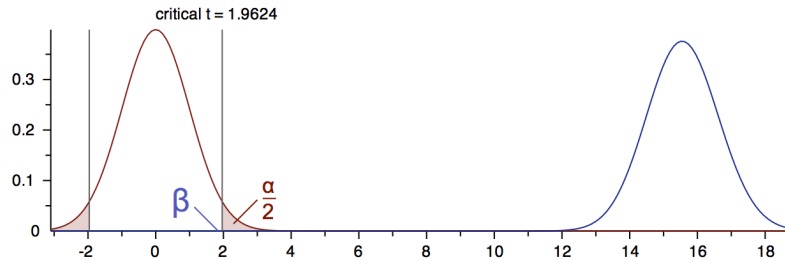|	Intervention				Intervention Effect		
N	Baseline Average Score (SD)	Final Activity Average Score (SD)	% Change	*P* Value	Average Effect Size	% Non-Overlap Baseline - Final Activity	Power
963	59.55% (23.31)	71.15% (22.95)	19.47	< .0005	0.501	33.59	1.000

SD = Standard Deviation
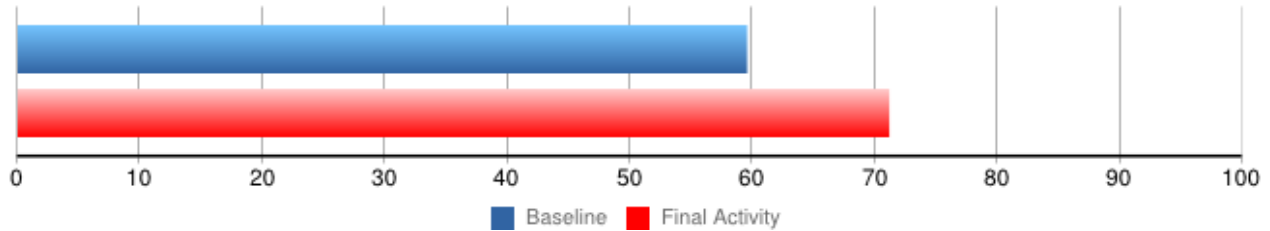
- Participants' average Performance score, based on the RealIndex, increased from 60% at baseline to 71% at the conclusion of the activity (*N* = 963). This 19% improvement in Performance reached statistical significance (*p* < .0005).
  - A significant 23% net gain (*p* < .0005) in Performance from baseline to the Post Curriculum Assessment (PCA) was also shown for learners (*n* = 112) who participated in the follow-up, eight weeks after completing the activity.
- The curriculum had a medium effect (*d* = .501) on learners' Performance, which equates to a 34% non-overlap between RealIndex distributions measured at baseline and at the end of the activity. The difference (non-overlap) found between the two distributions of learners' Performance scores represents the relative amount of improvement that occurred on the RealIndex over the activity.
- Standard deviations across the activity reflected a moderate level of individual score scatter, indicating that the average Performance scores are accurate representations of most learners.
- The learners that started but did *not* complete the activity (*n* = 850) demonstrated a significantly lower average baseline score (49%) when compared to the learners who completed the activity (*p* < .0005).

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Statistical Note

critical t = 1.9624

RealIndex Curriculum Effect Size & Power T-Value Graph

The graph above depicts a measure of distance between the two learner t-score distributions and incorporates information about the variability, sample size, power, and effect size of the curriculum.

The red bell-curve line in the graph represents the baseline RealIndex distribution; the blue line represents the final RealIndex distribution. The red shaded areas delineate the probability of a type I error (falsely rejecting the null hypothesis—represented by the *p*-value).

The critical t-values (at approximately -2 and 2) are based on the dependent t-test and represent the values at which the null hypothesis (representing no significant change) can be rejected; therefore, the larger the effect size and the larger the power, the less overlap between the two distributions and the greater the probability that the curriculum has to reject the null hypothesis when it is false.

In this case, the curriculum had a medium effect on learner Performance from baseline, and achieved a high level of power (1.000). Since the entire final RealIndex distribution is positioned well to the right of the rejection region and statistical significance was met ($p < .0005$), the alternative hypothesis can be accepted; the completion of the intervention resulted in positive changes in learner Performance.

Curriculum Report: Level 5 - Performance

Curriculum Practice Question

**A Breath of Fresh Air: Improving outcomes and quality of life in patients with PAH**
- How often do you request echocardiogram for workup of patients who have otherwise unexplained shortness of breath (based on a scale of 1 to 5, with 1= "Never" and 5= "Always")? - Frequency of use

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Change in Practice

Measures the change between the average score on the Pre-Test practice question and the average score on the Post-Test practice question across the activity.

N	Pre-Test Average Score (SD)	Post-Test Average Score (SD)	% Change	*P* Value
961	3.60 (1.19)	4.16 (0.99)	15.36	< .0005

SD = Standard Deviation
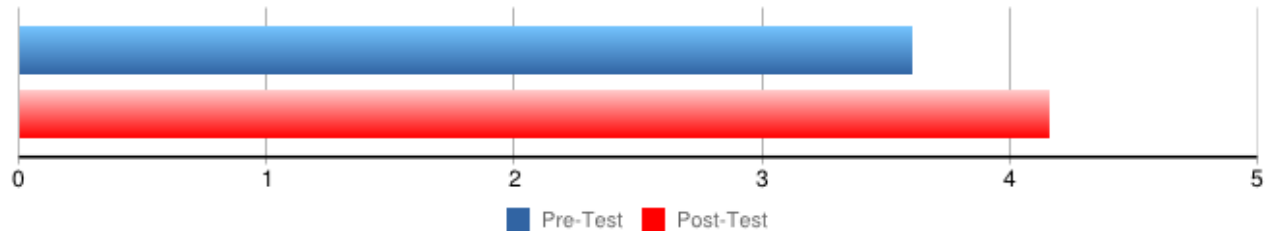
- A statistically significant ($p < .0005$) 15% increase was measured on the self-reported practice item across the activity ($N = 961$).
- Learner ratings improved from a Pre-Test average of 3.6 (on a Likert scale that ranges from 1 = *Never* to 5 = *Always*) to a Post-Test average of 4.2.
- Standard deviations were moderate and improved across the activity.

Learner Cohort Comparison Analysis: By Profession

This report compares the performance of different specified learner cohorts throughout the curriculum in the Knowledge, Competence, Confidence, and Performance domains.

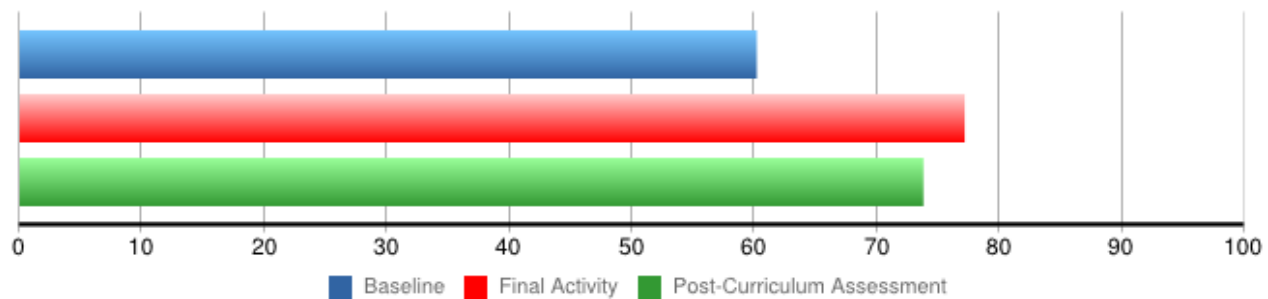|	Medical Doctor			Physician Assistant			Nurse Practitioner		
	Pre-Test	Post-Test	% Change	Pre-Test	Post-Test	% Change	Pre-Test	Post-Test	% Change
N		326			82			87	
Knowledge	60.22%	80.47%	33.62%	56.91%	80.89%	42.14%	52.87%	78.93%	49.28%
Competence	64.72%	90.49%	39.81%	52.44%	77.44%	47.67%	52.30%	77.01%	47.25%
N		302			78			78	
Confidence	2.86	4.05	41.60%	2.28	3.58	56.74%	2.32	3.59	54.70%
Practice	3.91	4.37	11.95%	3.44	3.90	13.43%	3.40	4.08	20.00%
N		304			78			78	
Performance	61.49%	74.75%	21.56%	60.26%	71.35%	18.40%	61.76%	71.55%	15.86%

- This activity was targeted towards primary care providers (PCPs) who manage patients with PAH. This report compares the proficiency of different PCP professionals (MDs, PAs, and NPs), all of which demonstrated significant gains ($p < .0005$) across the activity in each of the learning domains.

- In Knowledge, the average Pre-Test score of MDs was higher than that of NPs (which was significant, $p = .001$) and PAs (non-significant). Due to the greater gains achieved by PAs and NPs, Post-Test scores of all three cohorts were comparable.

- On Competence and Confidence items, the average scores of MDs were significantly higher than those of NPs and PAs at Pre-Test and Post-Test ($p \leq .002$).

- On the practice question, the average Pre-Test rating of MDs was significantly higher ($p < .0005$) than the average ratings of NPs and PAs. NPs demonstrated the greatest rating increase across the activity, resulting in a Post-Test average that was comparable to that of MDs; the Post-Test score difference between MDs and PAs, however, remained significant ($p < .0005$).

- On the RealIndex, no significant differences were measured among the cohorts at baseline and at the end of the activity.

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Performance Change Retention

Measures the change and effect size between the average RealIndex net score of curriculum participants at baseline (before participating in the activity) and the average RealIndex score of participants engaging in the Post Curriculum Assessment (PCA) survey, typically delivered 60 to 90 days after completion of the curriculum. This report also measures the average RealIndex score change from baseline to the final RealIndex, and the change and effect size from the final average RealIndex score in the curriculum to the average RealIndex score at the PCA.

Parameter	N	Retention			Retention Effect		
		Average Score (SD)	% Change (*P* Value)	Net % Change (*P* Value)	Effect Size	% Non-Overlap	Net % Non-Overlap
Baseline RealIndex	112	60.17% (21.67)	-	-	-	-	-
Final RealIndex	112	77.14% (18.56)	28.21 (<.0005)	NA	.182	12.86%	-
PCA RealIndex	112	73.78% (18.84)	-4.36 (0.014)	22.61 (<.0005)	.655	-	40.48%

Legend: Baseline ■ (blue) ■ Final Activity (red) ■ Post-Curriculum Assessment (green)

- Learners who participated in follow-up (measured by the PCA) delivered eight weeks after the completion of the activity (*n* = 112) showed a significant (*p* < .0005) 23% net gain in the RealIndex from baseline (60%) to the PCA (74%).

- A 40% non-overlap was measured between baseline and PCA RealIndex score distributions, which indicated that the curriculum had a medium-to-large net effect (*d* = .655) on learners' Performance.

- PCA participants' final RealIndex demonstrated a significant (*p* = .014) 4% decrease from the conclusion of the activity (77%) to the PCA. The 13% non-overlap in the learner Performance score distributions at the conclusion of the activity and in the PCA indicated a small effect (*d* = .182) on Performance.

- Standard deviations for PCA participants were moderate over the activity and at follow-up.

Curriculum Retention Report

This report measures only the matched responses of participants who completed questions in the curriculum *and* in the Post Curriculum Assessment (PCA). The average Pre-Test scores are compared to the average PCA scores to calculate the net percent change for all learning domains. The change between average Pre-Test and Post-Test scores is also calculated across learner-domains, for PCA participants only.

Parameter	N	Retention			% Change	
		Pre-Test Average Score (SD)	Post-Test Average Score (SD)	PCA Average Score (SD)	Post-Test to PCA (*p*-value)	Pre-Test to PCA (*p*-value)
Knowledge	108	56.21% (28.56)	77.45% (23.55)	58.50% (32.03)	-24.48 (< .0005)	4.06 (0.480)
Competence	112	61.16% (29.80)	87.50% (21.75)	67.41% (30.54)	-22.96 (< .0005)	10.22 (0.071)
Confidence	105	2.57 (1.03)	3.82 (0.76)	3.52 (0.81)	-7.73 (0.002)	37.04 (< .0005)
Practice	105	3.53 (1.12)	4.20 (0.87)	3.74 (0.94)	-10.88 (< .0005)	5.93 (0.065)

Knowledge
- PCA participants (*n* = 108) demonstrated a modest non-significant net gain (4%) in Knowledge from the average Pre-Test score (56%) to the PCA (59%).
- A significant 24% decrease (*p* < .0005) was observed from the average Post-Test score (77%) to the PCA.
- Standard deviations were elevated at Pre-Test and in the PCA, indicating a high level of individual score scatter affecting the average Knowledge scores.

Competence
- Learners' (*n* = 112) average Competence Pre-Test score (61%) showed a non-significant 10% net gain from Pre-Test to the PCA (67%).
- A significant 23% decrease (*p* < .0005) was measured from the average Post-Test score (88%) to the PCA.
- Standard deviations indicated a high level of individual score scatter at Pre-Test and in the PCA.

Confidence
- A significant 37% average net gain (*p* < .0005) was measured on the learner-rated Confidence question (*n* = 105) from Pre-Test (2.6 on a Likert scale) to the PCA (3.5).
- A significant 8% decline (*p* = .002) was observed from the average Post-Test rating (3.8) to the PCA.
- The moderate standard deviation at Pre-Test improved to a low level at Post-Test and in the PCA.

Practice
- A non-significant net gain of 6% was measured on the learner-reported practice question for PCA participants (*n* = 105) from the average Pre-Test rating (3.5 on a Likert scale) to the PCA (3.7).
- The change from the average Post-Test learner rating (4.2) to the PCA indicated a significant decrease of 11% (*p* < .0005).
- Standard deviations were moderate across the curriculum through follow-up.

Curriculum Patient Reach

This report presents the estimated patient reach of the curriculum.

Participants (N)	1,100
	Patient Reach Range
Monthly	2,375 – 7,593
Yearly	19,950 – 63,779

- Learners (*N* = 113) were asked to complete an item in the Post Curriculum Assessment requesting that they approximate the number of patients with symptoms of PAH that they see in their practice on a monthly basis by selecting a range. The resulting response distribution from this self-reported question was then applied to participants who completed the activity content (*N* = 1,100). The results indicate that this curriculum has the potential to affect the care of:
  - 2,375 – 7,593 patients on a monthly basis
  - 19,950 – 63,779 unique patients on an annual basis, based on the assumption that 30% of patients will be seen more than once a year by their clinician

Conclusions

This curriculum is effective at demonstrating improvements at Moore's Levels 1-5.

- **Level 1:** Participation
    - 2,672 learners participated in this curriculum
    - 41% of the total population of participants completed the activity's content and 39% finished the Post-Test. Among learners who started the Pre-Test, 67% completed the activity content and 66% finished the Post-Test
    - Based on participation levels, this curriculum has the potential to have an impact on the care of 19,950 – 63,779 unique patients with PAH annually

- **Level 2:** Satisfaction
    - Participants' comments and feedback indicate a high level of satisfaction with the activity and indicate that the curriculum was relevant to their practice

- **Level 3:** Knowledge
    - Participants show a statistically significant 35% increase in average Pre-Test to Post-Test Knowledge scores and a 4% net gain (non-significant) from Pre-Test to the Post Curriculum Assessment (PCA), eight weeks after curriculum completion

- **Level 4:** Competence and Confidence
    - Participants show a statistically significant 39% gain in average Pre-Test to Post-Test Competence scores and a 9% net gain (non-significant) from Pre-Test to the PCA
    - Participants demonstrate a statistically significant 45% improvement in average Pre-Test to Post-Test Confidence scores and a 36% net gain from Pre-Test to the PCA

- **Level 5:** Performance
    - RealIndex Performance scores improved significantly across the curriculum (19%) and a significant 23% net gain was measured from baseline to the PCA
    - Participants demonstrate a statistically significant 15% improvement on the practice strategy question from Pre-Test to Post-Test and a 5% net gain from Pre-Test to the PCA
    - Learners' reported improvement in practice strategy concerning the treatment of patients with PAH (measured across the activity to the PCA) correlates with Performance increases on the RealIndex from baseline to the PCA.

Conclusions

Further Conclusions:

- Learners demonstrated an average gain of 43% from Pre-Test to Post-Test on all Knowledge and Competence questions that were mapped to the four Learning Objectives identified in the curriculum.

- An analysis of learner engagement patterns revealed that only 42% of learners who started the curriculum completed the content and that most learner attrition occurred during the activity Introduction and Pre-Test. An analysis of learner demographics revealed that the activity completion rate was substantially higher among participants who indicated their profession as medical doctor (MD), physician assistant (PA), or nurse practitioner (NP) and who identified themselves as primary care providers. These learners also reported the highest level of interest and clinical relevance in the content, demonstrating that curriculum engagement is related to learner specialty and profession and the perceived relevance of the activity to participants' practice.

- The substantial increase observed in Confidence across the activity correlates with the improvement and high Post-Test score (92%) on the Knowledge question (Question: *Which of the following is a hallmark symptom of pulmonary arterial hypertension?* Answer: *Exertional dyspnea*) which also assessed learners' recognition of PAH symptoms. This observation highlights the improvement in learners' mastery and Confidence in PAH recognition resulting from their participation in the activity.

- Results from the Curriculum Retention Report show that although some slippage occurred from the time learners completed the activity to the PCA, net gains from Pre-Test were measured in Knowledge, Competence, Confidence, and on the practice item. A significant net increase was also measured in the RealIndex from baseline to the PCA. These results show that the curriculum produced sustainable gains that learners retained eight weeks after participating in the curriculum.

Application To Future Education

The results of this report suggest that future education should be considered in the following areas:

- Significant gains were shown on the Knowledge and Competence questions that were mapped to all of the Learning Objectives identified in the curriculum. However, learners' average Post-Test score in Learning Objective 1 (*Explain the pathophysiology of PAH*) remained low (66%). The low score in this Learning Objective resulted from learners' performance on the following Knowledge question: *Pathophysiologic mechanisms of pulmonary arterial hypertension include all of the following EXCEPT* (Answer: *Reduced production of vasoconstrictors*). This question also had the lowest score in the PCA (41%), suggesting that the pathophysiology of PAH remains a challenge for this population of learners, who would probably benefit from additional education on this topic to reinforce the gains achieved in the current activity and further improve their proficiency.

- The Curriculum Performance and Retention Reports showed a significant improvement in learner Performance that was sustained at follow-up. To better appreciate the specific improvements in Performance learners achieved in the activity, a statement-level analysis of the RealIndex was conducted. This analysis showed high final scores on statements relating to the screening of PAH, but comparatively low final scores on statements relating to the various pharmacological therapies for PAH (calcium channel blockers, long-acting bronchodilators, and inhaled corticosteroid). This observation suggests that this area represents an additional learning gap that could be the focus of future activities.