Updates in Nontuberculous Mycobacteria (NTM):
Best Practices for Diagnosis, Management and
Personalized Treatment Selection

Final Status Report
Live and Online Enduring Activity

This educational activity was supported by an educational grant from Insmed
Program Overview
The program is an innovative and multimedia live educational program held as an adjunct symposium to the American College of Chest Physicians Annual Meeting (CHEST 2019) and an online enduring activity based on that session. The goal of this live and online enduring program is to improve the awareness, knowledge, and competency of pulmonologists and infectious disease physicians in the diagnosis, management, and treatment of nontuberculous mycobacteria (NTM). The engaging multimedia program features expert faculty, a patient perspective video clip, interactive polling with immediate feedback, and infographic clinical reference aid to help attendees convert information into practice.

Learning Objectives
1. Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events.
2. Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation.

“All of the activity’s content was very important and interesting and the format and presentation was clear and easy to understand.”
- Online enduring participant
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Charles Daley, MD
Chief, Division of Mycobacterial & Respiratory Infections
Professor of Medicine
National Jewish Health
University of Colorado Denver
Denver, Colorado

Shannon H. Kasperbauer, MD
Associate Professor of Medicine
Division of Mycobacterial & Respiratory Infections
National Jewish Health
University of Colorado Denver
Denver, Colorado

Kenneth N. Olivier, MD, MPH
Senior Clinician
Pulmonary Clinical Medicine Section
National Institutes of Health
Bethesda, Maryland

Attendees overwhelmingly felt that the expert faculty were extremely effective with their presentation of the material.

For the Faculty Presenters, rate the effectiveness in communicating the key points of the presentation:

- Charles Daley: 96.03%
- Shannon Kasperbauer: 94.04%
- Kenneth Olivier: 93.38%

- Dr. Olivier: 3.97%
- Dr. Daley: 5.96%
- Dr. Kasperbauer: 6.62%

[Graph showing effectiveness ratings]

[Legend: Extremely effective, Somewhat effective, Not at all effective]
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Online Enduring Activity
Launched November 26, 2019


https://www.cmeuniversity.com/course/disclaimer/118954
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Online Enduring Activity
Additional Launch April 17, 2020

https://learning.freecme.com/a/34681P3qmCcG
Qualitative Educational Impact Summary: Final Online Enduring

<table>
<thead>
<tr>
<th>Participants</th>
<th>Educational Impact</th>
<th>Intended Practice Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>4,587 Learners</td>
<td>100% relative gain in participants’ ability to analyze recent evidence, guidelines and best practices for the diagnosis and treatment of NTM following the educational activity. [N=1286]</td>
<td>82% Reported that they intended to make changes to their practice following the activity [N=1162]</td>
</tr>
<tr>
<td>1,286 Completers</td>
<td>173% relative gain of participants’ ability to distinguish the appropriate personalized NTM treatment approach following the educational activity. [N=1286]</td>
<td>29% Identified changes related to diagnosis and treatment as the primary change they planned to make</td>
</tr>
<tr>
<td>Who see 17,790 NTM Patients Monthly</td>
<td>86% relative gain in participants ability to review strategies for patient adherence and treatment completion following the educational activity. [N=1286]</td>
<td>42% Listed treatment and management topics as their key take-away for this presentation</td>
</tr>
</tbody>
</table>
| Which translates to 213,480 Patient Visits Annually | *Numbers are based on post-test and evaluation survey data.  
*Learners include all three distribution partners and include those who visited the overview page  
*Completers include all three distribution partners |
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Quantitative Educational Impact Summary: Final Online Report

Participation
4,587 Learners, 1,286 Completers, 1,063 Certs

Learning Gains Across Objectives

- Analyze Evidence: 92% increase
- Personalize Treatment: 90% increase
- Improve Adherence: 91% increase

Intent to Change and Learner Needs

82% of learners stated they intend to make changes to their practice [N=1162]

- 29% improve process of diagnosis and treatment of NTM
- 18% apply overall knowledge and awareness of NTM
- 13% referral to specialist

Confidence @ Post-Test

- Very Confident: 24%
- Confident: 37%
- Neutral: 29%
- Not Confident: 10%

"Excellent program with information useful for non-pulmonologists." - Online enduring participant

Overall 117% relative gain in knowledge across all learning objectives combined.

Impact 213,480 Patients this year

*Note: Data not available for all 4,587 learners.
Level 1 Outcome: Participation Final Online Report

Participation by Designation

<table>
<thead>
<tr>
<th>Designation</th>
<th># of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD/DO</td>
<td>1054</td>
</tr>
<tr>
<td>PA</td>
<td>412</td>
</tr>
<tr>
<td>RN</td>
<td>187</td>
</tr>
<tr>
<td>NP</td>
<td>178</td>
</tr>
<tr>
<td>Student/Resident</td>
<td>102</td>
</tr>
<tr>
<td>PharmD</td>
<td>74</td>
</tr>
<tr>
<td>Consumer/Patient</td>
<td>42</td>
</tr>
<tr>
<td>Other</td>
<td>361</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2410</strong></td>
</tr>
</tbody>
</table>
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Level 1 Outcome: Participation Final Online Report

<table>
<thead>
<tr>
<th>Specialty</th>
<th># of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pulmonology</td>
<td>390</td>
</tr>
<tr>
<td>Family Medicine/General Practice</td>
<td>250</td>
</tr>
<tr>
<td>Infectious Disease</td>
<td>225</td>
</tr>
<tr>
<td>Internal Medicine</td>
<td>172</td>
</tr>
<tr>
<td>Emergency Medicine</td>
<td>116</td>
</tr>
<tr>
<td>Surgery</td>
<td>91</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>78</td>
</tr>
<tr>
<td>Cardiology</td>
<td>66</td>
</tr>
<tr>
<td>Obstetrics/Gynecology</td>
<td>51</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>46</td>
</tr>
<tr>
<td>Pathology</td>
<td>43</td>
</tr>
<tr>
<td>Dermatology</td>
<td>42</td>
</tr>
<tr>
<td>Radiology</td>
<td>38</td>
</tr>
<tr>
<td>Allergy/Immunology</td>
<td>38</td>
</tr>
<tr>
<td>Other</td>
<td>764</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2410</strong></td>
</tr>
</tbody>
</table>
Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events.

Distinguish appropriate personalized NTM treatment approach according to patient's clinical presentation.

Review strategies for patient adherence and treatment completion to improve patient outcomes.

Participants reported their confidence regarding each learning objective (confident – very confident):

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Before Presentation</th>
<th>After Presentation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review strategies for patient adherence and treatment completion to improve patient outcomes</td>
<td>33%</td>
<td>61%</td>
</tr>
<tr>
<td>Distinguish appropriate personalized NTM treatment approach according to patient's clinical presentation</td>
<td>31%</td>
<td>60%</td>
</tr>
<tr>
<td>Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events</td>
<td>34%</td>
<td>61%</td>
</tr>
</tbody>
</table>

Following the online activity, learners reported an 85% relative gain in confidence related to each of the stated learning objectives.
Level 2&3 Outcomes: Learning & Satisfaction

Analysis of participants responses related to educational needs
Participants reported the activity was “Excellent” to “Good” at:

- Improving your ability to treat or manage your patients: 91%
- Enhancing your ability to apply the learning objectives to practice: 92%
- Reinforcing and/or improving your current skills: 93%
- Meeting your educational needs: 94%

Participants reported high levels of satisfaction related to the ability of the activity to impact practical applications.
Level 3 and 4 outcomes were measured by comparing participants’ pre- and post-test answers. The attendees’ responses to these questions demonstrated that participants gained knowledge as a result of the activity.
Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Distinguish appropriate personalized NTM treatment approach according to patient's clinical presentation

Review strategies for patient adherence and treatment completion to improve patient outcomes

<table>
<thead>
<tr>
<th>Objective</th>
<th>Pre-test (N=1513)</th>
<th>Post-test (N=1286)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events</td>
<td>46%</td>
<td>92%</td>
</tr>
<tr>
<td>Distinguish appropriate personalized NTM treatment approach according to patient's clinical presentation</td>
<td>33%</td>
<td>90%</td>
</tr>
<tr>
<td>Review strategies for patient adherence and treatment completion to improve patient outcomes</td>
<td>49%</td>
<td>91%</td>
</tr>
</tbody>
</table>

Learning Gains By Objective
Level 3 Outcomes: Knowledge – Assessment Question 1 (Pre/Post-Test) (Online Enduring)

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q1: Which of the following symptoms were identified by a majority of NTM patients in a recent FDA patient-focused poll as having the most significant impact on their daily life?

- Chronic cough: 98%
- Weight loss: 20%
- Fever: 8%
- Chest pain: 4%

Question 1: Pre- and Post-test

- Chronic cough: 68% (Pre-test) vs. 98% (Post-test)
- Weight loss: 1% (Pre-test) vs. 20% (Post-test)
- Fever: 8% (Pre-test) vs. 0.7% (Post-test)
- Chest pain: 4% (Pre-test) vs. 0.7% (Post-test)

44% relative gain, 30% absolute gain
Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q2: Which of the following conditions has been associated with host susceptibility to NTM pulmonary disease?

- HIV/AIDS
- Interferon gamma receptor 1 defect
- Cystic fibrosis
- Lymphangioleiomyomatosis (LAM)

Question 2: Pre- and Post-test

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pre-test (N=1513)</th>
<th>Post-test (N=1286)</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV/AIDS</td>
<td>47%</td>
<td>4%</td>
<td></td>
</tr>
<tr>
<td>Interferon gamma receptor 1 defect</td>
<td>18%</td>
<td>3%</td>
<td></td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>30%</td>
<td>90%</td>
<td>200%</td>
</tr>
<tr>
<td>Lymphangioleiomyomatosis (LAM)</td>
<td>5%</td>
<td>3%</td>
<td></td>
</tr>
</tbody>
</table>

200% relative gain
60% absolute gain
Level 3 Outcomes: Knowledge – Assessment: Question 3 (Pre/Post-Test) (Online Enduring)

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q3: Which of the following drugs that are used to treat Mycobacterium avium pulmonary disease has the best correlation between in vitro resistance and treatment outcome?

- Clarithromycin
- Ethambutol
- Rifampin
- Clofazimine

Question 3: Pre- and Post-test

128% relative gain
50% absolute gain

Pre-test (N=1513) vs. Post-test (N=1286)
Level 3&4 Outcomes: Knowledge/Competence
Assessment: Question 4 (Pre/Post-Test) (Online Enduring)

Learning Objective: Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation

Q4: A 72-year-old woman with non-cavitary Mycobacterium avium complex pulmonary disease has remained sputum culture positive after 6 months of guideline-based treatment. Which of the following would be the most appropriate intervention?

- Add intravenous streptomycin to the regimen: 26% (Pre-test), 2% (Post-test)
- Add amikacin liposome inhalation suspension to the regimen: 37% (Pre-test), 94% (Post-test)
- Add oral moxifloxacin to the regimen: 27% (Pre-test), 2% (Post-test)
- Stop therapy because she has not culture converted: 10% (Pre-test), 2% (Post-test)

Question 4: Pre- and Post-test

154% relative gain
57% absolute gain
Level 3&4 Outcome: Knowledge/Competence
Assessment: Question 5 (Pre/Post-Test) (Online Enduring)

Learning Objective: *Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation*

Q5: Your patient is found to have M. abscessus subsp. abscessus pulmonary infection. She is an otherwise healthy 66-year-old female with weight loss, night sweats and cough. Her CT is notable for multiple small cavities in the right upper lobe. What is the most appropriate therapy?

<table>
<thead>
<tr>
<th>Option</th>
<th>Pre-test (N=1513)</th>
<th>Post-test (N=1286)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Begin oral azithromycin, ethambutol and rifampin</td>
<td>44%</td>
<td>5%</td>
</tr>
<tr>
<td>Begin oral azithromycin, ciprofloxacin and linezolid</td>
<td>17%</td>
<td>4%</td>
</tr>
<tr>
<td>Begin IV amikacin, IV imipenem, oral clofazimine and oral azithromycin</td>
<td>28%</td>
<td>85%</td>
</tr>
<tr>
<td>Recommend a right upper lobectomy</td>
<td>5%</td>
<td>11%</td>
</tr>
</tbody>
</table>

204% relative gain 57% absolute gain
Level 3 Outcome: Knowledge – Assessment: Question 6 (Pre/Post-Test) (Online Enduring)

Learning Objective: Review strategies for patient adherence and treatment completion to improve patient outcomes

Q6: The following measure will help improve adherence to therapy for M. abscessus pulmonary disease.

Question 6: Pre- and Post-test

- Administration of IV imipenem every 6 hours
  - Pre-test: 27% (N=1513)
  - Post-test: 49% (N=1286)
  - Relative gain: 86%
  - Absolute gain: 42%

- Stagger the introduction of antibiotics
  - Pre-test: 3% (N=1513)
  - Post-test: 91% (N=1286)
  - Relative gain: 86%

- Administration of IV amikacin daily
  - Pre-test: 24% (N=1513)
  - Post-test: 5% (N=1286)
Level 3 Outcomes: Knowledge – Interactive Polling Question 1 (Online Enduring)

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q1: Which of the following characteristics associated with NTM lung disease have not been associated with a worse prognosis?

- Male Sex: 53%
- Positive AFB smear: 20%
- Cavities: 13%
- Nodular Bronchiectasis: 14%

Polling questions were posed before the content.
Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q2: 23-year-old female with a cough for one year. Bronchoscopy negative for AFB, fungal, routine pathogens. Which diagnostic test will aid in the evaluation of possible M. abscessus lung disease?

Polling questions were posed before the content.
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 3 (Online Enduring)

Learning Objective: Review strategies for patient adherence and treatment completion to improve patient outcomes

Q3: The patient begins IV amikacin daily, IV imipenem every 8 hours, oral azithromycin daily and oral clofazimine daily. She develops tinnitus 3 weeks into treatment. How could you have avoided this side effect?

Polling questions were posed before the content.

- 25% Wait to begin the clofazimine until the IVs are complete
- 58% Dose the amikacin thrice weekly
- 16% Administer high dose vitamin D
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 4 (Online Enduring)

Learning Objective: Review strategies for patient adherence and treatment completion to improve patient outcomes

Q4: Which of the following factors would likely lead to the worst treatment outcome in this patient?

- Cavitary disease: 34%
- Bilateral disease: 19%
- Macrolide resistant disease: 32%
- Ethambutol resistant disease: 15%

Polling questions were posed before the content.

National Jewish Health
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 5 (Online Enduring)

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q5: Which of the following is the most common symptom related to use of amikacin liposome inhalation suspension?

- Cough: 32%
- Dyspnea: 16%
- Tinnitus: 26%
- Dysphonia: 25%

Polling questions were posed before the content.
An analysis of open-ended comments demonstrate the following changes learners intend to make (Online Enduring):

- Process of diagnosis and treatment of NTM: 29%
- Apply overall knowledge and awareness of NTM: 18%
- Referral to specialist: 13%
- Educating patients on side effects and compliance: 13%
- Proper medication regimen: 12%
- Identification of species through testing: 9%
- Use of amikacin liposome inhalation suspension: 3%
- Follow NTM guidelines for the management of NTM: 3%

N=1162
N=374
Program Evaluation (Online Enduring): An analysis of open-ended comments demonstrating the barriers that were addressed

- 64% felt that the activity addressed strategies for overcoming barriers to optimal patient care

N=1162

Existing barriers or challenges to implementing learning into practice

- Insurance Coverage/Cost (22 responses)
- Patient Adherence (24 responses)
- Time (3 responses)
- Access to Care (8 responses)

N=56
Program Evaluation (Online Enduring)

Take-Aways

- Referral to specialist (23 responses)
- Importance of species identification (21 responses)
- Recognition and overall understanding of NTM (118 responses)
- Diagnosis, treatment, and management strategies (187 responses)
- Medication management and regimen (58 responses)
- Updated guidelines for treatment and individualized care for patients (38 responses)

N=445

Most important take-away

N=1162

98%
- Material presented in an objective manner and free of commercial bias

97%
- Content presented was evidence-based and clinically relevant
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Program Evaluation (Online Enduring): Clinical Reference Aid

86% of participants are likely to use the clinical reference aid in their practice

N=1162
<table>
<thead>
<tr>
<th>What topics would you like more information about in future educational activities?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Autoimmune Disease</td>
</tr>
<tr>
<td>Lung Cancer</td>
</tr>
<tr>
<td>Coccidioidomycosis</td>
</tr>
<tr>
<td>Urology</td>
</tr>
<tr>
<td>Cardiology</td>
</tr>
<tr>
<td>Emergency Medicine</td>
</tr>
<tr>
<td>Tuberculosis</td>
</tr>
<tr>
<td>COVID-19 information and treatment</td>
</tr>
<tr>
<td>Skin manifestations of systemic diseases</td>
</tr>
</tbody>
</table>
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Live Symposia at 2019 CHEST Annual Meeting
Final Outcomes
Program Overview: LIVE Symposium
The program is an innovative and multimedia live educational program held as an adjunct symposium to the American College of Chest Physicians Annual Meeting (CHEST 2019) and an online enduring activity based on that session. The goal of this live and online enduring program is to improve the awareness, knowledge, and competency of pulmonologists and infectious disease physicians in the diagnosis, management, and treatment of nontuberculous mycobacteria (NTM). The engaging multimedia program features expert faculty, a patient perspective video clip, interactive polling with immediate feedback, and infographic clinical reference aid to help attendees convert information into practice.

Learning Objectives
• Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events.
• Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation.
• Review strategies for patient adherence and treatment completion to improve patient outcomes.
Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

Quantitative Educational Impact Summary: Live Symposium

Participation

Total Live Learners = 469

MD/DO: 81%
NP: 5%
RN: 1%
PA: 2%
Other: 11%

100% with a specialty in pulmonology

Learning Gains Across Objectives

- Analyze Evidence: 70% increase
- Personize Treatment: 46% increase
- Improve Adherence: 64% increase

Overall 20% relative gain in knowledge across all learning objectives.

Potential knowledge gap persists related to strategies for patient adherence and prognosis of NTM

- 35% were unable to review strategies for patient adherence

On follow-up, 74% of respondents indicated that patient adherence and treatment-related adverse events represented the greatest barriers toward optimal patient care.

Impact: 25,488* Patients this year

*Numbers are based on post-test and evaluation survey data N=151

Confidence @ Post-Test

- Very Confident: 28%
- Confident: 64%
- Neutral: 8%
- Not Confident: 0.4%

Barriers to Care

N=42
## Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

### Qualitative Educational Impact Summary: Live Symposium

<table>
<thead>
<tr>
<th>Participants</th>
<th>Educational Impact</th>
<th>Practice Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>469* Total Participants</td>
<td><strong>92%</strong> of participants reported that they were very confident or confident in their ability to analyze recent evidence, guidelines and best practices for the diagnosis and treatment of NTM following the educational activity.</td>
<td><strong>87.5%</strong> Reported that they had made changes to their practice as a result of the educational activity. N=40 for follow-up survey</td>
</tr>
<tr>
<td>Who see 531 NTM Patients Weekly</td>
<td><strong>90%</strong> of participants reported post-activity that they were very confident or confident in their ability to distinguish the appropriate personalized NTM treatment approach following the educational activity.</td>
<td><strong>100%</strong> Of those who had not yet made changes were very to somewhat likely to make practice changes.</td>
</tr>
<tr>
<td>Which translates to 12,744 Patient Visits over 6 Months; 25,488 Patient Visits Annually</td>
<td><strong>92%</strong> of participants reported post-activity that they were very confident or confident in their ability to review strategies for patient adherence and treatment completion following the educational activity.</td>
<td><strong>74%</strong> Listed patient adherence and treatment-related side effects as the biggest barriers toward optimal patient outcomes</td>
</tr>
</tbody>
</table>

*Numbers are based on post-test and evaluation survey data N=151.
Level 1 Outcome: Live Symposium Participation

Participation by Designation

<table>
<thead>
<tr>
<th>Designation</th>
<th># of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>MD/DO</td>
<td>381</td>
</tr>
<tr>
<td>NP</td>
<td>25</td>
</tr>
<tr>
<td>PA</td>
<td>9</td>
</tr>
<tr>
<td>RN</td>
<td>2</td>
</tr>
<tr>
<td>PharmD</td>
<td>2</td>
</tr>
<tr>
<td>Other</td>
<td>50</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>469</strong></td>
</tr>
</tbody>
</table>
## Level 2&3 Outcomes: Learning & Satisfaction

Participants reported their confidence regarding each learning objective (confident – very confident):

- **Review strategies for patient adherence and treatment completion to improve patient outcomes**: 92%
- **Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation**: 91%
- **Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events**: 93%

N=151

*Online activity will provide confidence data both pre- and post-activity*

Following the presentation, learners reported a high level of confidence related to each of the stated learning objectives.
Level 2&3 Outcomes: Learning & Satisfaction

Analysis of participants responses related to educational needs
Participants reported the activity was “Excellent” to “Good” at:

- Improving your ability to treat or manage your patients: 97%
- Enhancing your ability to apply the learning objectives to practice: 97%
- Reinforcing and/or improving your current skills: 98%
- Meeting your educational needs: 99%

Participants reported high levels of satisfaction related to the ability of the activity to impact practical applications.
Level 3 and 4 outcomes were measured by comparing participants’ pre- and post-test answers. The attendees’ responses to these questions demonstrated that participants gained knowledge as a result of the activity.
### Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

#### Level 3&4 Outcomes: Learning by Objective (Knowledge/Competence)

<table>
<thead>
<tr>
<th>Learning Objective</th>
<th>Pre-test (Avg. N=48)</th>
<th>Post-test (N=151)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Review strategies for patient adherence and treatment completion to improve patient outcomes</td>
<td>64%</td>
<td>65%</td>
</tr>
<tr>
<td>Distinguish appropriate personalized NTM treatment approach according to patient's clinical presentation</td>
<td>46%</td>
<td>70%</td>
</tr>
<tr>
<td>Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events</td>
<td>70%</td>
<td>78%</td>
</tr>
</tbody>
</table>

- **Post-test (N=151)**
- **Pre-test (Avg. N=48)**
Level 3 Outcomes: Knowledge – Assessment Question 1 (Pre/Post-Test)

**Learning Objective:** Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q1: Which of the following symptoms were identified by a majority of NTM patients in a recent FDA patient-focused poll as having the most significant impact on their daily life?

- Chronic cough: 100%
- Weight loss: 95%
- Fever: 3%
- Chest pain: 1%

**Question 1: Pre- and Post-test**

Learners possessed high baseline knowledge related to this question.

- **Pre-test (N=47):**
  - Chronic cough: 100%
  - Weight loss: 0%
  - Fever: 0%
  - Chest pain: 0%

- **Post-test (N=151):**
  - Chronic cough: 95%
  - Weight loss: 3%
  - Fever: 1%
  - Chest pain: 1%
Level 3 Outcomes: Knowledge – Assessment: Question 2 (Pre/Post-Test)

**Learning Objective:** Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

**Q2:** Which of the following conditions has been associated with host susceptibility to NTM pulmonary disease?

- HIV/AIDS
- Interferon gamma receptor 1 defect
- Cystic fibrosis
- Lymphangioleiomyomatosis (LAM)

**Question 2: Pre- and Post-test**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Pre-test (N=40)</th>
<th>Post-test (N=151)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HIV/AIDS</td>
<td>40%</td>
<td>31%</td>
</tr>
<tr>
<td>Interferon gamma receptor 1 defect</td>
<td>20%</td>
<td>18%</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
<td>40%</td>
<td>49%</td>
</tr>
<tr>
<td>Lymphangioleiomyomatosis (LAM)</td>
<td>0%</td>
<td>2%</td>
</tr>
</tbody>
</table>

23% relative gain
9% absolute gain
Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q3: Which of the following drugs that are used to treat Mycobacterium avium pulmonary disease has the best correlation between in vitro resistance and treatment outcome?

- Clarithromycin
- Ethambutol
- Rifampin
- Clofazimine

Question 3: Pre- and Post-test

- Clarithromycin: 70% Pre-test, 89% Post-test (27% relative gain, 19% absolute gain)
- Ethambutol: 6% Pre-test, 4% Post-test
- Rifampin: 24% Pre-test, 4% Post-test
- Clofazimine: 0% Pre-test, 3% Post-test (N=151)

Chart: Pre-test (N=49) vs Post-test (N=151)
Learning Objective: *Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation*

**Q4:** A 72-year-old woman with non-cavitary Mycobacterium avium complex pulmonary disease has remained sputum culture positive after 6 months of guideline-based treatment. Which of the following would be the most appropriate intervention?

- 26%: Add intravenous streptomycin to the regimen
- 70%: Add amikacin liposome inhalation suspension to the regimen
- 4%: Add oral moxifloxacin to the regimen
- 7%: Stop therapy because she has not culture converted
- 3%: 0%

**Pre-test (N=43)**: 24% relative gain, 17% absolute gain
**Post-test (N=151)**

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Updates in Nontuberculous Mycobacteria (NTM): Best Practices for Diagnosis, Management and Personalized Treatment Selection

[Final Live Report]
**Learning Objective:** Distinguish appropriate personalized NTM treatment approach according to patient’s clinical presentation

**Q5:** Your patient is found to have M. abscessus subsp. abscessus pulmonary infection. She is an otherwise healthy 66-year-old female with weight loss, night sweats and cough. Her CT is notable for multiple small cavities in the right upper lobe. What is the most appropriate therapy?

- Begin oral azithromycin, ethambutol and rifampin (34%)
- Begin oral azithromycin, ciprofloxacin and linezolid (27%)
- Begin IV amikacin, IV imipenem, oral clofazimine and oral azithromycin (30%)
- Recommend a right upper lobectomy (3%)

**Pre-test (N=53) vs Post-test (N=151):**
- **152% relative gain**
- **32% absolute gain**
Level 3 Outcome: Knowledge – Assessment: Question 6 (Pre/Post-Test)

Learning Objective: Review strategies for patient adherence and treatment completion to improve patient outcomes

Q6: The following measure will help improve adherence to therapy for M. abscessus pulmonary disease.

The ability to identify measures to improve adherence to therapy continues to represent a knowledge gap.
Level 3 Outcomes: Knowledge – Interactive Polling Question 1

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q1: Which of the following characteristics associated with NTM lung disease have not been associated with a worse prognosis?

- Male Sex: 67%
- Positive AFB smear: 14%
- Cavities: 0%
- Nodular Bronchiectasis: 19%

Polling questions were asked prior to the educational content.
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 2

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q2: 23-year-old female with a cough for one year. Bronchoscopy negative for AFB, fungal, routine pathogens. Which diagnostic test will aid in the evaluation of possible M. abscessus lung disease?

Polling questions were asked prior to the educational content.
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 3

Learning Objective: Review strategies for patient adherence and treatment completion to improve patient outcomes

Q3: The patient begins IV amikacin daily, IV imipenem every 8 hours, oral azithromycin daily and oral clofazimine daily. She develops tinnitus 3 weeks into treatment. How could you have avoided this side effect?

Polling questions were asked prior to the educational content.
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 4

**Learning Objective:** Review strategies for patient adherence and treatment completion to improve patient outcomes

**Q4:** Which of the following factors would likely lead to the worst treatment outcome in this patient?

- Cavitary disease: 23%
- Bilateral disease: 8%
- Macrolide resistant disease: 62%
- Ethambutol resistant disease: 7%

Polling questions were asked prior to the educational content.
Level 3&4 Outcomes: Knowledge/Competence – Interactive Polling Question 5

Learning Objective: Analyze recent evidence, guidelines, and best practices in the diagnosis, treatment, and management of NTM and adverse events

Q5: Which of the following is the most common symptom related to use of amikacin liposome inhalation suspension?

- Cough: 16%
- Dyspnea: 0%
- Tinnitus: 12%
- Dysphonia: 72%

Polling questions were asked prior to the educational content.
An analysis of open-ended comments demonstrate that completers plan to make changes in the following areas:

- **Follow guidelines and algorithms for treatment** (29 responses)
- **Use of inhaled amikacin** (25 responses)
- **Understanding of medication regimen** (19 responses)
- **Use of new treatment options** (11 responses)
- **Sensitivity testing** (11 responses)
- **Effective referrals to infectious disease** (10 responses)
- **Collaboration with lab to establish the species** (9 responses)
- **Frequent sputum induction cultures** (6 responses)
- **Screening of patients** (2 responses)
- **Consideration of surgery** (2 responses)
- **Team-based approach** (1 response)
- **Insurance coverage** (1 response)

Learners intend to make changes to practice as a result of the activity. N=127
Most important take-away

- Surgical option (6 responses)
- Overall management and understanding of NTM (39 responses)
- Use of inhaled amikacin (12 responses)
- Guidelines for treatment (38 responses)
- Treatment algorithms (20 responses)
- Importance of species identification (10 responses)

- Material presented in an objective manner and free of commercial bias 99%
- Content presented was evidence-based and clinically relevant 100%
- Activity addressed strategies for overcoming barriers to optimal patient care 90%

N=149

N=125
94% of participants are likely to use the clinical reference aid in their practice.
<table>
<thead>
<tr>
<th>What topics would like more information about in future educational activities?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bronchiectasis</td>
</tr>
<tr>
<td>NTM, when to treat</td>
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<tr>
<td>More information on newer medications</td>
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<tr>
<td>More clinical-based learning</td>
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<tr>
<td>Role of physiotherapy</td>
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<tr>
<td>Management of IPF</td>
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<tr>
<td>Case studies and examples</td>
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<tr>
<td>ILD</td>
</tr>
<tr>
<td>Updates on treatment</td>
</tr>
<tr>
<td>Lung nodule management</td>
</tr>
<tr>
<td>Cystic fibrosis</td>
</tr>
<tr>
<td>Non-pharmaceutical interventions</td>
</tr>
<tr>
<td>Management of side effects</td>
</tr>
</tbody>
</table>
Self-Reported Performance (Live Symposium)

Did this activity provide new ideas or information you have used in practice?

- Yes: 87.5%
- Haven't had an opportunity to implement changes in practice: 12.5%

N=40

What change will you incorporate into your practice as result of the knowledge acquired during the activity?

- Change my screening/prevention practice: 13%
- Incorporate different diagnostic strategies into patient evaluation: 27%
- Use alternative communication methodologies with patients and families: 12%
- Modify treatment plans: 42%
- Other: 6%

N=52

Those who haven’t made changes yet are somewhat to very committed to make changes (100%)
Did the activity provide information, education, tools or resources to be able to address any of those barriers?

- Yes: 65.0%
- No: 22.5%
- I did not experience any barriers: 12.5%

What barriers have you experienced since this activity that may impact patient outcomes or optimal patient care?

- Lack of evidence-based guidelines: 7.2%
- Lack of applicability of guidelines to my organizational or institutional setting: 6.0%
- Lack of time: 4.8%
- Patient adherence: 7.2%
- Treatment-related adverse events: 15.7%
- Staffing: 8.4%
- Patient knowledge: 4.8%
- Lack of training: 4.8%
- Cost of therapy: 9.6%
- Access to equipment: 2.4%
- None were identified: 6.0%
- Other: 1.2%

N=83

N=40
In which areas do you feel you need more education?

- Diagnosis of NTM (17 responses)
- Clinical features & risk factors for NTM (4 responses)
- Management of co-morbidities (10 responses)
- Treatment & emerging therapies (26 responses)
- Longitudinal management of NTM (18 responses)
- Multidisciplinary collaboration (11 responses)

Self-Reported Performance (Live Symposium)

2,418 Patients have benefited so far from this educational activity [Reported 6 weeks following activity]

N=86
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