EMPOWER

Engaging **M**ultidisciplinary Teams to Improve **P**atient **O**utcomes **W**ith NSCLC Using **E**ducational **R**esources

OUTCOMES REPORT–FEBRUARY 2015

CHEST AMERICAN COLLEGE of CHEST PHYSICIANS
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EXECUTIVE SUMMARY

The EMPOWER program was a year-long continuing medical education program that focused on improving the identification of optimal methods of diagnosis, staging, and treatment of NSCLC. In addition, the program focused on identifying and addressing barriers in community-based health systems affecting the collection of adequate lung samples, the diagnosis and staging of NSCLC, and the treatment of NSCLC with targeted therapies.

Supported by Pfizer, the program was a multidisciplinary collaboration between the American College of Chest Physicians, the American Society for Clinical Pathology, the University of Nebraska Medical Center, and the France Foundation. The EMPOWER program was implemented in five large health systems in the United States: The Johns Hopkins University, Duke University Medical Center, Texas Tech University Health Science Center, the University of Nebraska Medical Center, and Northwestern University Health System.

Program Description

The EMPOWER instructional design was intended to provide clinicians and institutions with tools to support NSCLC-related practice and system change beyond the year-long program implementation. The program employed four instructional strategies: (1) Systems-Based Assessment Survey, (2) a Train-the-Trainer program for the Coordinating Centers, (3) Coordinating/Satellite Center NSCLC webinars, and (4) Development of Systems-Based Action Plans. All aspects of curriculum development and instructional design were overseen by the EMPOWER Steering Committee, consisting of five additional national-level experts in NSCLC diagnosis, staging, and management.

The first education strategy, the EMPOWER Systems-Based Assessment Survey, was designed to assess the physician's individual and systems-based NSCLC practice in the United States. The Train-the-Trainer program was conducted with faculty from five Coordinating Centers, major medical centers that were selected based on regional prevalence of lung cancer and their prior interest or participation in lung cancer education efforts. In addition, each medical center selected up to five affiliated satellite sites, located in high-need areas, to participate in the program. The Satellite Centers, with support from Coordinating Center faculty, completed the last two instructional strategies—quarterly webinars and development of systems-based action plans for improving NSCLC practice in their communities.

The EMPOWER curriculum targeted the multidisciplinary team of physicians managing treatment of patients with lung cancer. The primary audiences for the program were (1) academic and community pulmonologists, (2) thoracic surgeons, (3) pathologists, and (4) medical oncologists. A secondary audience was allied healthcare professionals who care for patients with lung cancer.

Evaluation Design

This report presents the evaluation model and findings from the EMPOWER program. The evaluation model includes participation and satisfaction data, as well as the response to four questions:

1. What are multidisciplinary practice- and systems-based educational needs for NSCLC diagnosis, staging, and treatment?

2. What changes have participants made to their practice and health systems as a result of the EMPOWER program? How has the healthcare system for NSCLC patient diagnosis, staging, and treatment changed as a result of the EMPOWER program?

3. How has systems-based practice been influenced by participants as a result of participating in the EMPOWER program? What are barriers to the implementation of knowledge in healthcare systems?

4. What are remaining clinical/systems opportunities that are indicated for future programs?

The questions were answered using data from a variety of data sources and instruments.

Key Findings

The EMPOWER program provided a unique opportunity for participants to engage in multidisciplinary, systems-based approaches to NSCLC management. A selection of key findings from the evaluation of EMPOWER is provided below and provides evidence-based impressions of the program based on available evaluation data. A full report of evaluation findings and programming impacts may be found in Sections IV and V of this report.

- **Audience**: The typical EMPOWER program participant was a medical oncologist, had more than 20 years of experience, and was responsible for managing the treatment of 0 to 5 new lung cancer patients per month.

- **Educational Need**: Based on the analysis of need via the systems surveys, the EMPOWER participants indicated similar or greater NSCLC educational needs than the national survey respondents. In particular, EMPOWER participants demonstrated key educational needs compared to national systems survey respondents in the areas of obtaining adequate tissue samples, request of repeat biopsies, utilization of features of the multidisciplinary teamwork, and presence of systems-based barriers to optimal management of NSCLC patients. These results indicate that the community-based providers selected for this program are an appropriate audience. One participant stated that an important feature of this program was the knowledge that "we [rural] providers are not alone [in our experiences]."

- **Multimodal Education:** The EMPOWER instructional design incorporated a multimodal educational approach, involving several innovative instructional strategies. These strategies included problem-based learning (PBL), flipped-classroom instructional design, and on-demand webinars. "This [multidisciplinary]… approach [to lung cancer management] has been invaluable to our practice," commented one participant.

- **Participant Satisfaction:** The EMPOWER program was well received by participants. More than 75% of participants reported that they were "very satisfied" or "satisfied" with the program.

- **Intent to Change:** Overall, EMPOWER participants reported immediately implementing changes to their practice based on what they learned during the course of the program. Participating physicians gained statistically significant improvement in the knowledge/skills areas of causes leading to repeat biopsies, understanding the use of targeted therapies, communication with providers in their health systems, and inter-specialty communication. EMPOWER participants also identified a high number of barriers to change, reflecting their increasing awareness of systems-based challenges to their medical practice.

- **Multidisciplinary Teams:** Participants also showed statistically significant improvement in utilization of all six features surveyed regarding the multidisciplinary approach to NSCLC. Two of the top areas were regular communication between multidisciplinary teams and multidisciplinary patient-care teams that include pathologists, pulmonologists/thoracic surgeons, and oncologists.

- **EMPOWER Action Plan Presentations:** The quality and complexity of the action plans improved notably over the course of the program. In the initial action plans, the types of changes identified by the participants were primarily at the individual level or focused on a relatively narrow aspect of the practice/healthcare system. Over time the action plans increased in depth and complexity. They also demonstrated a shift from intra-systemic changes (e.g., focusing on one aspect or level within a system, like physician practice or billing/coding for insurance payment) to inter-systemic changes (e.g., addressing interdisciplinary issues or identifying potential changes across multiple system levels).

- **Future Educational Opportunities:** Although participants showed statistically significant gains in many aspects of NSCLC tissue sampling and testing as well as increased use of features of the multidisciplinary team approach in their practice, test results also indicate opportunities for additional education regarding technical skills and knowledge related to NSCLC. More than 80% of participants expressed a need for more NSCLC education in their geographic area.

Conclusion

The EMPOWER program provided a unique opportunity for participants to engage in a multidisciplinary, systems-based approach to NSCLC management. The program promoted a unique and successful approach for teaching innovative technical skills in NSCLC staging, diagnosis, and treatment and provided participants with support for recognizing systems-based challenges in patient management. The outstanding short-term results of the program also indicate increases in physician confidence in their ability to influence disciplinary, technical, logistic, and team communication changes that will benefit both their practice and the health system. As satellite and coordinating centers implement their action planning initiatives, the ultimate result will be better diagnosing, staging, and treatment for NSCLC patients across their health systems.

I. OVERVIEW OF EMPOWER

The aim of the **E**ngaging **M**ultidisciplinary Teams to Improve **P**atient **O**utcomes **W**ith NSCLC using **E**ducational **R**esources (**EMPOWER)** educational initiative was to identify optimal methods to evaluate and treat patients with non-small cell lung cancer (NSCLC) using assessment of the molecular biology of the tumor.

EMPOWER was a collaboration of the American College of Chest Physicians (CHEST), the American Society for Clinical Pathology (ASCP), the University of Nebraska Medical Center (UNMC), and the France Foundation. This report presents the implementation of the program and highlights the outcomes and lessons learned from EMPOWER. **Figure 1** below models the overall design of the EMPOWER program.

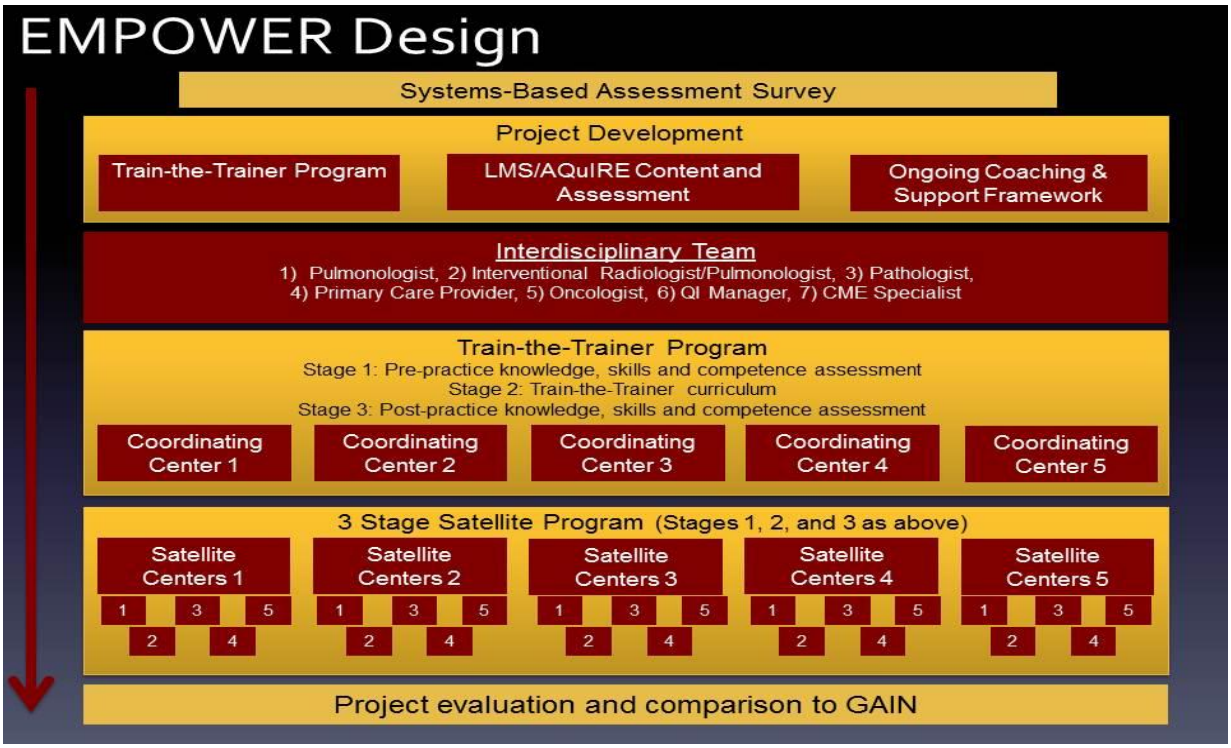

Figure 1. EMPOWER Instructional Design

This figure details specific components of the program that will be described in this section of the report, including the program activities, target audience, and instructional design. Overall, this report will describe EMPOWER implementation as well as highlight the outcomes and lessons learned during the course of the program.

EMPOWER Goals and Objectives

Like its predecessor GAIN 1.0, which was funded by Pfizer in 2010, EMPOWER supported the improvement of NSCLC staging, diagnosis, and treatment in the United States. To this end, the program aimed to improve identification of optimal methods of diagnosis and treatment of

NSCLC. Specifically, EMPOWER focused on identifying and addressing barriers in community-based health systems affecting the following:

- Collection of adequate lung samples
- Diagnosis and staging of NSCLC
- Treatment of NSCLC with targeted therapies

Clinical practice gaps in NSCLC were identified using performance metrics collected in the CHEST Performance Improvement Module (PIM) and CheckPath products at the conclusion of the GAIN 1.0 program. These practice gaps informed 12 learning objectives that guided the development of the EMPOWER program:

- Recognize the histologic subtypes of NSCLC
- Prioritize pathology analysis based on tissue availability, clinical information, and communication with the care team
- Describe *ALK* and *EGFR* tests and their role in characterizing NSCLC
- Describe needle sampling techniques for mediastinal staging
- Describe surgical sampling techniques for mediastinal staging
- Choose an appropriate sampling technique based on clinical and radiologic information
- Identify the various techniques to sample tissue in patients with suspected lung cancer
- Define the use of cytology specimens for molecular marker testing
- Review the importance of interdisciplinary communication to the acquisition and analysis of lung biopsy samples
- Identify mutations associated with NSCLC
- Apply biomarker tests to the diagnosis and monitoring of patients with NSCLC
- Use biomarker tests and targeted therapies to personalize the care of patents with NSCLC

The EMPOWER curriculum addressed these learning objectives through a multimodal approach to the educational curriculum.

Executive Committee

An Executive Committee, chaired by Dr. Momen Wahidi, MD MBA, of Duke University Medical Center, guided the content and educational format of the EMPOWER curriculum. The Executive Committee consisted of 6 physician members who represented the disciplines of pulmonology/ thoracic surgery, pathology, and oncology. The Executive Committee members were responsible for the development of the curriculum and oversight of the program and are listed below.

Table 1: Members of the EMPOWER Executive Committee

Name/Affiliation
Momen Wahidi, MD, MBA (Chair) Duke University Medical Center Durham, North Carolina
Andrea V. Arrossi, MD Cleveland Clinic Lerner College of Medicine Cleveland, Ohio
Jeffrey Crawford, MD Duke University Medical Center Durham, North Carolina
Arkadiusz Dudek, MD, PhD University of Illinois College of Medicine Chicago, Illinois
Mari Mino-Kenudson, MD Harvard Medical School Boston, Massachusetts

(Please refer to **Appendix A** for a listing of Executive Committee members and their specialties)

EMPOWER Collaborators

EMPOWER was developed and implemented as a result of collaboration between four organizations, including two medical specialty societies, a major medical center, and an accredited medical education provider organization. These organizations and their primary EMPOWER-related responsibilities are noted below:

American College of Chest Physicians (CHEST)

- Project oversight
- Oversight of curriculum
- Organization and management of Executive Committee
- Design of pulmonology content
- Design and management of pulmonology simulation equipment and other hands-on tools

American Society for Clinical Pathology (ASCP)

- Design of pathology content

- Outcomes plan development and instrument design
- Collection, analysis, and reporting of outcomes data

University of Nebraska Medical Center (UNMC)
- Development of National Systems Survey

The France Foundation (TFF)
- Collaborator management
- Organization and management of EMPOWER communications and logistics with Coordinating and Satellite Centers

Collaborating organization staff who contributed to the project are noted in **Appendix B**.

EMPOWER Sites

Five major United States healthcare systems, also known as *Coordinating Centers*, were selected to host the program based on their regional prevalence of lung cancer and their prior interest/participation in the first GAIN program. **Figure 2** below depicts the location of the EMPOWER Coordinating Center sites.

Figure 2. EMPOWER Coordinating Center Sites

Site leaders at each EMPOWER Coordinating Center identified two to three local pulmonology, oncology, and pathology physician "champions" to promote learner attendance and serve as lead faculty for EMPOWER at the coordinating center institution. In turn, the physician champions identified up to five local community-based Satellite Centers within their healthcare system to participate in the program. A complete listing of Coordinating Center Champions and their

affiliations is identified in **Appendix C**. A complete listing of satellite sites may be found in **Table 3** of this report.

II. EMPOWER CURRICULUM

Introduction

Lung cancer is the leading cause of cancer-related mortality in the United States, responsible for more deaths than colon, breast, and prostate cancers combined. The average age at diagnosis for lung cancer is 71 years, with 68% of patients diagnosed over the age of 65.[1] Non-small cell lung cancer (NSCLC) is the most common cell type, accounting for approximately 82% of all lung cancers.[2] The average five-year survival rate for all stages of NSCLC is abysmally low at 15%.[3]

These poor outcomes drive an urgent need for innovative research and education. New models of targeted therapies and personalized care are developing, but their use is impeded by gaps in knowledge and practice related to anatomic staging and assessment of genetic molecular markers of specific cancers. There is also a need to coordinate care among interdisciplinary specialists, including pulmonologists, pathologists, medical oncologists, thoracic surgeons, primary care clinicians, quality improvement management, and the continuing medical education (CME) department. Clinicians must have the knowledge and procedural skills to provide clinical pathologists with suitable biopsy specimens for analysis of molecular markers.[4] In addition, oncologists must have appropriate testing and communication of results to determine suitable treatment protocols for their patients.

Our review of pulmonology performance data collected from 2009 through 2010 indicates that the initial diagnosis of lung cancer has been made in 57% of the samples from a total of 1,600 patients representing 3,676 anatomical sites. In more than 10% of the remaining cases, a diagnosis of lung cancer was made by a subsequent bronchoscopy procedure. These data illustrate the need to improve physicians' ability to obtain adequate samples for diagnosis. In a recent survey of barriers to proper preparation and storage of NSCLC tissue specimens, almost 50% of pathologists cited lack of an adequate tissue, illustrating the need to improve physicians' ability to obtain them.[5]

In addition to this information, CHEST and its collaborators analyzed the outcomes from the GAIN (EnGAging an Inter-Disciplinary Team for NSCLC Diagnosis, Personalized Assessment,

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[1] National Cancer Institute Surveillance Epidemiology and End Results Cancer Stat Fact Sheet on Cancer of the Lung and Bronchus. 2008. Available from: http://seer.cancer.gov/statfacts/html/lungb.html.

[2] National Cancer Institute: Lung Cancer. 2010 Available from: http://www.cancer.gov/cancertopics/types/lung.

[3] American Lung Association Lung Cancer Fact Sheet. 2010 Available from: http://www.lungusa.org/lung-disease/lung-cancer/resources/facts-figures/lung-cancer-fact-sheet.html

[4] American Society for Clinical Pathology CME department 2009 needs assessment for "Update on the Staging System of Non-Small Cell Lung Carcinoma" by Gretchen Galliano, MD.

[5] AQUIRE database from visits 2/2009- 7/2010. ACCP data.

and Treatment) project to develop EMPOWER curriculum and project plans. GAIN was an educational curriculum designed to improve the knowledge, competence, and performance of a team of interdisciplinary specialists responsible for assessing and managing patients with NSCLC. These results informed the development of the EMPOWER instructional design and curriculum.

EMPOWER Instructional Design

The EMPOWER curriculum targeted the following healthcare professionals who focus on NSCLC diagnosis and patient care:

- Academic and community pulmonologists
- Thoracic surgeons
- Pathologists
- Medical oncologists
- Allied healthcare professionals who care for patients with lung cancer

The EMPOWER instructional design was intended to provide clinicians and institutions with tools to support practice and system change beyond the year-long program implementation. To facilitate this program vision, the EMPOWER program employed four primary instructional components:

- Systems-Based Assessment Survey
- Train-the-Trainer program for the Coordinating Centers
- Coordinating/Satellite NSCLC webinars
- Development of Systems-Based Action Plans

All EMPOWER content was reviewed and approved by the EMPOWER Executive Committee. These components of the EMPOWER program are described in the remainder of this section.

Systems-Based Assessment Survey

The first instructional component of the EMPOWER program was a systems-based survey distributed to the CHEST and ASCP membership. The systems survey was conducted to determine the current state of interdisciplinary NSCLC medical practice among the target audience. A secondary purpose of the survey was to collect information on NSCLC indicators that had been specifically identified in data collection and review of barriers during GAIN and to obtain common denominators through many healthcare systems to include in the educational curriculum.

To ensure a broad range of feedback on systems-based approaches to NSCLC management, the survey was also distributed to oncology and primary care providers in the United States. In

addition, a local systems survey was distributed to EMPOWER participants to benchmark and identify NLSCLC management and practice barriers.

The University of Nebraska Medical Center's College of Public Health, Center for Collaboration on Research and Design facilitated the development of the survey in conjunction with the EMPOWER Steering Committee. A report of the key findings from the national survey may be found in **Appendix D**.

Train-the-Trainer Program

The EMPOWER program utilized a Train-the-Trainer approach to dissemination of continuing medical education. An in-person Train-the-Trainer workshop was conducted in September 2013 with representatives of the target audience from the five coordinating centers: University of Nebraska Medical Center, Duke University Medical Center, Northwestern University Health System, the Johns Hopkins University School of Medicine, and Texas Tech University Medical Center. This meeting was held at CHEST Headquarters in Chicago and also attended by the Executive Committee Members.

> *One thing it [participation in the EMPOWER program] points out is that that we are not alone. The problems we face are the kinds of problems everybody faces, no matter where you are…The case discussions we've had during the program [tumor boards] are within the national norms.*
>
> —Satellite Center Participant

Faculty for the Train-the-Trainer workshop were drawn from the exceptional group of faculty from the GAIN 1.0 project, as well as from other national experts identified by the collaborators. The Train-the-Trainer program participants included the three target disciplines of pulmonologists, pathologists, and oncologists from each of the coordinating centers. These individuals became EMPOWER trainers for their institutions and their affiliated satellite centers. For coordinating center participants unable to attend the live program, additional training webinars and instructor's guides were produced to facilitate virtual training.

The Train-the-Trainer meeting also served as a "beta-test" for EMPOWER materials and instructional methods. During Train-the-Trainer, EMPOWER materials were reviewed and assessed by the Executive Committee and Coordinating Center Champions. After this meeting the materials were revised to address the feedback from the attendees before dissemination to the satellite centers.

Train-the-Trainer Agenda

10:00 – 10:15 AM	Welcome and Introduction
10:16 – 10:30 AM	Overview of EMPOWER
10:31 – 10:40 AM	Introduction of EMPOWER Steering Committee

10:41 – 11:00 AM	Brief Overview National Survey Data Review: Team-Based Learning Exercise
11:01 – 11:10 AM	Systems Survey Description
11:11 – 11:45 AM	Action Plan Review Including IHI and LMS reviews
11:46 AM – 12:05 PM	Review of Quarterly Calls
12:06 – 12:20 PM	Problem-Based Learning (PBL)
12:21 – 12:30 PM	PBL Virtual Room Overview
12:31 – 1:00 PM	Lunch
1:01 – 1:45 PM	Pulmonology Content Review and Feedback
1:46 – 2:30 PM	Pathology Content Review and Feedback
2:31 – 3:15 PM	Oncology Content Review and Feedback
3:16 – 3:45 PM	Wrap-Up/Next Steps

After completion of the live Train-the-Trainer, Coordinating Center and Satellite Center Guides outlining the content of the training were created for coordinating center champions and other program faculty who were unable to attend the session. These guides outlined the project background and expectations, roles and responsibilities, instructional formats and technology. Please refer to **Appendix E** for the Coordinating Center Guide.

Quarterly Webinars

CHEST and its collaborators facilitated the delivery of training opportunities via hour-long quarterly webinars. The quarterly webinars followed a flipped-classroom model, featuring problem-based cases submitted by the satellite centers. Pre-webinar online lectures in pathology, pulmonology, and oncology were viewed before each webinar. In addition, participants were asked to review problem-based cases submitted by their EMPOWER Satellite Center peers. The webinar featured a problem-based case review guided by a coordinating center faculty expert. The webinars also provided an opportunity to address key performance-related topics and to discuss strategies to overcome participant-identified systems and practice challenges.

Pre-Webinar Work

A flipped-classroom model was implemented for the webinars. This model requires learners to go online via the CHEST Learning Management System (LMS) before the live activity to learn

new content by watching e-lectures, PowerPoint presentations, and other material, at their own convenience. The webinar could then focus on applying the concepts and knowledge learned in the pre-course material, through PBL. Because the participants have completed the pre-work, faculty can offer more personalized guidance and interact with participants, instead of lecturing.

Webinar Agendas

Kick-off call

This webinar provided an overview of the EMPOWER Program, how to use the technology platforms and tools to improve team coordination, knowledge, and performance. (See Appendix F for Kick-off Webinar Slides) Topics reviewed on the call included:

A. Empower Project Overview

- Introduction of participating centers, team members, and roles
- Overview and project scope
- Results of national systems-based survey
- Programs goals
- Assessment outcomes
- Background (GAIN Results and Summary)

B. Satellite Center Curriculum

- Calendar of events
- Review of each quarterly call
  - Use of CHEST LMS
  - Pre/Post learning material
  - Review of quarterly call focus areas
  - How to submit cases for live discussion
  - Review of Satellite Center Manual

C. Measurement & Evaluation Tools

- National Systems Survey
- Local Systems Pre/Post Surveys
- Action Plan analysis
- Knowledge assessment

Webinar Content

Prior to the Webinar

Satellite center respondents were asked to submit two cases in the content area for the upcoming webinar. In addition, respondents were asked to complete the relevant e-lecture and to review submitted cases prior to the webinar.

During the Webinar

During each webinar, coordinating center faculty and satellite center participants reviewed a medical case highlighting the specific goal of that webinar using a PBL model. Coordinating center faculty guided participants through the instruction in three specialty-specific and change-

management cases:

- Pulmonology: Interdisciplinary Teams and Specimen Collection
- Pathology: Change Management and Barriers to the Analysis of Lung Cancer Biopsies
- Oncology: Communication and Tumor-Marker Testing

After the Webinar

Learners were offered the opportunity to review additional problem-based cases and resources and then asked to complete the Institute for Healthcare Improvement (IHI) Quality Improvement course relevant to their discipline. Participants reviewed a basic IHI course on change management provided in CHEST LMS. This course taught basics of the Model for Improvement, to improve everything from tennis games to hospital infection rates. Participants learned the basic steps in any improvement project: setting an aim, forming a team, selecting measures, developing ideas for changes, testing changes using Plan-Do-Study-Act (PDSA) cycles, and measuring to determine if the changes tested are leading to improvement. Specifically, the learning objectives for this course included:

- Using the Model for Improvement to plan and execute improvement projects
- Identifying the key elements of an effective aim statement
- Identifying three kinds of measures: process measures, outcome measures, and balancing measures
- Explaining how to use change concepts to generate good ideas for testing
- Developing tests of change on a small scale, using the PDSA cycle

Additional NSCLC management resources were also provided to participants for review at their leisure.

EMPOWER Webinar Activities

Each quarterly webinar focused on a particular theme related to NSCLC and/or specialty-specific concerns. During each webinar, the following items were discussed:

- Pertinent guideline recommendations
- Review of assigned e-lectures
- Action plan review and discussion
- Review of satellite center–submitted patient cases

Webinar #1: Kick-off Webinar Materials and Content

Each coordinating center and its affiliated satellite centers participated in Kick-off Webinars that outlined project expectations, instructional formats, and technology. A Satellite Center Guide was created for the satellite center participants.

Webinar #2: Pulmonology Materials and Content

Each satellite center was asked to submit two cases focused on the interdisciplinary team's role in ensuring that appropriate tissue samples are collected to provide adequate diagnosis and mediastinal staging. The coordinating center was responsible for identifying the case(s) to be discussed on the call. CHEST instructional designers produced supplementary pre- and post-conference call materials.

A. Pre-course e-learning material

- Pulmonary e-lecture
- Pulmonary PBL cases
- Additional resources to develop action plan

B. Live conference call

- Review of PBL case(s) selected by the coordinating center that month
- Action plan discussion
- Guideline recommendations

C. Post-course material

- Review of other cases submitted but not presented

Webinar #2: Pathology

Each satellite center sent in 1 to 2 cases focused on change management in addressing appropriate analysis of lung cancer biopsies. The coordinating center was responsible for identifying the case(s) to be discussed on the call. ASCP instructional designers helped to build the material around the case.

A. Pre-course e-learning material

- Pathology e-lecture
- Pathology PBL cases
- Additional resources to develop action plans

B. Live conference call

- Review of PBL case(s) selected by the coordinating center that quarter
- Action plan discussion
- Guideline recommendations

C. Post-course material

- Review of other cases submitted but not presented

Webinar #3: Oncology

The cases focused on communication to ensure assessment of tumor biomarkers to provide targeted therapy. ASCP and CHEST instructional designers provided supplementary materials to support the webinar.

A. Pre-course e-learning material

- Oncology e-lecture
- Oncology PBL cases
- Additional resources to develop action plans

B. Live conference call

- Review of PBL case(s) selected by the coordinating center that quarter.
- Action plan discussion
- Guideline recommendations

C. Post-course material

- Review of other cases submitted, which were not presented
- Action plan assessment

Satellite Center Action Plans

The development of action plans for identifying and addressing physician-practice barriers in NSCLC management was an important component of the EMPOWER program. The development of the satellite center action plans took part in four phases:

1. Systems Survey benchmarking
2. Identification of Areas for Improvement
3. Development of Improvement Plans
4. Virtual webinar

Each of these phases in the development of action plans is described below.

Data: Systems Survey Benchmarking

The development of action plans relied on Data Reports that were provided to each satellite center. The Data Report provided customized data regarding potential areas of quality improvement for each satellite center that completed the local systems survey. A total of 21 of 23 participating satellite centers received Action Plan Reports. These reports provided several discussion points for potential areas of improvement, as determined by benchmarking the national NSCLC data with each satellite center's individual data. A sample report is located in **Appendix G**.

Areas for Improvement/Development of Improvement Plans

Based on quality improvement discussions conducted by each satellite center, the Center Leader entered quality improvement plan data into the CHEST LMS. Thirteen satellite centers, referencing 26 potential projects, provided improvement plan data.. Data were entered identifying (1) potential areas of improvement, (2) resources available for improvement, (3)

potential barriers to improvement, and (4) determining indicators for measuring change for improving their practice/systems-based management of NSCLC patients.

Action Plan Virtual Webinar

To encourage participants to share experiences and best practices, CHEST and other collaborators implemented one-hour virtual wrap-up webinars at the end of the project. The conference focused on best practices for NSCLC quality improvement and medical practices across all satellite sites. A total of 10 satellite centers presented their action plans during the five wrap-up webinars. Presentations were scored by faculty, who collected additional qualitative outcome data. The results of the conference will be developed into a white paper detailing best practices in NSCLC management in the coming months.

Data Collection and Analysis

The EMPOWER Evaluation utilized a mixed-methods approach, including both qualitative and quantitative instruments and methods, to understand the impact of the program on participants. A variety of evaluation tools and methodologies were used to evaluate the EMPOWER program. Tools gathered information from EMPOWER participants and also from the action plans developed by the participating satellite centers.

Table 2. EMPOWER Assessment Completions
provides the completion summary for the surveys used in the assessment of the evaluation questions.

Table 2. EMPOWER Assessment Completions

Data Collection Instrument	Unit of Analysis	Evaluation Assessments	Target Research Audience	Number of Participants	Number of Satellite Center
National Systems Survey	Individual	National System Survey	National Healthcare Providers	433	N/A
Pre-EMPOWER Program Participant Assessments		Systems Survey-Coordinating Center	Coordinating Center Champions (N=15)	13	N/A
		Systems Survey-Satellite Center	Satellite Center (N=82)	47	N/A

Data Collection Instrument	Unit of Analysis	Evaluation Assessments	Target Research Audience	Number of Participants	Number of Satellite Center
		Knowledge Pre-test	EMPOWER Satellite Center Participants (N=82)	19	N/A
Post-EMPOWER Program Participant Assessment		Knowledge Post-test	EMPOWER Satellite Center Participants (N=82)	5	N/A
		EMPOWER Follow-up Surveys		24	N/A
Action Plan/ System Change Assessments	Satellite Center (N=23)	Identification of Change Projects in CHEST LMS	EMPOWER Satellite Center Groups	N/A	13
		Action Plan Scoring Rubrics	EMPOWER Satellite Center Groups as rated by faculty and independent raters	N/A	10
		Action Plan Presentations	EMPOWER Satellite Center Groups	N/A	10
		Action Plan Presentation Recording	EMPOWER Satellite Center Groups	N/A	10

Assessments Completed Prior to EMPOWER Program

This group of assessments was used to establish national benchmarks for assessing educational needs and the status of participant indicators prior to participation in the program.

The National Systems Survey

The National Systems Survey was designed by the EMPOWER Steering Committee and the University of Nebraska Center for Collaboration in Research Design. This survey assessed national prevalence of education and systems gaps related to the diagnosis, staging, and treatment of NSCLC. Surveys were distributed to members of CHEST and ASCP who were involved in management of patients with lung cancer. This survey was fielded from April 2013 to January 2014. A total of 510 respondents—representing pulmonology, pathology, thoracic surgery, oncology, and several other specialties—completed the survey. Of these respondents, 433 indicated that they had been involved in the treatment of lung cancer within the past year and provided usable data for analysis.

EMPOWER Pre-test

The EMPOWER Pre-test was a 10-item knowledge and skills–based assessment designed by the EMPOWER Steering Committee. This assessment focused on pathology, pulmonology, and oncology skills required in NSCLC diagnosis, staging, and treatment. Satellite center participants were asked to complete the assessment via the CHEST LMS. A total of 19 participants completed this assessment.

Systems Survey Coordinating Center and Satellite Centers

The EMPOWER Systems Survey was also administered to both coordinating center and satellite center participants. Like the national survey, this local systems survey assessed the prevalence of education and systems gaps in the management of NSCLC among program faculty and participants. A total of 13 coordinating-center and 47 satellite-center participants completed this survey. The survey was fielded from January 2014 to December 2014.

Assessments Completed Upon Program Conclusion

This group of assessments was used to assess participant outcomes and evaluate changes in practice and healthcare systems as a result of EMPOWER.

EMPOWER Post-test

The EMPOWER Post-test was a 10-item knowledge and skills–based assessment designed by the EMPOWER Steering Committee. The survey was designed to test changes in physician knowledge and skills related to the diagnosis, staging, and treatment of lung cancer. Satellite-center participants were asked to complete the assessment via the CHEST LMS. A total of five participants completed this assessment.

EMPOWER Follow-up Survey

The EMPOWER Follow-up Survey assessed satellite-center participants' self-reported changes in confidence, individual medical practice, and systems changes upon the conclusion of the

program. The survey was also designed to assess individual intent to change and barriers to practice. A total of 24 participants completed this survey.

Action Planning Rubric

EMPOWER Coordinating Center faculty were asked to assess satellite center action plans presented during the EMPOWER Wrap-up Webinar. The action planning rubric focused on five areas associated with quality improvement initiatives for systems change: scientific/medical knowledge, identification of goals, resource allocation, measuring success, and team communication. A conceptual model for the EMPOWER rubric is seen in **Figure 3** below.

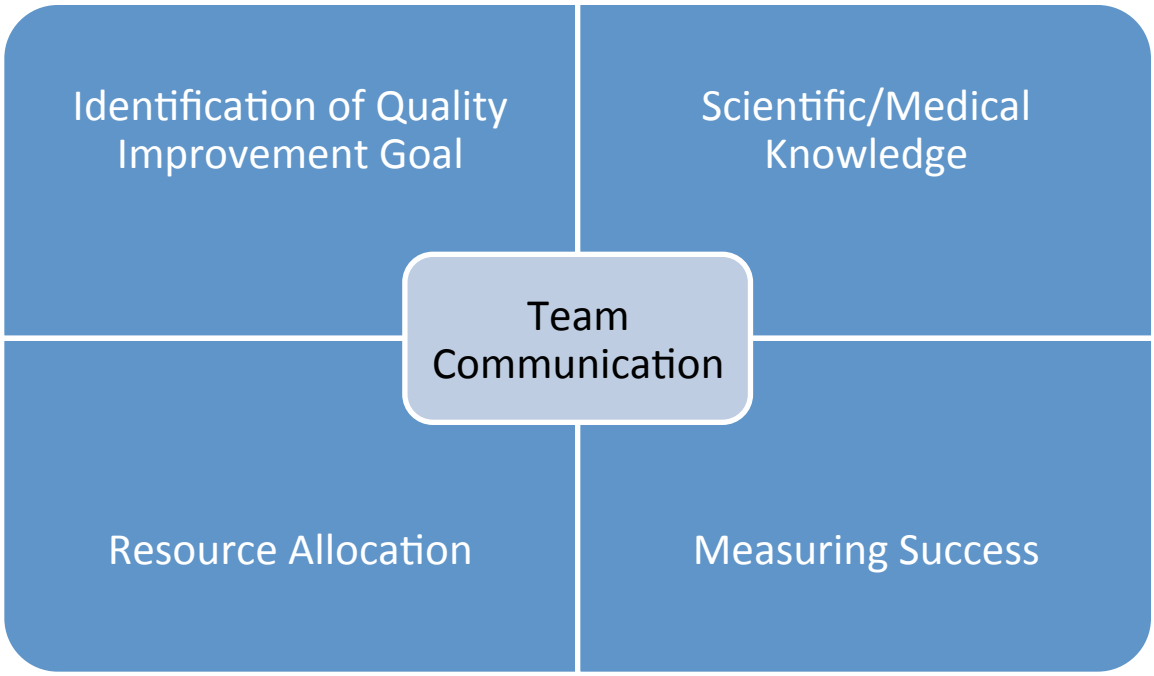

Figure 3. EMPOWER Action Plan Rubric Conceptual Model

Ten satellite centers representing 38 participants completed personalized action plans for NSCLC Quality Improvement. The Action Plan Rubrics were quantitative assessments scored out of 18 total points by faculty and the evaluation team. The rubrics scores were then supplemented by qualitative data from action plan presentations and recorded discussions collected during the EMPOWER Wrap-up Webinar.

III. Outcome Results

Formative and Summative Evaluation

This section provides evaluation data for the EMPOWER program. The EMPOWER Evaluation Plans (**Appendix H**) called for both formative and summative evaluation. Formative data, provided to the collaborators during the course of the program, were used by participating centers and collaborators to assess progress toward intended program outcomes. Formative data provided for this program included:

- Train-the-Trainer: Steering Committee feedback on Train-the-Trainer
- Train-the-Trainer: Assessment of the Pre/Post-tests of knowledge and skills
- Data Reports: Satellite Center Action Plan Data Reports
- Conference calls between Coordinating Center and Collaborators

The Train-the Trainer session data were used to inform instructional design and program development before launching the webinars. The Action Plan Data Reports provided benchmarked national data to the satellite centers to support the development of the Action Plan Initiatives. Conference calls between coordinating center leads and collaborators were utilized to gather information about program challenges and provided guidance for making mid-course program improvements.

The remainder of this section provides summative evaluation data and insights for the EMPOWER program. This evaluation report will focus on the short- and intermediate-term outcomes, which are measurable within six months or less after the conclusion of the intervention.

Evaluation Model[6]

The EMPOWER Logic Model (**Appendix I**) provides a visual description of the program's goals, interventions, evaluation, outcomes, and impacts. The programmatic pathways described in the logic model form the basis for assessing the progress that the EMPOWER project has made toward achieving its goals.

In the EMPOWER grant, Donald Moore's model for continuing medical education (CME) was identified as the primary model for evaluating the education efforts (**Appendix J**: EMPOWER Grant). By design, the EMPOWER program was not a traditional CME program in terms of content, instructional formats, and intended outcomes. Instead, the program's instructional design incoporated traditional medical education formats (ie, problem-based learning [PBL] case

[6] During the course of the program, the EMPOWER Outcomes Committee researched and developed a targeted model for assessing program outcomes for a year-long initiative for systemic change.

studies, e-learning modules, live meetings) with the more innovative formats of the flipped-classroom model, coaching/mentoring in the form of supportive IHI videos, and the development of evidence-based action plans.

The first two levels of Moore's model provided a framework for evaluating participation and satisfaction with the EMPOWER program. In addition to using Moore's model, the evaluation also incorporated the EMPOWER Logic Model. As described in Appendix I, the overall intended impact of the EMPOWER program is to "support the improvement of NSCLC diagnosis and treatment in U.S. healthcare systems." To this end, the four educational objectives of the EMPOWER program were to:

- Identify the educational needs and gaps in the management of NSCLC
- Increase physician knowledge, skills, and competence in NSCLC management and assessment
- Increase the impact of lung cancer education on the healthcare systems
- Determine opportunities for future NSCLC education

A chart describing the relationship between program goals, program activities, and data tools/instruments may be found in **Appendix J**: Data Collection Tools and Interventions. This document describes each of the three project goals and their relationship to EMPOWER educational objectives, and the evaluation tools developed and utilized to assess the EMPOWER program.

Drawing in the program goals from the logic model, the following four questions framed the evaluation:

1. What are multidisciplinary practice and systems-based educational needs for NSCLC diagnosis, staging, and treatment?
This question focuses on indicators of systems and physician knowledge/skills gaps in NSCLC diagnosis, staging, and treatment. The main hypothesis for this analysis is that significant gaps exist in both technical skills and systems barriers related to NSCLC management.

2. What changes have participants made to their practice and health systems as a result of the EMPOWER program? How has the healthcare system for NSCLC patient diagnosis, staging, and treatment changed as a result of the EMPOWER program?
This question focuses on indicators of whether and how specific conditions as well as practices within the respondents' practice and health systems have changed (eg, the types of barriers that are prevalent, whether they've been reduced). One of the main implications/assumptions is that the changes would include increased collection of adequate lung samples and diminished barriers to efficient diagnosing and staging.

3. How has systems-based practice been influenced by participants as a result of participating in the EMPOWER program? What are barriers to the implementation of knowledge in healthcare systems?
This question focuses on specific aspects of the evidence-based action plans created by the participants/centers (eg, whether or how the action plan incorporates certain key components). One of the main implications/assumptions is that development of the action plan will contribute to system-level changes.

4. What are remaining clinical/systems opportunities that are indicated for future programs?
This question focuses on clinical gaps remaining at the conclusion of the program in collecting lung samples, diagnosing and staging, and treating NSCLC. One of the main implications/assumptions is that medical testing and assessments should provide opportunities for appropriate clinical intervention.

To describe the impact of the program on participants and their respective healthcare systems, the EMPOWER instructional design (See **Appendix K:** EMPOWER Blueprint) focused on assessment of the four questions provided above. Assessment areas and instruments were aligned with these four assessment goals. **Figure 4** describes the evaluation model used for the program.

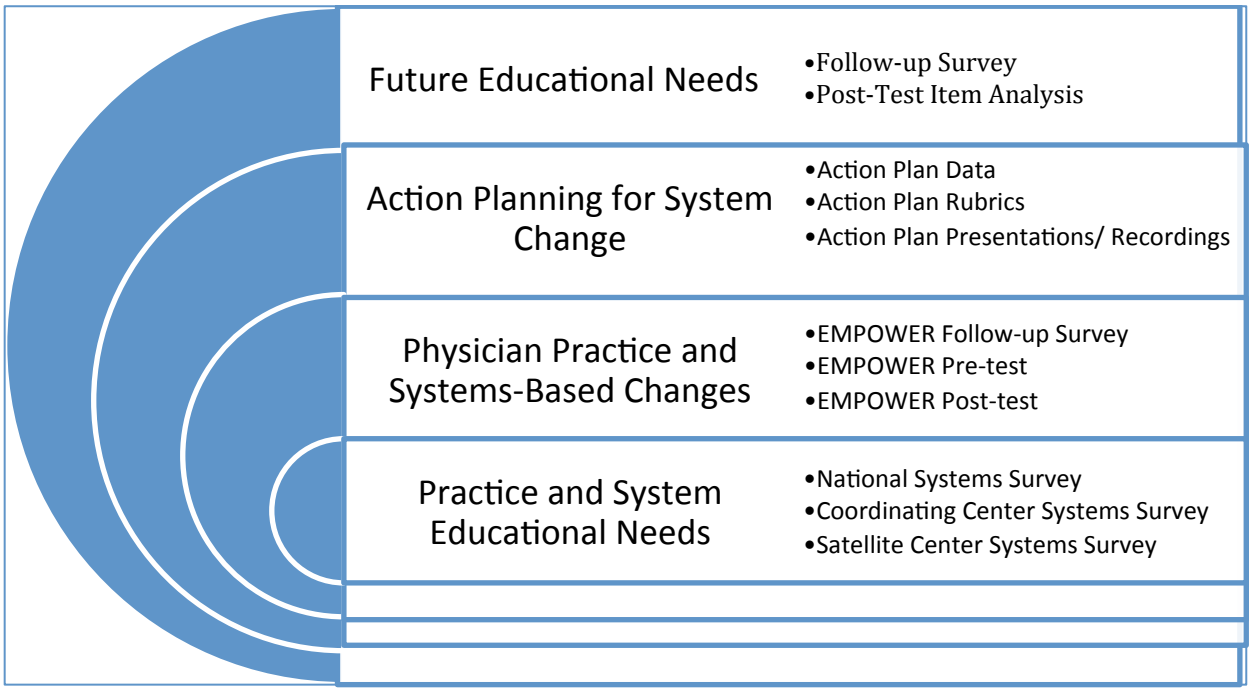

Figure 4. EMPOWER Evaluation Model

The EMPOWER Evaluation Model depicts the increasing impact of the EMPOWER program on community-based NSCLC physicians, beginning with the assessment of NSCLC educational needs, addressing practice and systems changes, and leading to planning for health systems

changes. Finally, the model evaluates which components of the NSCLC education resulted in the most educational gains and as well as relevant and useful education for EMPOWER participants.

Evaluation Results

The EMPOWER program is a complex medical educational program with several goals, and it uses many interventions/activities to achieve those goals. The Evaluation section begins with a summary of participation and participant satisfaction with the program. In the remainder of this section, relevant outcomes for the EMPOWER program are organized by the evaluation data. The EMPOWER outcome indicators and program data are current as of January 14, 2015, unless otherwise indicated. This evaluation of the EMPOWER program presents an assessment of progress made toward the goals of the program, as well as participation and satisfaction measures for the program and its components.

Program participation and satisfaction measures represent data available in several data-collection tools, including the Participant Tracker (n=81), the EMPOWER Satellite & Coordinating Center System Survey (n=60), and the EMPOWER Follow-up Survey (n=24).

Program Participation

EMPOWER was a year-long curriculum, requiring ongoing intensive participation from satellite and coordinating centers. Coordinating center lead faculty were asked to identify up to five community-based centers for participation in the EMPOWER program. The EMPOWER satellite center participants, described in **Table 3** below, include staff and physicians affiliated with the EMPOWER Satellite Centers.

Table 3. EMPOWER Satellite Center Participants by Affiliated Coordinating Center

Coordinating Center	Satellite Center	EMPOWER Satellite Center Participants
Duke University Medical Center (n=24)	Indian River	4
	Johnston	7
	Lexington	5
	Marquette	5
	Southeast Medical Center	3
Johns Hopkins University Medical Center (n=15)	Greater Baltimore Med. Ctr.	4
	University of North Carolina	3
	Pennsylvania State University	3
	Sibley	2
	Virginia Cancer Specialists	3

Coordinating Center	Satellite Center	EMPOWER Satellite Center Participants
University of Nebraska Medical Center (n=21)	Avera Medical Group	6
	Great Plains Health	6
	St. Francis Cancer Treatment Center	5
	Yankton	4
Northwestern University (n=7)	Cook County Hospital	1
	Franciscan	1
	Mt. Sinai	1
	Pulmonary Specialists of NW Indiana	4
Texas Tech University (n=13)	Carlsbad	2
	Medical Center Hospital	3
	Plains Regional	3
	Roswell	1
	Texas Tech	4
Non-physician Staff		2
Total Satellite Center Participants		82

A total of 82 satellite center learners, representing 23 satellite sites, participated in the EMPOWER program. The highest number of EMPOWER satellite center participants (n=27) hailed from the sites affiliated with Duke University Medical Center. The satellite center with the second highest number of participants (n=21) was affiliated with the University of Nebraska Medical Center.

Satellite center participants were joined and supported by up to three lead faculty members at each coordinating center site. The faculty leads represented the target specialties of pulmonology, pathology, and oncology. A total of 14 coordinating center lead faculty participated in the program, for a total of 96 participants in the program across both satellite center and coordinating center sites.

EMPOWER participants were asked to complete a systems survey before participating in the program. A total of 47 satellite center participants and 13 coordinating center participants completed this survey, for a response rate of 62.5%. To reflect the intent of the program to impact NSCLC management across the participating health systems, the responses of the coordinating and satellite center staff were combined in this analysis. The following data regarding the participants' demographics were collected from this survey.

Specialty of EMPOWER Participants

EMPOWER participants were asked to indicate their primary specialty. Ninety-seven percent of respondents (n=60) identified themselves as "physician[s]." One respondent each identified him/herself as a "nurse practitioner" and "education coordinator." Forty-one percent of respondents indicated oncology or radiology as their primary function in managing patients with lung cancer, while 33% identified their primary function as pulmonology/thoracic surgery, and 25% as pathology.

Setting of Primary Medical Practice

EMPOWER participants were asked the setting of their primary medical practice. **Figure 5** displays their responses.

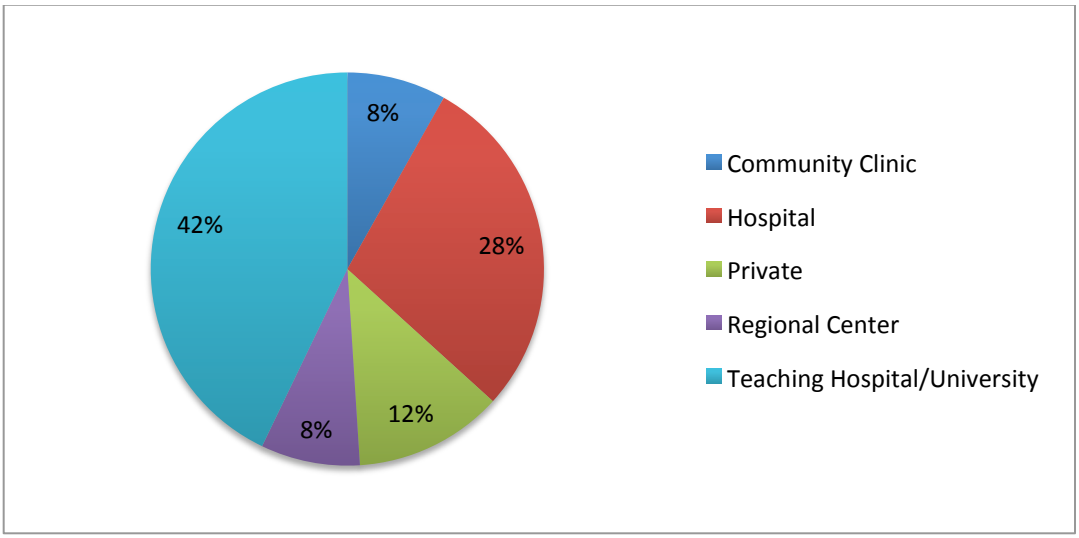

Figure 5. Primary Medical Practice Setting of EMPOWER Participants (n=60)

EMPOWER satellite center participants were selected for the program based on their status as community-based providers. In their survey responses, most participants reported their practice setting as "teaching hospital/university [42%]" or "hospital [28%]," the largest reported affiliation, while only 8% of respondents indicated that they were "community-based." Based on the EMPOWER selection process, the respondents tended to report their practice affiliation with a major medical institution rather than their geographic affiliation. However, analysis of the respondent affiliations indicates that approximately 88.1% of all EMPOWER participants had community-based practice affiliations, either in clinics in rural areas or low-income inner city areas.

New Cases of Lung Cancer

Across all specialties, most respondents reported seeing between 0 and 5 new lung cancer patients per month. A complete reporting of the number of new cases per month reported by specialty is provided in **Table 4**.

Table 4. New Lung Cancer Cases per Month by Primary Function

About how many new cases of suspected lung cancer do you typically encounter each month?	Oncology (n = 23)	Pathology (n =15)	Pulmonology (n =17)	Radiation Oncology (n = 2)	Thoracic Surgery (n = 3)
0-5	11 (48%)	5 (33%)	6 (35%)	0	3 (100%)
6-10	4 (17%)	1 (7%)	5 (29%)	2 (100%)	0
11-20	6 (26%)	5 (33%)	1 (6%)	0	0
21-30	1 (4%)	3 (20%)	3 (18%)	0	0
> 30	0	1 (7%)	2 (12%)	0	0
Other	1 (4%)	0	0	0	0

All target specialties responding to the survey—oncologists (48%), pathologists (33%), pulmonologists (35%), and thoracic surgeons (100%)—reported seeing between 0 and 5 new lung cancer cases a month. The second highest reported category for oncology (26%) and pathology (33%) was between 11 and 20 new cases. For pulmonologists, the second highest reported category (29%) was between 11 and 20 new cases per month. A few pathologists (7%) and pulmonologists (12%) reported seeing over 30 new cases per month. These patterns were somewhat similar among the national sample. Forty six percent of the respondents to the national systems survey reported 0 to 5 new cases per month. Slightly more than one third of the respondents (34.2%) reported 6 to 10 new cases per month.

Participant Satisfaction

Participant satisfaction and utility of program components was assessed using results of the EMPOWER Follow-up Survey. The EMPOWER Follow-up Survey solicited information about changes that the participants had implemented in their practice as well as challenges they faced and their confidence in implementing various aspects of the program. A total of 24 respondents completed this survey.

Overall, participants expressed a high level of satisfaction with the program. **Figure 6** shows the satisfaction rates reported by EMPOWER Follow-up Survey respondents.

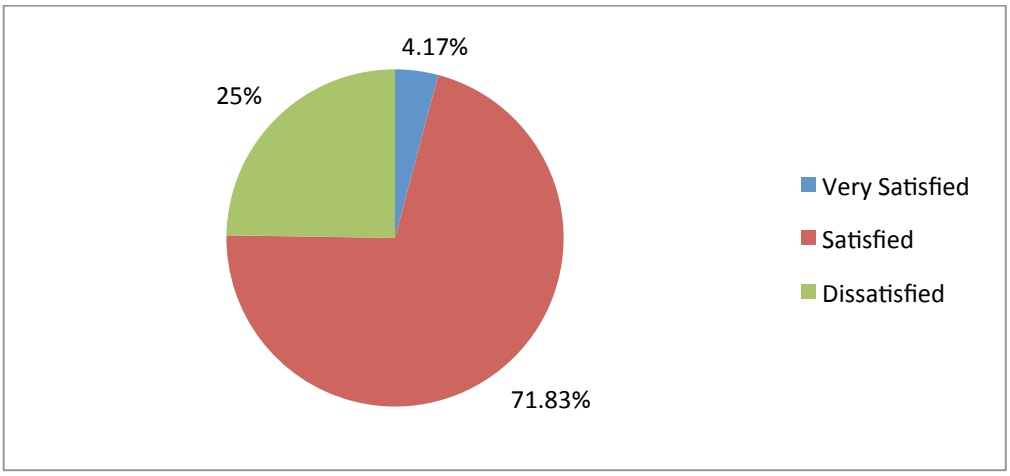

Figure 6. Participants' Overall Satisfaction With the EMPOWER Program

Seventy-five percent (75%) of respondents to the Follow-up Survey indicated that they were "very satisfied" or "satisfied" with the program. Among the 25% who were not satisfied with the program, the reasons included "more face-to-face interaction" and "less emphasis on change management."

In addition, EMPOWER participants were asked to rate the usefulness of the primary various instructional materials and educational materials in their practice. **Figure 7** below provides the percentage of respondents who reported the following program components "somewhat" or "extremely useful".

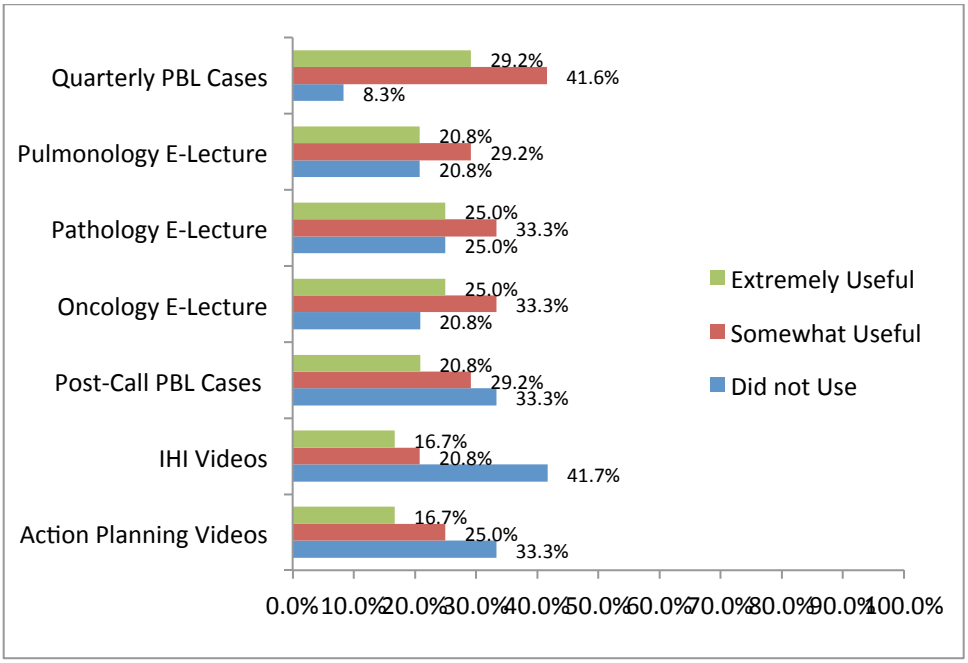

Figure 7. Participant Ratings of the Usefulness of EMPOWER Components in Their Current NSCLC Practice

The majority of EMPOWER participants found the program's resources and instructional materials to be useful to their current practice, and 70.8% found that the quarterly planning webinar was useful to their NSCLC practice. Of the remaining enduring materials, the most highly rated content available on the CHEST LMS were the e-lectures *Interdisciplinary Teams* and *Specimen Collection* (58.3% rating "extremely" or "somewhat" useful) and *Change Management* and *Barriers to the Analysis of Lung Cancer Biopsies* (58.3% rating "extremely" or "somewhat useful").

> *The format of participating in the web conferences and doing the cases together was very helpful in driving us to do some of these things and to develop a plan for improvement.*
>
> —Satellite Center participant

The Action Planning Module was rated "extremely" or "somewhat useful" by 41.7% of respondents, while 33.3% did not access this module at all. Many respondents (41.7%) reported not using the IHI videos at all.

Furthermore, two respondents (8.3%) indicated that they did not utilize any of the program resources in their practice. There were an additional three respondents (12.5%) whose responses indicated that they had utilized only one of the seven resources provided. In contrast, the overall ratings indicated that the majority of the respondents had utilized at least one resource and found it to be at least a little useful. Over half of the respondents (13, 54.2%) had utilized all of the program resources.

EMPOWER Results

This section presents information on outcomes from the EMPOWER program. The outcomes are organized by evaluation question with supporting data. Each evaluation question relies on one or more of the EMPOWER data collection instruments to examine program results. Specific data collection tools to address each are noted after the relevant question.

Evaluation Question #1: What are multidisciplinary practice and systems-based educational needs for NSCLC diagnosis, staging and management?

This evaluation question focuses on indicators of knowledge and skills gaps related to NSCLC management, as well as systems issues in NSCLC management. The question addresses both gaps identified by both National Systems Survey respondents and the combined data of the Satellite and Coordinating Systems Survey respondents. The hypothesis guiding this analysis is that there are both medical/scientific knowledge gaps and systems issues affecting multidisciplinary teams that affect the optimal diagnosis, staging, and treatment of suspected lung cancer. The data for this evaluation were responses to the Systems Survey completed by the EMPOWER participants and the parallel Systems Survey completed by a national sample of physicians, pathologists, and pulmonologists recruited from members of ASCP and CHEST. The

latter group was intended to represent the primary audiences of pulmonologists and pathologists as well as clinical and professional personnel nationwide with knowledge and expertise in the care of persons with suspected or known lung cancer.

Participants

Among the EMPOWER participants who completed the Systems Survey, also known as the Coordinating and Satellite Center Systems Survey, were 47 participants from the satellite centers and 13 participants from the coordinating centers. There were 433 respondents who provided usable data from the national sample. The composition of the respondents by their primary function in managing patients with lung cancer is shown in **Figure 8**. Whereas pathologists made up the largest percentage of the national sample (55.7%), oncologists comprised the largest percentage of the EMPOWER respondents (38.3%). Pathologists accounted for a quarter of the EMPOWER respondents, and oncologists accounted for only 1.2% of the national sample. Pulmonologists were well represented across both groups (33.9% of the national sample and 28.3% of the EMPOWER respondents).

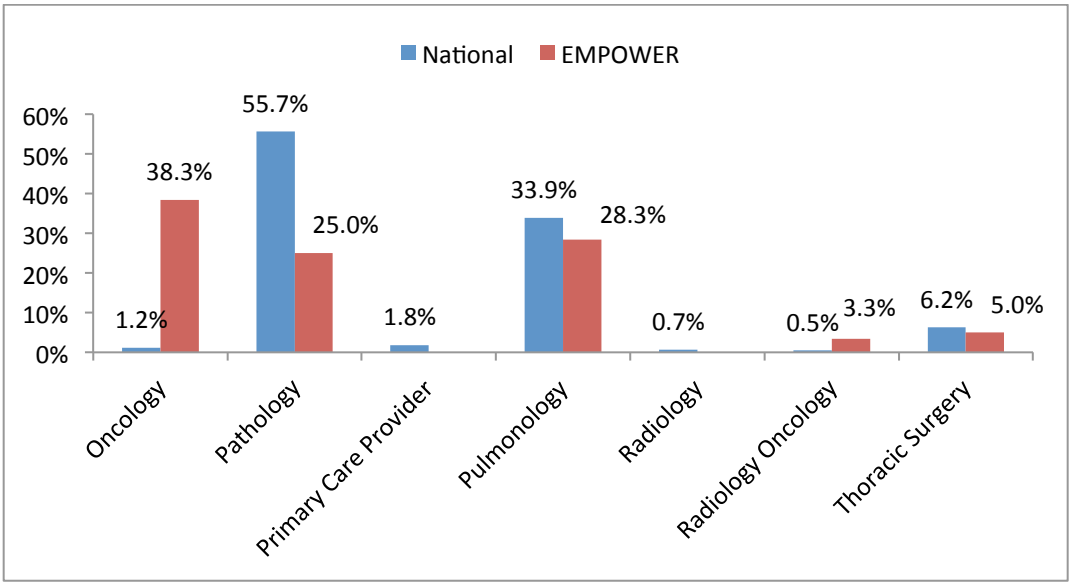

Figure 8. Percentage of Survey Respondents From the EMPOWER Participants (n = 60) and the National Sample (n = 433)

Practice- and Systems-Based Educational Needs

Five main areas of practice- and systems-based educational needs were examined for the diagnosis, staging, and treatment of lung cancer:

- Adequacy of tissue samples
- Request of repeat biopsies

- Utilization of a multidisciplinary team approach
- Barriers in practice/healthcare system
- Management of change

Adequacy of Tissue Samples

One mid- to long-term aim of the education provided by the EMPOWER program was to increase the adequacy of tissue samples from patients with suspected lung cancer. Twenty percent of the EMPOWER participants "agreed" or "strongly agreed" that this issue (tissue inadequacy) limited their practice. Among the national sample, who were asked how often their practice was limited by tissue inadequacy, 33.5% of the respondents indicated that it was "usually" or "always" an issue.

The systems survey used two indicators to measure the adequacy of tissue samples: the percentage that was adequate for diagnosis and classification of lung cancer, and the percentage that was adequate for biomarker testing. For each of these indicators, the EMPOWER participants were asked to report the percentage of tissue samples from patients with suspected lung cancer that was adequate.

The first analysis entailed comparing the mean percentages of tissue sample adequacy between the satellite centers and the coordinating centers, which are shown in **Figure 9**. The results of an independent-means *t*-test between the centers showed no significant difference between the two groups in percentage of adequate samples for diagnosis and classification of lung cancer, $t(54) = -1.77$, $p > .05$, or the percentage of adequate samples for biomarker testing, $t(50) = -1.02$, $p > .05$. This finding indicated that there were similar levels of this practice- and systems-based need among the satellite centers and coordinating center. Furthermore, based on these results, the data for the satellite centers and the coordinating centers were combined into one group for remaining analysis.

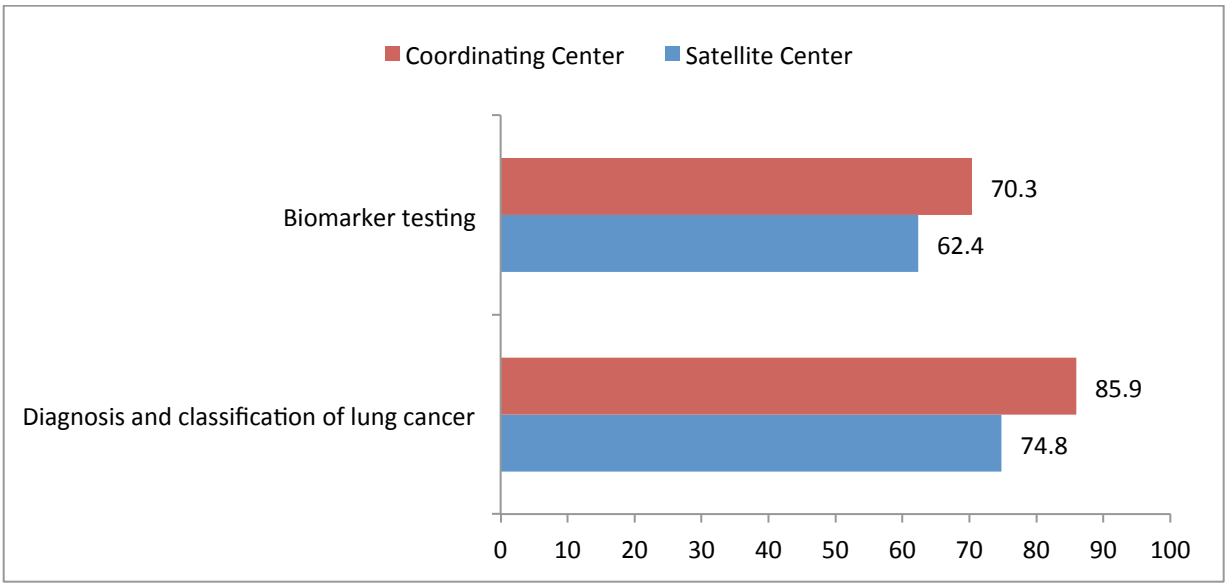

Figure 9. Mean Percentage of Adequate Tissue Samples Between EMPOWER Satellite Centers and Coordinating Centers

As shown in **Figure 10**, the mean percentage of adequate tissue samples for diagnosis and classification was 77.4 (SD = 20.00), and the mean percentage of adequate tissue samples for biomarker testing was 65.4 (SD = 23.44). Whereas the magnitude of these percentages suggests that tissue samples are adequate for diagnosis/classification three-quarters of the time and are adequate for biomarker testing almost two-thirds of the time, they also imply a need to increase the adequacy of the tissue samples.

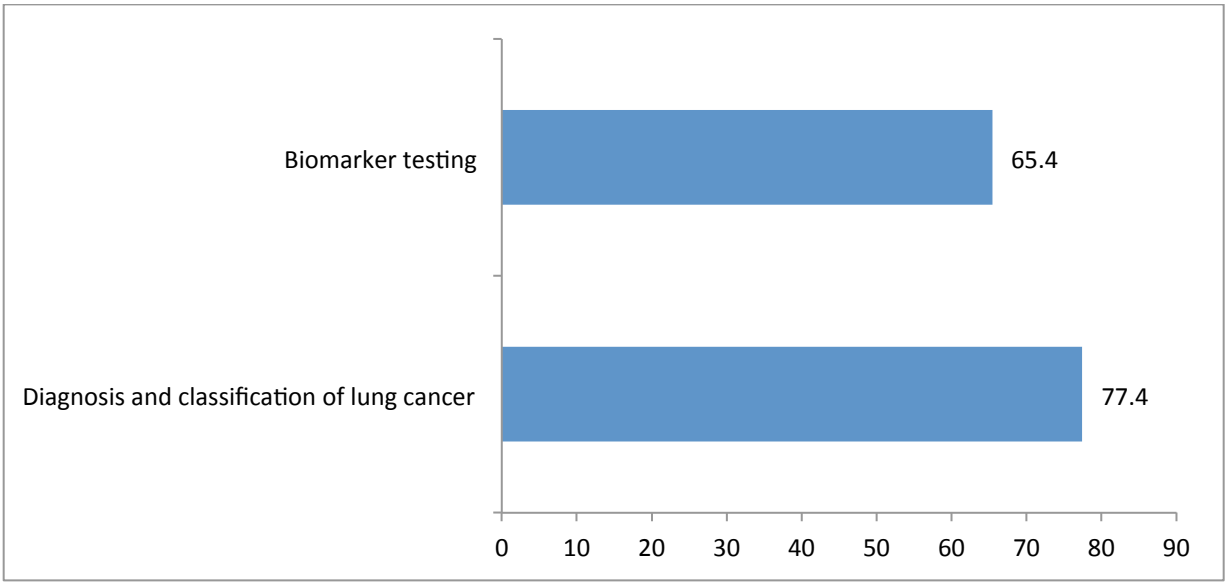

Figure 10. Mean Percentage of Adequate Tissue Samples Reported by EMPOWER Participants

In the national sample, the respondents were restricted to predefined ranges for reporting the percentage of adequate samples: 0 to 25%, 26 to 50%, 51 to 75%, and 76 to 100%. There were also response categories to indicate that the respondent did not know the requested information or that it was not applicable. To enable comparisons between the EMPOWER group and the national group, the percentages of adequate tissue samples from the EMPOWER survey were recoded into the corresponding ranges presented on the national survey. These ranges were used as the analysis variables for the percentage of adequate tissue samples.

The comparison of the adequacy of tissue samples between the EMPOWER participants and the national sample indicated that the latter group had a slightly higher mean percentage of adequate tissue samples for diagnosis and classification of lung cancer (M = 3.67, SD = 0.70 compared with M = 3.49, SD = 0.77, respectively, as shown in **Figure 11**). However, the results of an independent-means *t*-test showed no statistically significant difference between the means of the national sample and the EMPOWER participants, $t(398) = 1.76$, $p > .05$. The national sample also had a higher mean percentage of tissue samples that were adequate for biomarker testing (M = 3.45, SD 0.99 compared with M = 2.96, SD = 1.03, respectively). This difference was statistically significant, $t(393) = 3.26$, $p < .01$.

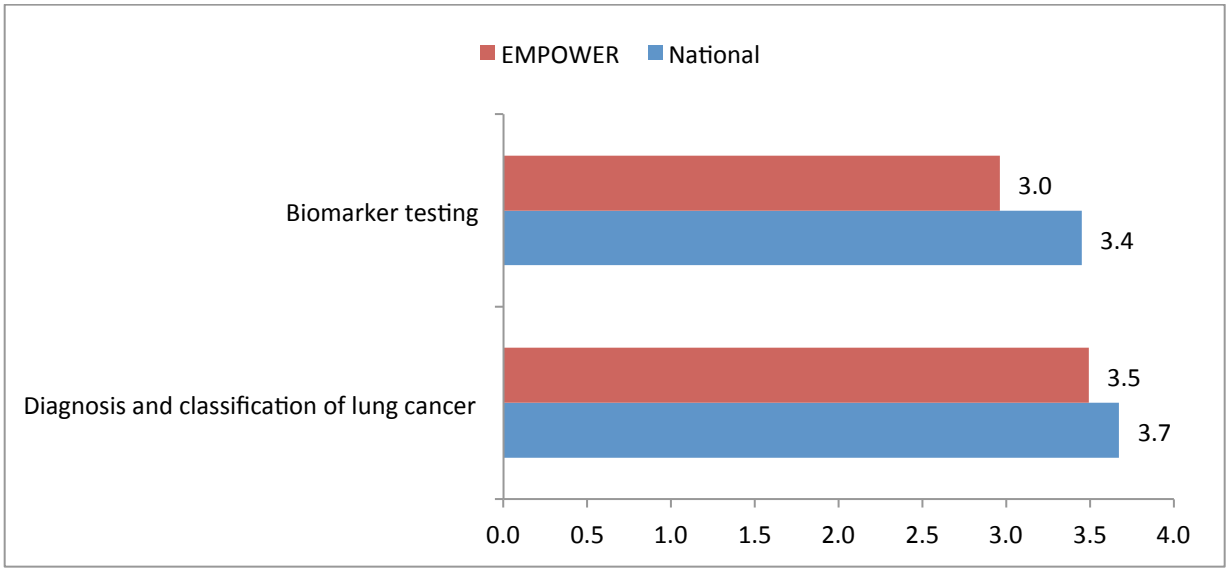

Figure 11. Mean Percentage of Adequate Tissue Samples for the National Sample and the EMPOWER Participants

The reasons for inadequate samples for pathology analysis also implied several practice- and systems-based educational needs. Furthermore, the findings were similar between the two groups (refer to **Figure 12**). Among the EMPOWER group, the two most frequent reasons for

inadequate sample were the size of the biopsy sample being too small and too few tumor cells in the biopsy sample (41.7% and 40.0%, respectively). These problems were also the two most frequent reasons for inadequate biopsy samples among the national sample. Slightly more than 21% of the national sample reported that each of these reasons was "often" or "always" a reason for inadequate biopsy samples (refer to **Figure 12**).

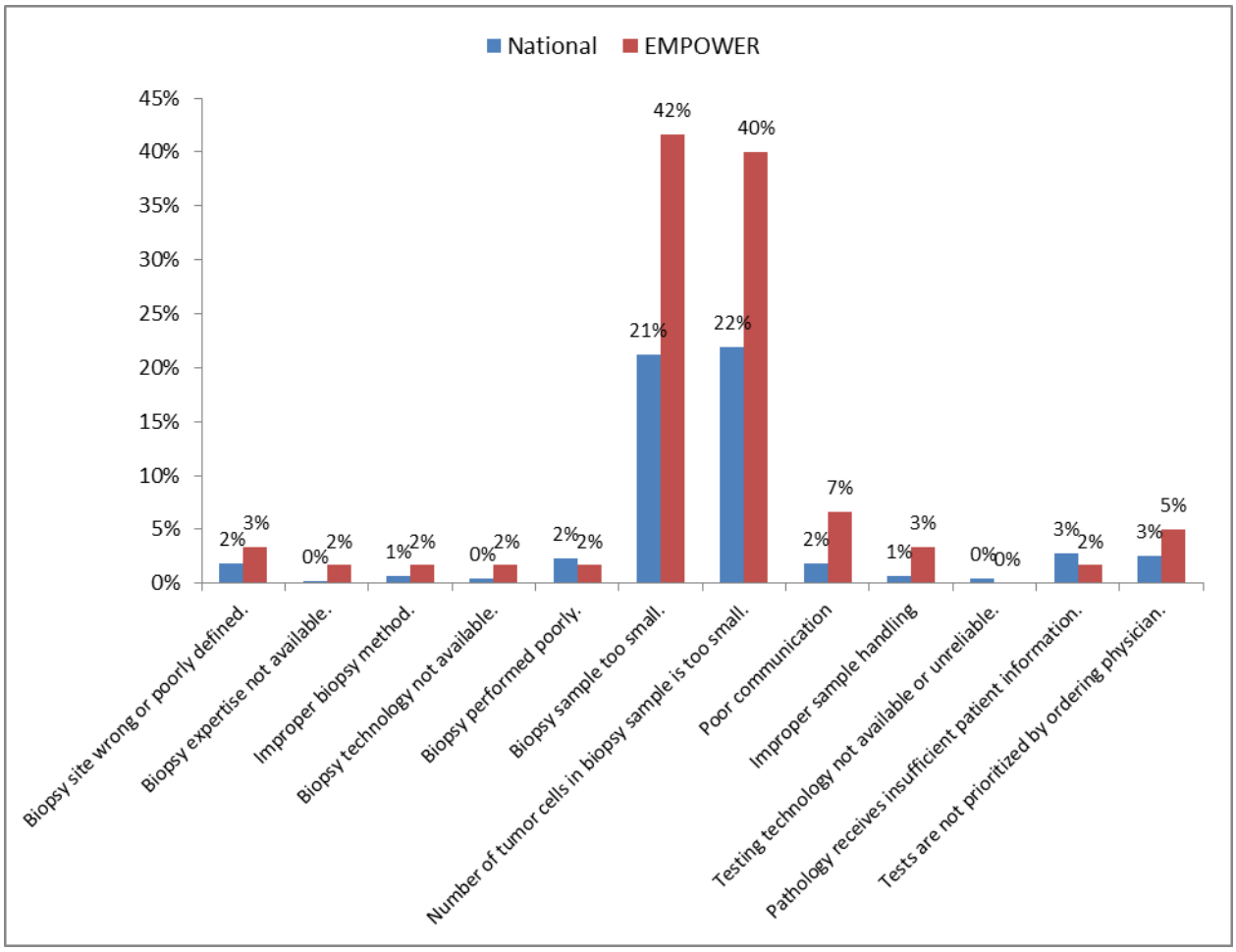

Figure 12. Reasons for Inadequate Biopsy Samples and Percentage of Participants Reporting That the Problem Occurred Often or Always

Although the lung tissue sample sizes were a consistent problem, reported by the highest percentages within each group (EMPOWER or national), the third most frequent reason varied between the two groups. Among the EMPOWER participants, "poor communication" was the third most frequent reason for inadequate biopsy samples, reported by 6.7% of participants. However, poor communication had the sixth highest frequency among the national sample, with only 1.8% of the respondents indicating that it was "often" or "always" a reason for inadequate biopsy samples.

The other source of the problem, which showed a stark contrast between the EMPOWER participants and the national sample, was "pathology receives insufficient patient information." Whereas 2.8% of the national group reported that this problem was "often" or "always" a reason for inadequate biopsy samples, only 1.7% of the EMPOWER group reported that it was "often" or "always" the reason.

Request of Repeat Biopsies

The EMPOWER program also aimed at decreasing repeat biopsies. The first analysis of the percentage of repeat biopsies entailed comparing the satellite centers and the coordinating centers. Both means indicated that a repeat biopsy was requested for slightly more than 18% of patients with suspected lung cancer (refer to **Figure 13**). An independent-means *t*-test showed no significant difference between the means for the two centers, $t(53) = -0.09$, $p > .05$.

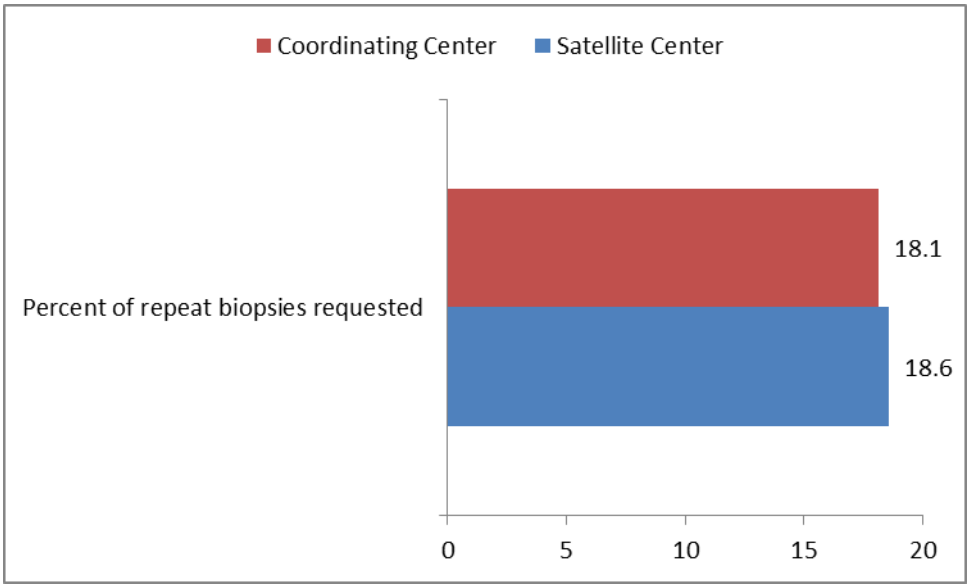

Figure 13. Mean Percentage of Repeat Biopsies, EMPOWER Satellite Centers and Coordinating Centers

As shown in **Figure 14**, the mean percentage of repeat biopsies reported by the EMPOWER participants was 16.20 (SD = 9.41), lower than the mean percentage reported by the national sample (M = 18.46, SD = 14.69). However, the difference between the two means was not statistically significant, ($t(356) = -1.48$, $p > .05$).

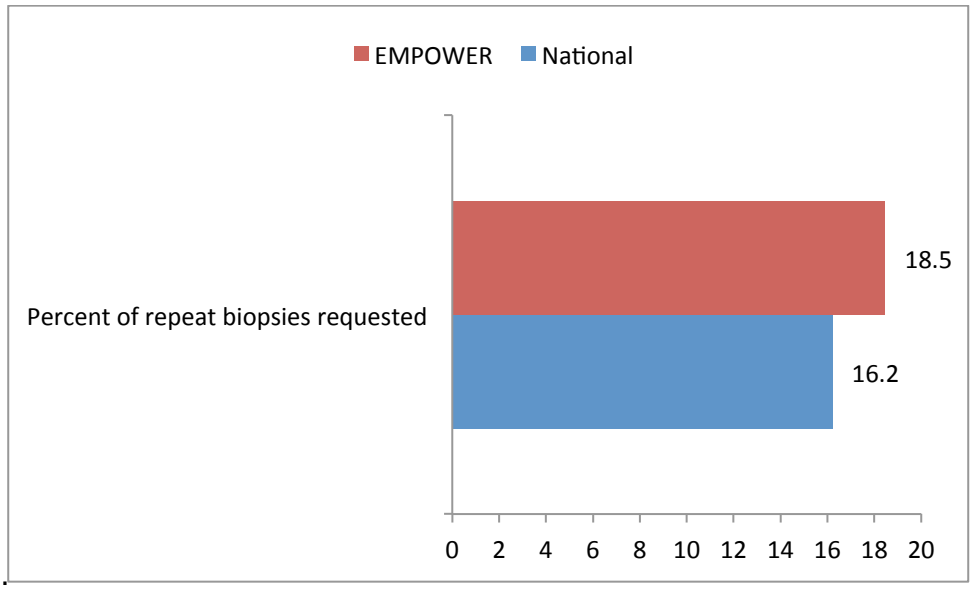

Figure 14. Mean Percentage of Repeat Biopsies, EMPOWER Participants and National Sample

Use of a Multidisciplinary Approach

A key area of need addressed in the EMPOWER program was the multidisciplinary team approach for managing patients with suspected or known lung cancer. When asked whether a multidisciplinary team approach was commonly used for this purpose, a relatively high percentage of both the EMPOWER participants (88.3%) and the national sample (79.9%) indicated that it was relatively common in the setting where they see patients. However, more than a quarter of each group reported that the approach needed improvement (26.1% of the national sample and 28.3% of the EMPOWER participants). Only 9.7% of the national sample and 6.7% of the EMPOWER participants reported that a multidisciplinary team approach was not commonly used.

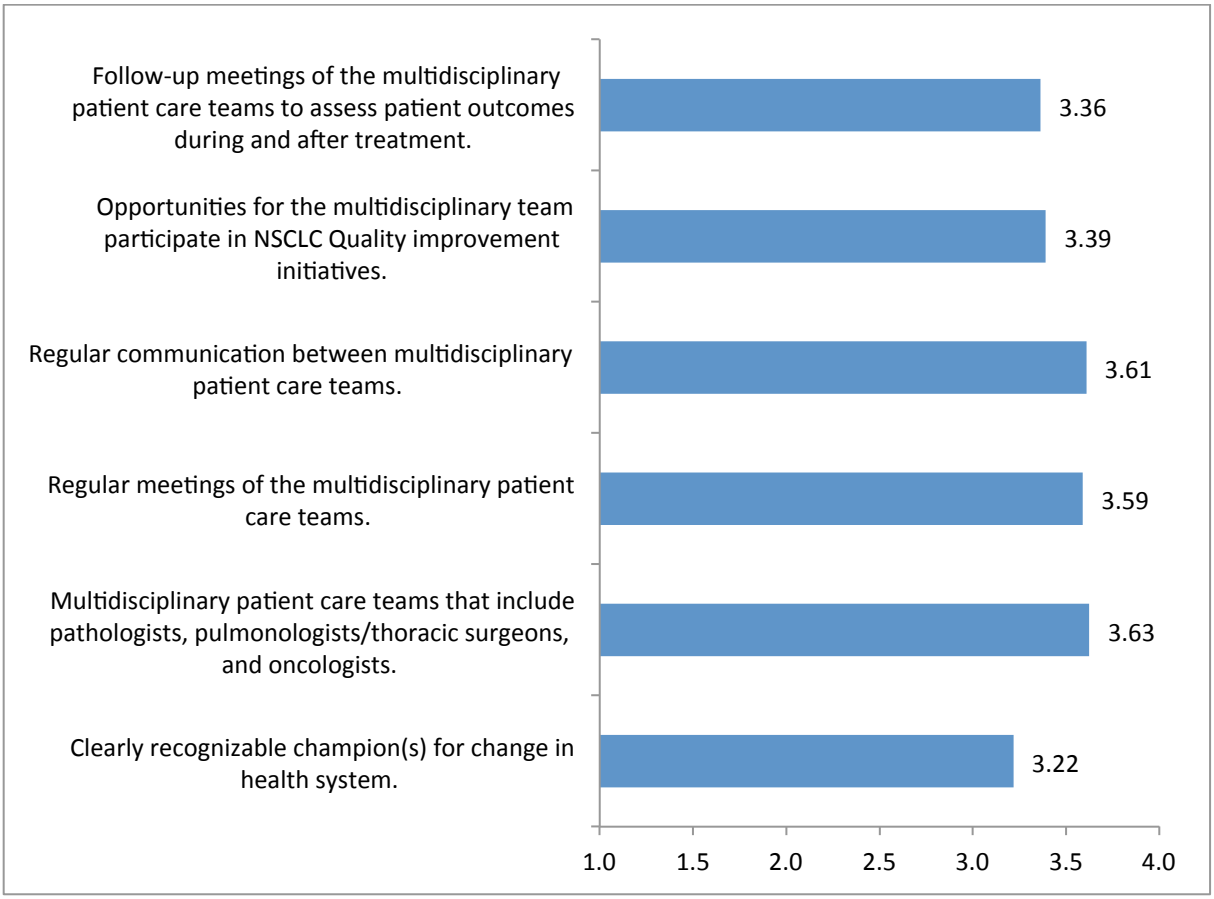

Figure 15. Mean Rating of the Use of Various Features of a Multidisciplinary Approach Before EMPOWER (4-Point Scale of Agreement from 1 [strongly disagree] to 4 [strongly agree] with a response category [5] for "not applicable")

The responses to the EMPOWER Satellite Center Follow-up Survey also provided insight into some of the specific needs related to implementing a multidisciplinary team approach. In the survey, respondents from the satellite centers were asked to report whether they were utilizing various features of a multidisciplinary approach in their practice before participating in the EMPOWER program. **Figure 15** above shows the mean ratings for these features. Whereas multidisciplinary patient care teams that included pathologists, pulmonologists/thoracic surgeons, and oncologists and regular meetings and communication among them were common (based on a mean rating of 3.6), there was a greater need in the areas of follow-up meetings to assess patient outcomes during and after treatment (M = 3.4). There was a slightly greater need for utilizing opportunities for the multidisciplinary team to participate in NSCLC quality improvement initiatives (M = 3.4). The greatest need, based on mean ratings, was having a clearly recognizable champion for change at the healthcare system (M = 3.2).

Barriers in Practice/Healthcare System

The respondents also reported several barriers in their practices/healthcare systems. A summary of the prevalence of these barriers is shown in **Figure 16**.

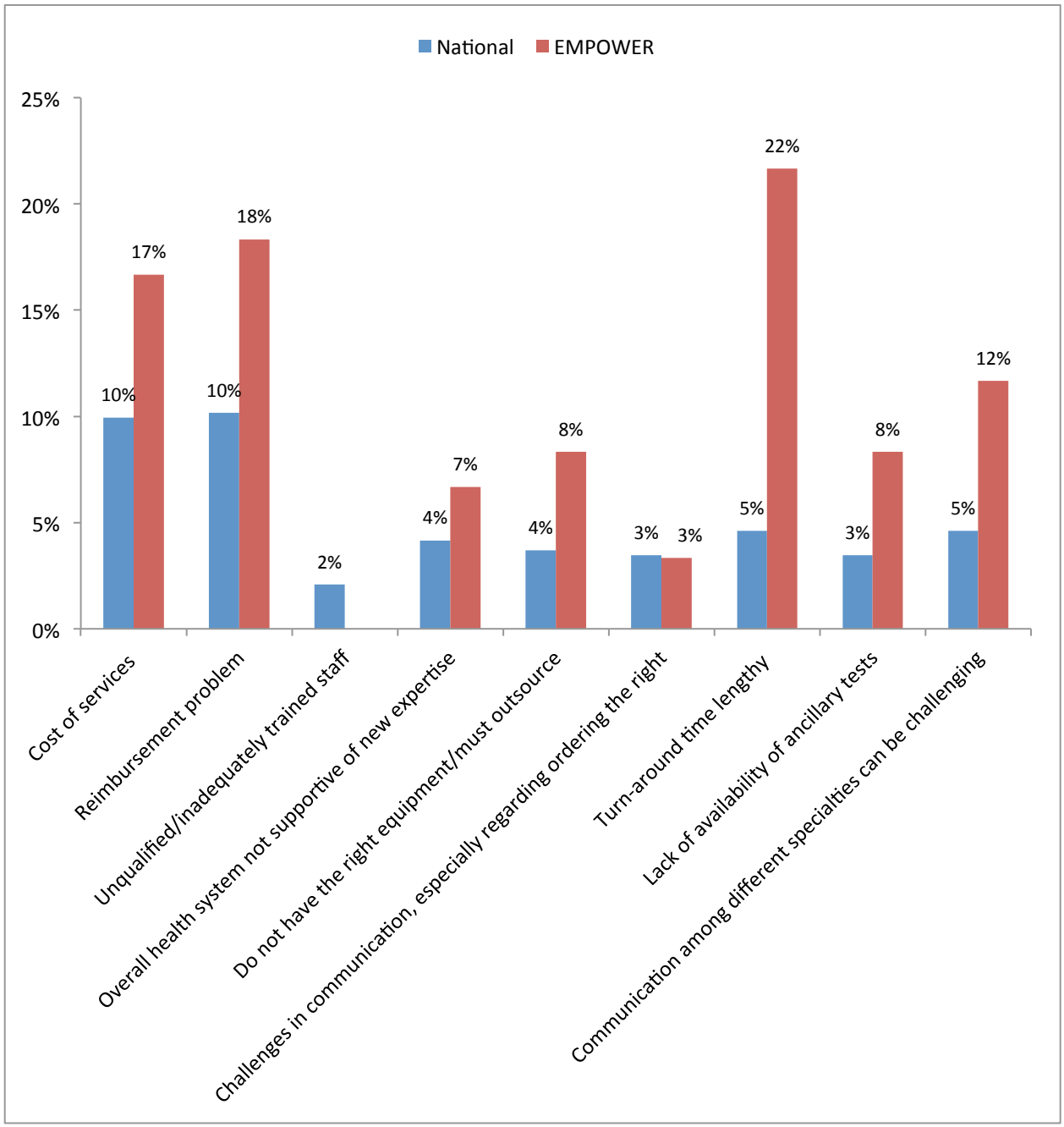

Figure 16. Percentage of Participants Reporting Various Barriers Occurring Often or Always

Across the two groups, the four barriers that were reported to occur "most often" and "always" were lengthy turnaround time, cost of services, reimbursement, and challenging communication

among different specialties. For the EMPOWER group, a lengthy turnaround time was the barrier that the highest percentage of respondents (21.7%) reported occurring "often" and "always." In contrast, only 4.6% of the national sample reported that this barrier occurred "often" or "always."

The second most frequent barrier reported by the EMPOWER group was reimbursement, which 18.3% reported was a barrier "often" or "always." This barrier also had the highest percentage among the national sample (10.2%). Cost of services was also one of the top barriers for both groups. Almost 10% of the national sample and 16.7% of the EMPOWER group reported that cost was "often" or "always" a barrier.

Challenges in communication between specialties was also an issue among both groups (refer to **Figure 16**). It was the third highest barrier among the national sample and the fourth highest among the EMPOWER group. More than 11% of the EMPOWER respondents reported that it was "often" or "always" a barrier, compared with 4.6% of the national group.

Although the respondents were not asked whether molecular testing presented a problem in their practice/healthcare system, the percentage reporting that molecular testing occurred off-site may imply a barrier, as shown in **Figure 17**.

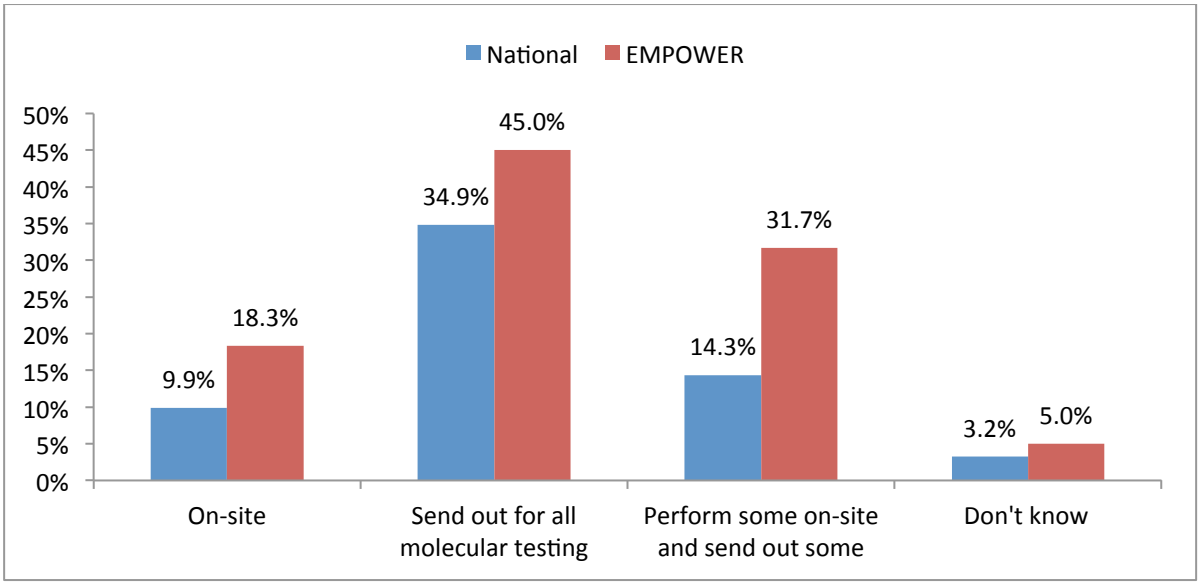

Figure 17. Location of Molecular Testing

More than a third of the national sample (34.9%) reported sending out for all molecular testing, compared with 9.9% who reported that molecular testing was conducted on-site. Both percentages were higher among the EMPOWER group. Forty-five percent of the participants reported sending out for all molecular testing, and 18.3% reported that molecular testing was conducted on-site.

Management of Change

The other area of practice- and systems-based educational need addressed by the systems surveys was the management of change in the respondent's healthcare system and related barriers. In both surveys the respondents were asked about the extent to which they agreed or disagreed with various aspects of change management in their practice setting. For both groups, the top three needs pertained to the availability of funding (refer to **Figure 18**). Slightly more than a quarter of the national sample and 26.7% of the EMPOWER participants "disagreed" or "strongly disagreed" with the statement, "there are funds available for new equipment and technology." The availability of funds for implementing systems change was another area of concern. Twenty-three percent of the national sample and 28.3% of the EMPOWER participants "disagreed" or "strongly disagreed" that this funding was available. Funding for skills training was the third area that had the greatest need, with 22.6% of the national sample and 25.0% of the EMPOWER sample reporting that these funds were not available.

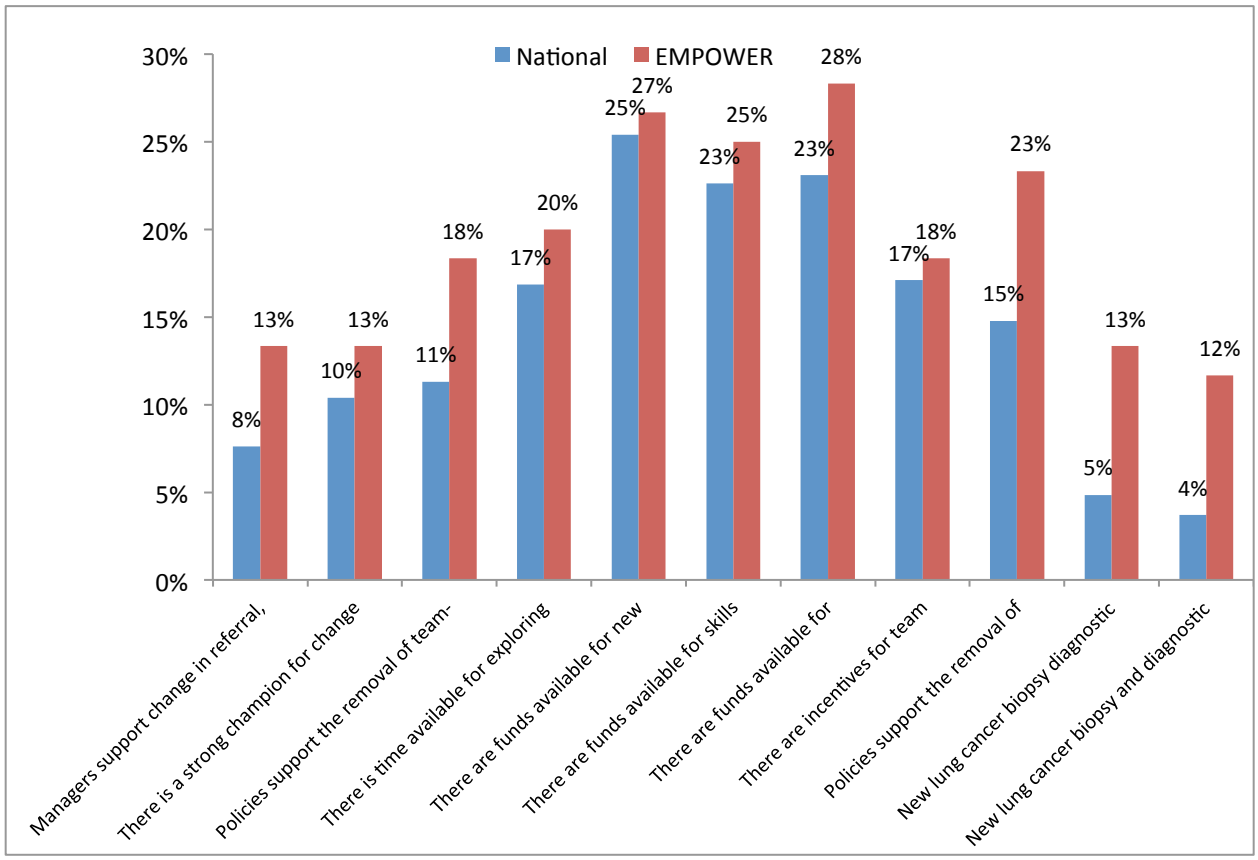

Figure 18. Percentage of Respondents Who Disagreed or Strongly Disagreed About the Presence of Various Aspects of Change Management in Their Practice

Evaluation Question #2: How has physician and systems-based practice changed as a result of participation in EMPOWER?

This question focuses on indicators of whether and how specific conditions and practices within the respondents' practice and health system have changed (i.e., the types of barriers that are prevalent, whether they've been reduced). The hypothesis driving this analysis is that the changes would include increased collection of adequate lung samples and increased awareness of barriers to efficient diagnosing and staging. The primary data utilized in this analysis are the EMPOWER Pre/Post-test results and the EMPOWER Follow-up Survey data.

Figure 19 below shows the percentage of physicians reporting that their participation in EMPOWER had an immediate effect on their practice.

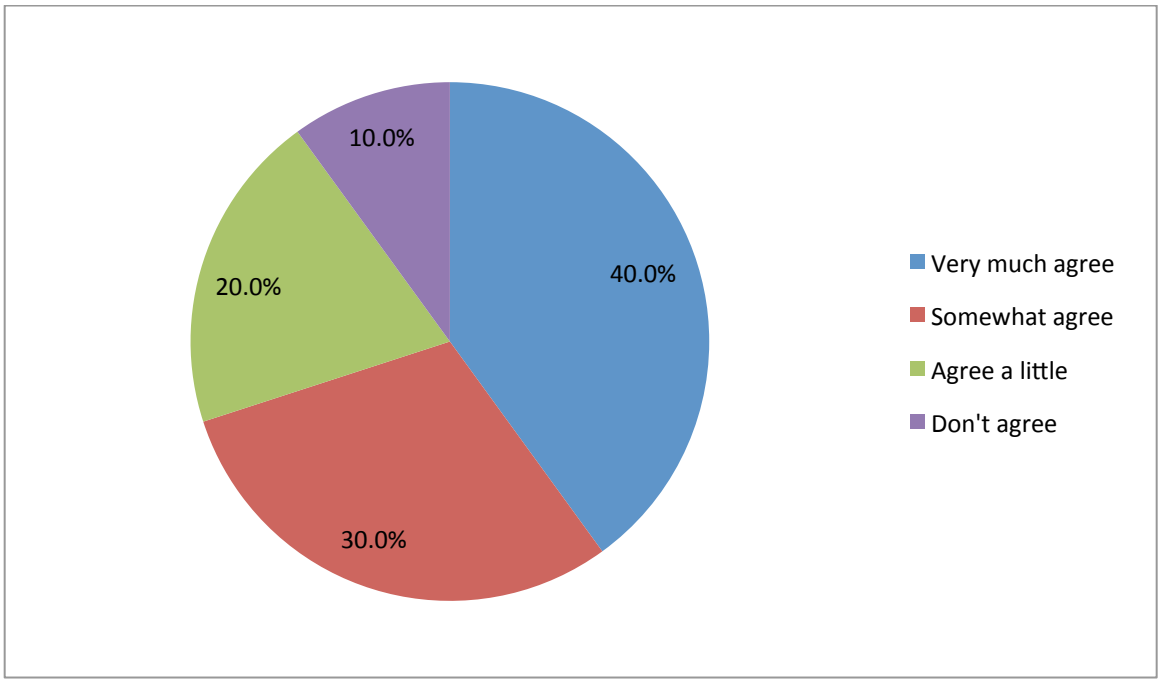

Figure 19. Percentage of EMPOWER Participants Reporting That Their Participation Had an Immediate Effect on Their Practice

Overall, 70% of EMPOWER participants reported "very much" or "somewhat" agreeing that "EMPOWER program participation increased [their] ability to apply knowledge, skills, and professional judgment related to NSCLC in my practice."

The foundation of these changes was an increase in technical knowledge, evidenced by a slight score increase, from 5.1/10 to 5.9/10, among the five participants who completed both the pre-test and the post-test.[7] Instead, physicians reported implementing several practice changes as a result of the program. **Table 5** reports the percentage of participants identifying relevant practice changes since their participation in the program.

[7] Matched pre-test and post-test responses were too low to compute statistical significance.

Table 5. Participants' Indications of the Changes They Have Made to Their Practice Due to Their Participation in the EMPOWER Program[8]

Changes to Practice[9]	% of Participants (n = 24)
Ensure adequate biopsy sample is obtained	62%
Evaluate new diagnostic strategies	42%
Use biomarkers to guide therapy	38%
Utilize a multidisciplinary approach (tumor board) to lung cancer	38%
Utilize a team-based approach (tumor board) to lung cancer	33%
Implement improved professional judgment skills to the diagnosis and/or treatment of patients	33%
Apply recommendations from **NCCN** evidence-based guidelines to your practice	29%
Apply recommendations from **CHEST** evidence-based guidelines to your practice	25%
Improve patient education	25%
Incorporate new treatment strategies for lung cancer	21%
Offer new therapies	17%
Use biomarkers to monitor disease progression	17%
Other	12%

EMPOWER participants indicated several specific changes they have made to their practice as a result of the EMPOWER Program. Four areas of change indicated most often by participants were: ensuring adequate biopsy samples are obtained (62%); evaluating new diagnostic strategies (42%); using biomarkers to guide therapy (38%); and utilizing a multidisciplinary approach (tumor board) to lung cancer treatment (38%). Other reported changes included "guide to primary care providers related to referring those with suspicious lung nodule to the navigator," "Improving coordination of patient care during diagnostic process," and "coordinate multidisciplinary care between different specialties."

There were no respondents who made all 18 of the changes queried in the survey, but there was one respondent who reported making all but one of the specific changes. This participant was one of two respondents (8.3%) who reported making 10 or more changes and one of nine respondents (37.5%) who reported making 6 or more changes. Participants who made only 1 or

[8] Participants could select more than one of the 18 changes queried on the survey. The table lists only the changes that were reported by at least 10% of the respondents.
[9] Changes include the initiation of use, increased use, improved knowledge and application, etc.

2 changes accounted for slightly more than half of the respondents (n = 13, 54.2%), with two changes reported by the highest number of respondents (n = 10, 41.7%).

EMPOWER participants were also asked what barriers they had experienced in their practice. **Table** below shows the most frequently indicated practice barriers.

Table 6. Respondents' Indications of Barriers to Implementing Changes to Their Practice

Barriers to Implementing Changes to Practice	% of Participants (n = 24)
Availability/expertise/training of specialists	38%
(No barriers)	29%
Further training is needed	29%
Cost	29%
Reimbursement/insurance issues	25%
Lack of equipment	21%
Lack of communication	21%
Lack of staff to assist in procedures	17%
Lack of staff to provide administrative support	17%
Lack of health system support	17%
Lack of time	12%
Patient compliance issues	8%
Other patient issues (transportation, language barriers, etc.)	4%
Other: staff recruitment and turnover[10]	4%

Twenty-nine percent of participants indicated in the survey that there were no barriers to implementing changes in their practice. In contrast, over half of the participants (58.3%) reported encountering at least one barrier. There were no respondents who reported experiencing all 13 of the barriers queried in the survey, but there were four respondents (16.7%) who reported experiencing six or more barriers. The overall percentage of survey respondents indicating whether any of the 13 factors were barriers to change was relatively low; the most prevalent barrier was reported by less than 40% of respondents. The most prevalent barriers, according to survey respondents, were availability/expertise/training of specialists (38%) and cost (29%). Better team communication through meetings and multidisciplinary tumor board/conferences were indicated as ways to address these barriers.

[10] "Other-please specify" category response

Changes to the Healthcare System

Overall, 66.7% of the EMPOWER Survey respondents noted that they had successfully influenced changes in their respective healthcare systems. Furthermore, 52.4% of the respondents indicated that they had made changes and will continue to do so after the program has completed. The foundation of these changes was the participant's confidence in areas related to NSCLC management, which allowed them to address systems barriers to NSCLC management.

Participants' Ratings of Confidence in Twelve NSCLC Areas

Participants indicated their confidence in 12 areas pertaining to NSCLC clinical techniques as a result of participating in the quarterly calls. In eight of these areas, participants showed statistically significant gains in confidence from before to after participation in the EMPOWER quarterly calls. These areas are indicated below in **Figure 20**.

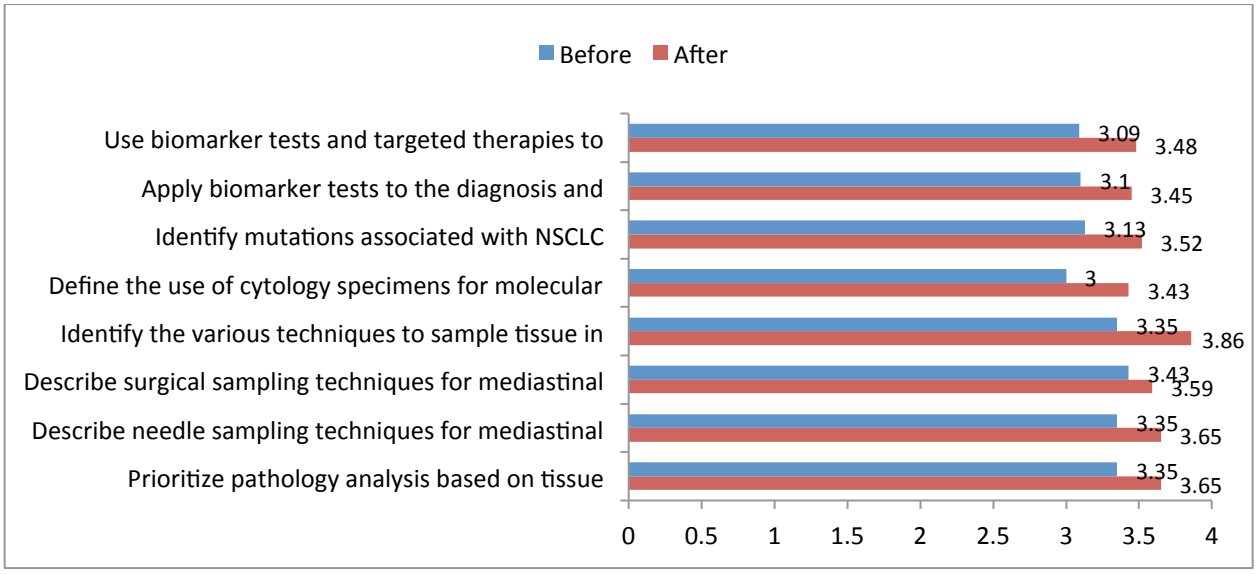

Figure 20. Participants' Ratings of Confidence in NSCLC Areas (Based on a 4-Point Scale From "Poor" to "Excellent")

Table 7 illustrates the statistically significant increases in confidence from before to after participation in the EMPOWER quarterly calls.

Table 7. Participant Confidence in Select NSCLC Areas (Based on 4-Point Scale From "Poor" to "Excellent" With a "Not Applicable" Option)

Confidence Area	Before /After	Mean	SD	Gain[11]	*t*	*p*[12]	Effect Size[13] (Δ)
Prioritize pathology analysis based on tissue availability, clinical information, and communication with the care team	Before	3.35	0.65	0.30	2.61	.016*	0.53
	After	3.65	0.49				
Describe needle sampling techniques for mediastinal staging	Before	3.35	0.78	0.30	3.10	.005*	0.48
	After	3.65	0.49				
Describe surgical sampling techniques for mediastinal staging	Before	3.43	0.68	0.19	2.17	.042*	0.32
	After	3.59	0.50				
Identify the various techniques to sample tissue in patients with suspected lung cancer	Before	3.35	0.65	0.48	3.63	.002*	0.95
	After	3.86	0.36				
Define the use of cytology specimens for molecular marker testing	Before	3.00	0.95	0.43	3.14	.005*	0.54
	After	3.43	0.66				
Identify mutations associated with NSCLC	Before	3.13	0.92	0.39	2.86	.009*	0.50
	After	3.52	0.59				
Apply biomarker tests to the diagnosis and monitoring of patients with NSCLC	Before	3.10	0.83	0.35	2.10	.049*	0.45
	After	3.45	0.74				
Use biomarker tests and targeted therapies to personalize the care of patents with NSCLC	Before	3.09	0.87	0.36	2.35	.029*	0.45
	After	3.48	0.73				

Note. Participants were asked "Please rate your confidence in each of the following areas **BEFORE/AFTER** quarterly calls and their effect on your NSCLC practice."

A paired-samples *t*-test was conducted to evaluate increases in participant confidence in select NSCLC areas before and after participation in the EMPOWER quarterly calls. Participants showed a significant increase in their confidence in describing needle sampling techniques for

[11] The difference between the mean *After (post-) EMPOWER* ratings and the mean *Before (pre-)* EMPOWER ratings. These were calculated using ratings given by respondents on both measures (ie, in pairs) and subsequently used in matched-pairs *t*-tests. The number of "before-after" pairs for survey items ranged between 20 and 24.

[12] The asterisks (*) symbolize statistically significant differences between the reported means.

[13] Effect size is also used here to convey the magnitude of impact of the EMPOWER program on participants. For each "before-after" survey item pair, an effect size value was calculated by dividing the "gain" value for each survey item by the average of their respective before/after standard deviations (using pairs only). Effect size values are therefore expressed in terms of standard deviations. Although there is no universally accepted definition, effect sizes of .25 are generally considered "small," whereas values of .50 are considered moderate and 1.00 large.

mediastinal staging from before to after their participation in the EMPOWER quarterly calls $t(23) = 3.10$, $p < .01$. From before to after participation in the quarterly calls, the mean increased from 3.35 (SD = 0.78) to 3.65 (SD = 0.49). Further analysis indicated significant increases in participants' confidence in eight of the 12 areas at the $p = .05$ level.

Multidisciplinary Approach to NSCLC Management

In the EMPOWER Follow-up Survey, participants indicated their level of agreement with six features of a multidisciplinary approach to the management of lung cancer as a result of participating in the EMPOWER program. Participants showed significant improvement in all areas. In addition, **Table 8** below highlights the statistically significant gains in participant utilization of features of a multidisciplinary team.

Table 8. Participants' Levels of Agreement With 6 Features of a Multidisciplinary Approach (Based on a 4-Point Scale of Agreement)

Features of a Multidisciplinary Approach to the Management of Lung Cancer Patients	Before /After	Mean	SD	Gain	*t*	*p*[14]	Effect Size (Δ)
Clearly recognizable champion(s) for change in health system/practice	Before	3.22	0.74	0.45	3.58	.002*	0.74
	After	3.68	0.48				
Multidisciplinary patient care teams that include pathologists, pulmonologists/thoracic surgeons, and oncologists	Before	3.57	0.51	0.27	2.81	.011*	0.60
	After	3.82	0.39				
Regular meetings of the multidisciplinary patient care teams	Before	3.59	0.59	0.24	2.50	.021*	0.47
	After	3.77	0.43				
Regular communication between multidisciplinary patient care teams	Before	3.55	0.51	0.29	2.83	.010*	0.64
	After	3.82	0.39				
Opportunities for the multidisciplinary team to participate in NSCLC quality improvement initiatives	Before	3.39	0.58	0.36	2.94	.008*	0.71
	After	3.77	0.43				
Follow-up meetings of the multidisciplinary patient care teams to assess patient outcomes during and after treatment	Before	3.36	0.73	0.43	2.90	.009*	0.74
	After	3.77	0.43				

[14] An asterisk in this column denotes a statistically significant difference in means for the factor.

A paired-samples *t*-test was conducted to examine the increase in participants' utilization of a multidisciplinary approach to the management of NSCLC before and after participation in the EMPOWER program. Responses indicated a significant increase in utilizing a clearly recognizable champion(s) for change in health system/practice from before to after their participation in EMPOWER $t(23) = 3.58$, $p < .01$. From before participation to after, the mean increased from 3.22 ($SD = 0.74$) to 3.68 ($SD = 0.48$). Further analysis indicated a significant change in every approach at the $p = .05$ level.

Evaluation Question #3: How could healthcare systems be impacted as a result of participation in the EMPOWER program?

This evaluation question focused on the specific aspects of evidence-based action plans created by the participants/center (i.e., the extent to which action planning incorporated the five conceptual components of the Action Planning Rubric). The hypothesis guiding this analysis was that the development of action plans will contribute to system-level change in NSCLC management. Data for this analysis included the scored Action Plan Rubrics, action planning PowerPoint presentations, and recordings of Action Plan Summits. A total of 10 participating centers, representing 38 EMPOWER Satellite Center participants, completed the action plans.

The first step of action planning development was the identification of change initiatives and their entry into the CHEST LMS. Thirteen satellite centers identified 26 potential change initiatives, which are detailed in **Table 9**.

Table 9. Potential Action Plan Initiatives Identified by Participants

Summary of Satellite Teams' Action Plan Following Their Participation in the EMPOWER Program		
Area	**Description**	**Number Indicated**
Addressing disciplinary differences	Addressing/reconciling disciplinary differences in significance/uses of tissue acquisition and processing and biomarker testing across specialty areas/disciplines.	2
Addressing technical issues	Addressing technical issues/challenges related to on- and off-site testing, for example, improving adequacy/accuracy of test ordering and obtained tissue samples and using outdated technology, procedures.	4
Addressing logistical issues	Addressing logistical issues/challenges related to on- and off-site testing, improving the efficiency and pace of workup needed for treatment, and reducing turnaround times. For example, using limited tissue from needle biopsies in a timely and efficient manner, and/or improving timing and establishing immediate	7

	testing of *EGFR* and *ALK*.	
Multidisciplinary team building and improving communication	Improving communication/cooperation/team building in lung cancer diagnosis and treatment.	8
Other	"Standard reporting and communication" (3x), "Rate of change within system" (1x)	4

Action Plan Rubrics

Action Plan Rubrics were used to assess the presence of the five components of the Action Planning Conceptual Model. **Table 10** summarizes the scores provided by raters for the action plans, including the mean number of elements that were present and the elements that were most often missing from the plans.

Table 10. Summary of Satellite Center Final Action Plan Scores (n=10)

Scoring Area	No. of Elements[15]	Mean No. of Elements Evidenced	Scoring Element Most Often Missing From the Action Plans
Identification of quality improvement goal	4	3.43	**Element 1.3:** Plan to achieve goal, including specific steps, is clearly outlined (n = 3).
Scientific/medical knowledge	2	2.00	*All Satellite presentations included this element.*
Resource allocation	4	3.55	**Element 3.2:** Resources (team members, equipment, policies, etc.) needed to achieve the goal are clearly identified (n = 2).
Measuring success	4	3.00	**Element 4.2:** Indicators for change reflect goals (n = 5).
Team communication	4	2.86	**Element 5.2:** Evidence of satellite center and coordinating center collaboration in the solution to challenges (n = 7).
Total score	**18**	**15.9**	

[15] Total possible score by criterion.

"Identification of quality improvement goal" comprised four elements, of which an average of 3.43 was addressed in the action plans. The corresponding element that was most often missing from the plans was Element 1.3 ("Plan to achieve goal, including specific steps, is clearly outlined"). This element was missing from the action plans of three groups. Based on the percentage of elements addressed, the area of scientific/medical knowledge had the highest mean coverage as all of the satellite presentations included this element. The area of resource allocation was also addressed in a relatively high percentage of action plans.

Ten satellite centers presented their action plans to their coordinating center faculty for feedback. On average, the action plans received a 15.9 of 18 possible points. As shown in **Table 11**, eight teams' action plans were judged by raters to be "excellent"/"very good." They clearly identified priority areas (quality improvement goals) and elaborated on specific strategies and resources for implementing and supporting a multidisciplinary approach to NSCLC detection, diagnosis, and treatment in their respective sites. Three action plans were scored as "satisfactory." Most of the five scoring elements included in the scoring rubric were addressed in the teams' presentations.

Table 11. Ratings of the Satellite Center Final Action Plans.

Overall Assessment of Action Plan	No. of Action Plans by Rating			
Mean Rating	(4) Excellent	(3) Very Good	(2) Satisfactory	(1) Needs Improvement
3.5	6	2	3	0

Furthermore, a qualitative analysis was conducted to determine how the EMPOWER Action Plans had already impacted and may continue to impact healthcare systems. The analysis of the action plans included data triangulation of the data from all action plan sources, including presentations, the CHEST LMS, and Action Plan Rubrics. Action plan components assessed included the most frequently selected areas for improvement, including reported successes, perceived barriers, and resources utilized for implementing the change plans. A detailed table of these results may be found in **Appendix K**. A summary of the results is provided below.

Action Plan Presentations: Areas for Improvement

Overall, participants identified four areas for improvement, which were addressed in the action plan presentations. The selected improvement projects were aligned with the change initiatives identified in the CHEST LMS during the EMPOWER program.

- **Disciplinary differences in lung cancer management:** This topic focused on addressing/reconciling disciplinary differences in significance/use of tissue acquisition and processing and biomarker testing across specialty areas/disciplines. In

addition, efforts to resolve specialty-based inconsistencies in guidelines and practice patterns were frequently mentioned in this area.

- **Technical (medical knowledge/skills) gaps:** This topic addressed technical issues/challenges related to on- and off-site testing, for example, improving adequacy/accuracy of test ordering and obtained tissue samples, and using outdated technology or procedures based on current practice guidelines. Participants often cited lack of time

- **Logistical gaps related to tissue acquisition and diagnosis:** This topic included effort for addressing logistical issues/challenges related to on- and off-site testing, improving the efficiency and pace of workup needed for treatment, and reducing turnaround times. For example, using limited tissue from needle biopsies in a timely and efficient manner and/or improving timing and establishing immediate testing of *EGFR* and *ALK* were in this category.

- **Multidisciplinary communication and teamwork:** This topic focused on improving interdisciplinary communication/cooperation/team building in lung cancer diagnosis and treatment. Efforts included establishing more frequent or structured tumor boards, including additional members of the interdisciplinary team on tumor boards, and establishing scheduled meetings/conferences to support interdisciplinary approaches to lung cancer management.

While the overall topic areas identified by participants were similar, the types of changes identified by the participants in the CHEST LMS were primarily at the individual level or focused on a relatively narrow aspect of physician practice or the healthcare system. Over time the action plans reflected increased levels of complexity. They also marked a shift from more intra-systemic changes (eg, focusing on one aspect or level within a system, such as physician practice improvement) to more inter-systemic changes (eg, addressing interdisciplinary issues or identifying potential changes across multiple system levels).

Action Plan Successes, Barriers, and Resources

During their presentations, participants identified successes, challenges, and utilized resources related to their Action Plan Changes Initiative. A summary of these results is presented below.

Action Plan Initiative Successes

Numerous successful initiatives were identified in the action plans, as reflected in the detailed listing in **Appendix K**. In addition to increased knowledge and improved communication, there was also progress in areas related to the classification of NSCLC per guidelines and multidisciplinary approaches with tissue collection (ROSE/EBUS/TBNA). Related to logistical

issues, the groups also made progress in procedural planning and workflow, as well as management of various aspects of the testing process.

> *How can we get this through our local lead institution sites and network? Will there be future endeavors in this area?*
> —EMPOWER Satellite Center Participant

Many groups reported strides in more frequent or expanded use of formal multidisciplinary team meetings and other communication among multidisciplinary team members. For example, one group reported using a common LungRADS scoring system to select cases for the multidisciplinary team discussions. The successful integration of a patient coordinator and other health professionals to ensure quality care and follow-through with the patient were promising successes reported by several groups. Other promising successes were one group's commitment to requiring oncology sign-off on testing orders to ensure more thorough patient care from staging through treatment and a commitment from pathologists in another group to triage tissue for molecular testing at the time of diagnosis. These successes reflected the EMPOWER curriculum approach of combining technical and logistical learning with systems-based change initiatives.

Action Plan Initiatives: Barriers

Participants also identified barriers to successful implementation of their action plan initiatives.

> *One center identified a five-year goal to "establish a single physical site for lung cancer patients."*
> —EMPOWER Action Plan

These barriers included interdisciplinary differences in lung cancer management, such as conflicting discipline-specific guidelines, the difficulties of overcoming outdated practice patterns, and staying abreast of new knowledge and techniques. There were also technical gaps related to tissue acquisition and diagnosis, such as difficulty ensuring the quality of on-site testing and obtaining adequate samples. Furthermore, there were logistical gaps related to tissue acquisition and diagnosis, such as dealing with multiple routes/sources of referrals, multiple points of patient entry into the healthcare system, and issues related to patients' insurance coverage. The nature of a multidisciplinary approach also posed challenges, such as logistical issues coordinating patient care in remote areas and difficulties achieving consensus among the team regarding best biopsy approach, especially in settings where there is not an available specialist in pulmonary medicine or lung cancer management.

Action Plan Initiatives: Resources

Many EMPOWER resources were utilized in the development of action plans, including the knowledge-building webinars and e-learning cases. A few satellite centers also specifically mentioned the use of various guidelines or testing protocols, as well as increasing staffing resources to ensure better patient care. Several satellite centers added to the resources provided by the program by conducting their own literature review or seeking additional education in lung cancer management, including educational resources offered by CHEST or ASCP. Some also

added their own resources or the coordinating center resources to promote their efforts, including the medical education committee or discussions with grant teams, or contribution of other resources**.** Overall, physicians reported that the EMPOWER program made them more comfortable in seeking resources from the coordinating center or allowed them to identify champions for change in the coordinating system who could help them seek and secure resources for their lung cancer change initiatives.

Action Plan Initiatives: Next Steps

> *We just need to keep working at it [the Action Plan Initiatives].*
>
> —Satellite Center Participant

Finally, participants were offered the opportunity to identify next steps and longer-term plans for their change initiatives. Resolutions for the identified barriers were often addressed in this portion of the presentation, representing longer-term solutions for identified initiatives than allotted in the timeframe for EMPOWER. For example, one center identified a five-year goal to establish "a single physical site [for lung cancer patients]," akin to establishing a Center for Excellence. In addition, there were plans to establish a Cancer Committee to set official guidelines based on Foundation Medicine discussions and promote these standards hospital-wide. Efforts were also made by some centers to increase opportunities for interdisciplinary tumor boards and informational interdisciplinary discussions. In addition, some centers referenced the committees to establish quality control initiatives, such as a review protocol for off-site cases for biomarker testing or establishing incentives for providing practice data for lung cancer data registries. There were also plans to identify and implement incentives for participation in multidisciplinary approaches.

> *One unanticipated result of the program is that Coordinating Center faculty—my oncology colleagues and I—drove some distance to one of our Satellite Sites in order to observe and provide feedback on their tumor board. This Satellite Center clearly demonstrated the multidisciplinary approach that was discussed in EMPOWER. Many features of the multi-disciplinary team that were described in program (multi-specialty teams, standardized communication, etc.) were being considered or adopted by the Center. It was rewarding for us as Coordinating Center Faculty to see these changes in their practices and I believe it was rewarding for them to have Coordinating Center faculty engage in their processes.*
>
> —Coordinating Center faculty member, pulmonologist

The EMPOWER Action Plan Change Initiatives and the Wrap-up Webinars offered an important opportunity for participants to reflect on their progress with the coordinating centers. While the above data provide some insight into the Action Plan Initiatives, the reporting timeframe does not allow for analysis related to the long-term impact. Many groups who completed this component of the program were enthusiastic about their results and intended to continue their efforts beyond the program. Several participants inquired about continued opportunities to check in with their coordinating center via the program meetings. The

action plans represent an important component of sustainability for the EMPOWER program. Per the EMPOWER grant, these results will be reviewed by faculty and developed into a white paper for further dissemination to CHEST and ASCP membership in the future.

Evaluation Question #4: What are remaining clinical/systems educational gaps in NSCLC management that may be indicated for further education?

The need for NSCLC education still exists among EMPOWER participants and national healthcare providers. Sixty-six percent of survey respondents indicated that they have successfully influenced changes in their respective healthcare systems and will continue to influence them as a result of their participation in EMPOWER. However, 81% of respondents agreed with the statement, "There is still a need for education on NSCLC in my geographic area."

> *It was amazing to see statistically significant increases in participant confidence as a result of EMPOWER efforts.*
>
> —EMPOWER Faculty

Participants indicated their confidence in 12 areas pertaining to NSCLC clinical techniques as a result of participating in the quarterly calls. Of these areas, only four did not show significant improvement. These areas are shown in Figure 21.

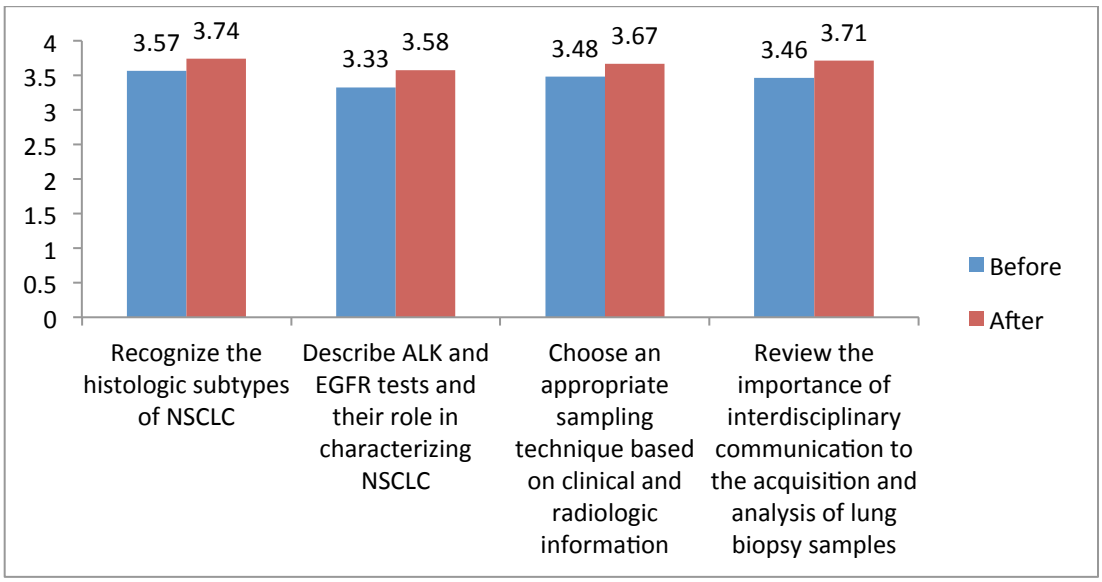

Figure 21. Mean Rating of EMPOWER Educational Opportunity Areas

While the above EMPOWER Learning Objectives showed overall improvement, a paired-samples *t*-test to evaluate a change in confidence in select NSCLC areas showed no significant gains in participants' confidence for the following areas before the institution of the quarterly calls:

- Recognizing histologic subtypes of NSCLC

- Choosing an appropriate sampling technique
- Reviewing the importance of interdisciplinary communication

Describing *ALK* and *EGFR* tests and their role in characterizing NSCLC was only slightly insignificant. However, there may be opportunities to emphasize this particular type of testing to impact patient care in future NSCLC programs. **Table 12** demonstrates that participants reported small gains in these knowledge and skill areas, indicating that further education may be warranted for these learning objectives.

Table 12. Participant Ratings of Confidence in Areas Before and After Their Participation in EMPOWER.

Confidence Area	Before /After	Mean	SD	Gain	*t*	*p*	Effect Size
Recognize the histologic subtypes of NSCLC	Before	3.57	0.66	0.17	1.70	.10	0.29
	After	3.74	0.54				
Describe *ALK* and *EGFR* tests and their role in characterizing NSCLC	Before	3.33	0.96	0.25	2.01	.06	0.30
	After	3.58	0.71				
Choose an appropriate sampling technique based on clinical and radiologic information	Before	3.48	0.60	0.15	1.83	.08	0.27
	After	3.67	0.48				
Review the importance of interdisciplinary communication to the acquisition and analysis of lung biopsy samples	Before	3.46	0.66	0.25	1.81	.08	0.45
	After	3.71	0.46				

Note: Participants were asked "Please rate your confidence in each of the following areas **BEFORE/AFTER** quarterly calls and their effect on your NSCLC practice."

An analysis of participant performance on the EMPOWER Post-test suggests that the post-test items Q5, Q8, and Q9 offer opportunities for additional education. These questions are linked to the following learning objectives:

- Choosing appropriate testing protocols for lung cancer specimens
- Recognizing histological subtypes of NSCLC
- Utilizing appropriate techniques to obtain adequate tissue samples

Conclusion

Section III provided evaluation results for the four educational objectives of the EMPOWER program, based on data collected from participants and project stakeholders during the program. These objectives were:

- Identifying the educational need and gaps in the management of NSCLC
- Increasing physician knowledge, skills, and competence in NSCLC management
- Increasing the impact of the EMPOWER program on the health system
- Identifying opportunities to enhance NSCLC knowledge in the future

The Systems Survey data indicate clear educational gaps in NSCLC management among EMPOWER participants compared with national norms. Overall, the participants who completed the EMPOWER program expressed satisfaction with the program and demonstrated promising changes in intermediate term confidence outcomes indicators of the educational gaps in the technical aspects of NSCLC management as well as multidisciplinary teamwork. In addition, the Action Plan Virtual Conference presentations demonstrate complex multidisciplinary practice improvement projects related both technical and change management components of NSCLC patient management. Finally, EMPOWER Post-test and confidence ratings suggest a handful of potential areas for further focus in future NSCLC education.

IV. Findings and Lessons Learned

This section presents findings for EMPOWER based on the outcomes results described in the previous section of the report. The section presents findings for program participation and satisfaction. From there, findings are organized and presented according to the EMPOWER evaluation questions.

Program Participation

Program participants: A total of 81 participants representing 23 satellite centers in five coordinating health systems participated in the EMPOWER program.

Participant demographics: The typical EMPOWER participant was a medical oncologist, had more than 20 years of experience, and was responsible for managing the treatment of 0 to 5 new lung cancer patients per month. Although most participants reported affiliation with a hospital or health system, almost all satellite centers were located in community-based or high-need areas.

Program Satisfaction

Overall satisfaction: Most participants expressed high levels of satisfaction with the EMPOWER program. Seventy-five percent of respondents to the EMPOWER Follow-up Survey indicated that they were "very satisfied" or "satisfied" with the program. Among the 20% who were not satisfied, the reasons included a desire for "more face-to-face interaction," and "less emphasis on change management." These respondents frequently mentioned that they would have preferred a more traditional CME program.

EMPOWER instructional components: Follow-up survey respondents rated the usefulness of EMPOWER instructional components in their NSCLC practice. The EMPOWER component rated most useful was the webinars, with 70% reporting that it was "extremely" or "somewhat" useful. The next most useful components were the enduring materials, including e-lectures, with 58.3% of respondents reporting that these features were extremely or somewhat useful. For the least useful instructional components, 41.7% reported not accessing the IHI videos and 33.3% reported not accessing action planning videos and modules.

Evaluation Question #1: Educational Need

The first evaluation question focused on identifying the multidisciplinary practice- and systems-based educational needs for the diagnosis, staging, and treatment of lung cancer. Needs in five main areas were examined using data from the systems survey:

- Adequacy of tissue samples
- Request of repeat biopsies
- Utilization of a multidisciplinary team approach
- Barriers in practice/healthcare system
- Management of change

Aligned with the overall goals of the EMPOWER program, these areas targeted the collection of adequate tissue samples and the diagnosis and staging of NSCLC.

Adequacy of tissue samples: Among EMPOWER participants, 77% of tissue samples were adequate for diagnosis and classification of lung cancer, whereas only 65% were adequate for biomarker testing. The magnitude of these values suggests a need for investigating potential reasons for inadequate samples and ways of addressing them to improve the adequacy of tissue samples. In addition, the lower reported adequacy of tissue samples for biomarker testing implied a higher need among the EMPOWER participants.

Contributors to tissue adequacy: The top two problems that likely contributed to the inadequacy of tissue samples were the size of the biopsy sample and the number of tumor cells in the biopsy sample being too small. Among the EMPOWER participants, poor communication was also one of the most prevalent reasons for inadequate tissue samples.

Request for repeat biopsies: The second area of need targeted by the EMPOWER program focused on requests for repeat biopsies. The mean number of repeat biopsies reported by the EMPOWER participants was 16.20 (SD = 9.41), which was lower than the mean percentage reported by the national sample (M = 18.46, SD = 14.69). However, both means were higher than the national average 10% of re-biopsies reported in the CHEST AQuIRE registry among pulmonologists and thoracic surgeons.

Utilization of a multidisciplinary team approach: As a result of participating in the EMPOWER program, participants showed significant improvement in the utilization of all six features of a multidisciplinary approach to the management of lung cancer examined on the Follow-up Survey. Two of the top areas of improvement were regular communication between multidisciplinary teams and multidisciplinary patient care teams that include pathologists, pulmonologists/thoracic surgeons, and oncologists**.**

Management of change: For both national and EMPOWER groups, the top three needs pertained to the availability of funding. Slightly more than a quarter of the national sample and 26.7% of the EMPOWER participants “disagreed” or “strongly disagreed” that “there are funds available for new equipment and technology.” The availability of funds for implementing systems change was another area of concern. Twenty-three percent of the national sample and 28.3% of the EMPOWER participants “disagreed” or “strongly disagreed” that this funding was available. Funding for skills training was the third area that had the greatest need, based on 22.6% of the national sample and 25.0% of the EMPOWER sample reporting that these funds were not available.

Evaluation Question #2: Physician Practice and Multidisciplinary Teamwork Change

The second evaluation question focused on the changes that EMPOWER participants made to their practice and health system as a result of participating in the program.

Practice changes: Participants indicated several specific changes they have made to their practice as a result of EMPOWER. Four areas of change indicated most often by participants were:

- Ensuring adequate biopsy samples are obtained (62%)
- Evaluating new diagnostic strategies (42%)
- Using biomarkers to guide therapy (38%)
- Utilizing a multidisciplinary approach (tumor board) to lung cancer treatment (38%)

Barriers to practice change: Participants highlighted the most significant barriers to implementing practice change as availability/expertise/training of specialists (38%) and cost (29%).

Increased confidence in NSCLC clinical skills: Participants rated their change in confidence in 12 areas pertaining to NSCLC clinical techniques as a result of participating in the EMPOWER quarterly calls. In eight of these areas, participants showed statistically significant improvement in confidence. The top three areas in statistical significance were:

1. Identifying the various techniques to sample tissue in patients with lung cancer
2. Prioritizing pathology analysis based on tissue availability, clinical information, and communication with the care team
3. Describing needle sampling techniques for mediastinal staging

Increased confidence in multidisciplinary teamwork: Participants rated their change in their level of agreement with six features of a multidisciplinary approach to the management of lung cancer as a result of participating in the EMPOWER program. Participants showed statistically significant improvement in all areas surveyed. Two of the top areas were regular communication between multidisciplinary teams and multidisciplinary patient care teams that include pathologists, pulmonologists/thoracic surgeons, and oncologists.

Evaluation Question #3: Health Systems Change

The third evaluation question focused on ways in which the EMPOWER program influenced systems-based practice among the participants.

Summary of Action Plan Initiatives: In the initial action plans, the types of changes identified by the participants were primarily at the individual level or focused on a relatively narrow aspect of the practice/healthcare system. Over time the action plans reflected increased levels of depth. They also marked a shift from more intra-systemic changes (eg, focusing on one aspect or level

within a system) to more inter-systemic changes (eg, addressing interdisciplinary issues or identifying potential changes across multiple system levels).

Action Plan Initiative successes: Numerous successes were identified in the action plans. In addition to increased knowledge and improved communication, there was also progress in areas related to the classification of NSCLC per guidelines and multidisciplinary approaches with tissue collection (ROSE/EBUS/TBNA). Related to logistical issues, the groups also made progress in procedural planning and workflow, as well as management of aspects of the testing process.

> *We [Satellite Center Clinicians] will be meeting with the Coordinating Center's Department of Medicine for further funding for new diagnostics and establishing our existing Lung nodule clinic with broader scope and participation.*
>
> —Satellite Center participant

Action Plan Initiative challenges: Some of the challenges identified in the action plans pertained to interdisciplinary differences in lung cancer management, such as conflicting discipline-specific guidelines and the difficulties of overcoming outdated practice patterns and staying abreast of new knowledge and techniques. There were also technical gaps related to tissue acquisition and diagnosis, such as difficulty ensuring the quality of on-site testing and obtaining adequate samples. Furthermore, there were logistical gaps related to tissue acquisition and diagnosis, such as dealing with multiple routes/sources of referrals and issues related to patients' insurance coverage. The nature of a multidisciplinary approach also posed challenges, such as logistical issues with remote areas and difficulties achieving consensus among the team regarding best biopsy approach, especially in settings where there may not be a specialist in pulmonary medicine.

Action Plan Initiatives next steps: Several aspects of the challenges were addressed in the next steps identified in the action plans. For example, there were plans to establish a Cancer Committee to set official guidelines based on Foundation Medicine discussions and promote these standards hospital-wide. There were also plans to identify and implement incentives for participation in multidisciplinary approaches.

Evaluation Question #4: Further Education Needs

The fourth evaluation question focused on clinical/systems–related needs that future programs may address. These findings suggest an ongoing need for further NSCLC education among healthcare providers.

Continued need for NSCLC education: 81% of EMPOWER respondents agreed that "there is still a need for education on NSCLC in [their] geographic area."

Potential areas for further education: Of the 12 areas pertaining to NSCLC clinical techniques that were targeted by the Follow-up Survey, four areas did not show statistically significant improvement in the participants' confidence. In addition, EMPOWER post-test results suggest potential further continuing education is needed in the following areas:

- Recognizing the histologic subtypes of NSCLC

- Describing ALK and EGFR tests and their role in characterizing NSCLC
- Choosing an appropriate sampling technique based on clinical and radiologic information
- Reviewing the importance of interdisciplinary communication in the acquisition and analysis of lung biopsy samples
- Choosing appropriate testing protocols for lung cancer specimens
- Utilizing appropriate techniques to obtain adequate tissue sample

V. CONCLUSION

The EMPOWER Educational Program provided an opportunity for multidisciplinary US healthcare providers to improve the identification of optimal methods of diagnosis and treatment of NSCLC. Specifically, the EMPOWER program focused on identifying and addressing barriers in community-based health systems affecting:

- Collection of adequate lung samples
- Diagnosis and staging of NSCLC
- Treatment of NSCLC with targeted therapies

The EMPOWER Curriculum supported addressing systems-based barriers to healthcare delivery targeting four main educational objectives:

- Identifying the educational needs and gaps in the management of NSCLC
- Increasing physician knowledge, skills, and competence in NSCLC management and assessment
- Increasing the impact of lung cancer education on the healthcare system
- Assessing additional opportunities for future NSCLC education

The EMPOWER program supported these educational objectives via four EMPOWER interventions:

- EMPOWER Systems Surveys
- Train-the-Trainer Live Meetings
- EMPOWER Interdisciplinary and Change Management Webinars
- Action Plan Development and Wrap-up Webinars

Each EMPOWER intervention was linked to an educational objective as described in the EMPOWER Logic Model and Outcomes Chart (Appendix I). This report provides a summative assessment of the progress achieved in meeting the educational objectives to date. The previous sections of the report provide a comprehensive description of the EMPOWER program, its curricular interventions, a review of the data collected regarding program impact, and a summary of findings regarding the program. In addition, this section of the report provides a summary of the key strengths and challenges of the program.

EMPOWER Strengths

- Based on the analysis of need, the EMPOWER participants indicated similar or greater NSCLC educational needs than the national survey respondents. These results indicate that the community-based providers selected for this program are an appropriate audience. One participant stated that an important feature of this program was the knowledge that "we [rural] providers are not alone [in our experiences]."

- The EMPOWER program, like its predecessor GAIN 1.0 and its sister program GAIN-EU, adopted a multidisciplinary approach to NSCLC management. In this approach, participants engaged in activities and learning across the entire NSCLC diagnosis, staging, and treatment cycle. Many EMPOWER participants commented that this approach was novel and useful. "This prospective approach [to lung cancer management] has been invaluable," said one participant.

- The EMPOWER webinars and curriculum incorporated a multimodal educational approach, involving several innovative instructional strategies. These strategies included problem-based learning, flipped-classroom instructional design, and webinars. In addition, participants were asked to identify and report on the implementation of long-term systems-based change management initiatives.

- The EMPOWER program was well received by participants. Over 75% of participants reported that they were "very satisfied" or "satisfied" with the program.

- Overall, EMPOWER participants reported immediately implementing changes in their practice based on what they learned during the course of the program. Participants showed statistically significant gains in confidence in eight of 12 surveyed areas of technical knowledge based on the EMPOWER Learning Objectives. Participants showed statistically significant improvement in the utilization of all six features surveyed regarding the multidisciplinary approach to NSCLC. Two of the top areas were regular communication between multidisciplinary teams and multidisciplinary patient care teams that include pathologists, pulmonologists/thoracic surgeons, and oncologists.

- EMPOWER Action Plan development was useful for the sites that completed this part of the program. Action plans focused on addressing four main areas of improvement: disciplinary differences, technical/scientific knowledge or skills, logistical issues, and multidisciplinary teamwork/ communication. Action Plan Rubric scoring (15.9/18) indicated that participants understood the components of change management. Participants identified significant long- and short-term improvement projects.

- The quality and complexity of the EMPOWER Action Plan Initiatives improved significantly over the course of the program. In the initial action plans, the types of changes identified by the participants were primarily at the individual level or focused on a relatively narrow aspect of the practice/healthcare system. Over time the action plans reflected increased levels of depth and complexity. They also marked a shift from more intra-systemic changes (eg, focusing on one aspect or level within a system like physician practice or billing/coding for insurance payment) to more inter-systemic changes (eg, addressing interdisciplinary issues or identifying potential changes across multiple system levels).

- Although participants showed statistically significant gains in many aspects of NSCLC tissue sampling and testing as well as increased utilization of features of the multidisciplinary team approach in their practice, there remain several opportunities for additional education regarding technical skills and knowledge related to NSCLC. Over 80% of participants feel there is a need for more NSCLC education in their geographic area.

EMPOWER Challenges

- EMPOWER participants were largely medical oncologists, followed by pulmonologists and pathologists. Pathologists in the program reported not fully understanding their role in the interdisciplinary approach before the start of the program.

- EMPOWER was an intensive, year-long educational intervention that targeted community-based physicians affiliated with major health systems. The majority of participants reported that the program had immediate benefits to their practice. However, there was high attrition by the end of the program (of the original 23 satellite centers, only 10 presented their original completed action plans). In addition, about 25% of respondents reported "dissatisfaction" with the instructional model, as they would have preferred more "traditional programs" or "skills-based training" offered in traditional CME.

- The reputation and influence of the Coordinating Center Champions was an important component of participant engagement in the program. However, many sites were located at great distances from their coordinating sites, with little contact with their coordinating faculty. Participants at these sites often reported being "too busy to fully participate" as a result of their practice demands. Similarly, other satellite center participants reported being "stretched too thin" to participate in the flipped-classroom style CME. One participant suggested replacing LMS-based resources and pre-work with short "flash-talks" at the beginning of the PBL webinars for future programs.

EMPOWER Summary

The EMPOWER program provided a unique opportunity for participants to engage in multidisciplinary, systems-based approach to NSCLC management. The program promoted a unique and successful approach for teaching innovative technical skills in NSCLC staging, diagnosis, and treatment as well as providing participants' support for recognizing systems-based challenges. The outstanding short-term results for the program also indicate increases in physician confidence in their ability to influence disciplinary, technical, logistic, and team communication changes that will benefit both their practice and the health system. As satellite and coordinating centers implement their action planning initiatives, the resulting changes will ultimately lead to better diagnosing, staging, and treatment for NSCLC patients across their health system.

APPENDICES