The Role of Lung Cancer Advocacy Organizations in Biomarker Testing

Document Type:
White Paper

Authors:
Carolyn Aldigé
Upal Basu Roy, PhD, MPH
Win Boerckel, LCSW-R, MSW, MBA
Andrew Ciupek, PhD
Dusty Donaldson, MA
Hildy Grossman, PhD
Cindy Langhorne
Lauren S. Rosenthal, MPH
Claire Saxton, MBA
Gerard A. Silvestri, MD, MS
Robert A. Smith, PhD
Linda Wenger

Target Publication(s):
Factsheet
Materials with consistent messaging

Work supported by:
Winfield Boerckel, LCSW-R, MSW, MBA
Cancer*Care*

Support provided by:
AbbVie

Prepared by:
Sarah Hummasti, PhD
AOIC, LLC

Draft and date:
D3V2 Final
August 29, 2018

AOIC Project Number:
CC18111

One East Uwchlan Avenue, Suite 408
Exton, PA 19341
Phone: (610) 321-1623
www.aoic.net

The Role of Lung Cancer Advocacy Organizations in Biomarker Testing

Authors:
Carolyn Aldigé[1]
Upal Basu Roy, PhD, MPH[2]
Win Boerckel, LCSW-R, MSW, MBA
Andrew Ciupek, PhD[4]
Dusty Donaldson, MA[5]
Hildy Grossman, PhD[6]
Cindy Langhorne[7]
Lauren S. Rosenthal, MPH[8, 11]
Claire Saxton, MBA[9]
Gerard A. Silvestri, MD, MS[10, 11]
Robert A. Smith, PhD[8, 11]
Linda Wenger[2]

Affiliations:
1. Prevent Cancer Foundation
2. LUNGevity Foundation
3. Cancer*Care*
4. Lung Cancer Alliance
5. Dusty Joy Foundation (LiveLung)
6. Upstage Lung Cancer
7. Caring Ambassadors Lung Cancer Program
8. American Cancer Society
9. Cancer Support Community
10. Medical University of South Carolina
11. National Lung Cancer Roundtable

Address correspondence to:

Win Boerckel wboerckel@cancercare.org

The Role of Lung Cancer Advocacy Organizations in Biomarker Testing

Introduction

A group of directors from lung cancer patient advocacy organizations and key opinion leaders in the lung cancer field held a roundtable on March 13–14, 2018, in New York City to discuss trends in biomarker testing for patients with lung cancer.

The objective of this roundtable was to align on strategies to optimize patients' and physicians' awareness of biomarker testing to increase uptake in order to ensure all lung cancer patients receive the most effective treatment. Discussions from the roundtable led to the development of this whitepaper, which will be posted on the websites of the participating lung cancer advocacy groups and cancer organizations (Table 1). Its goals are to highlight advances in lung cancer treatment due to the advent of targeted therapies, describe underutilization of biomarker testing in patients with advanced lung cancer, and develop an action plan to optimize the education of patients and physicians regarding biomarker testing.

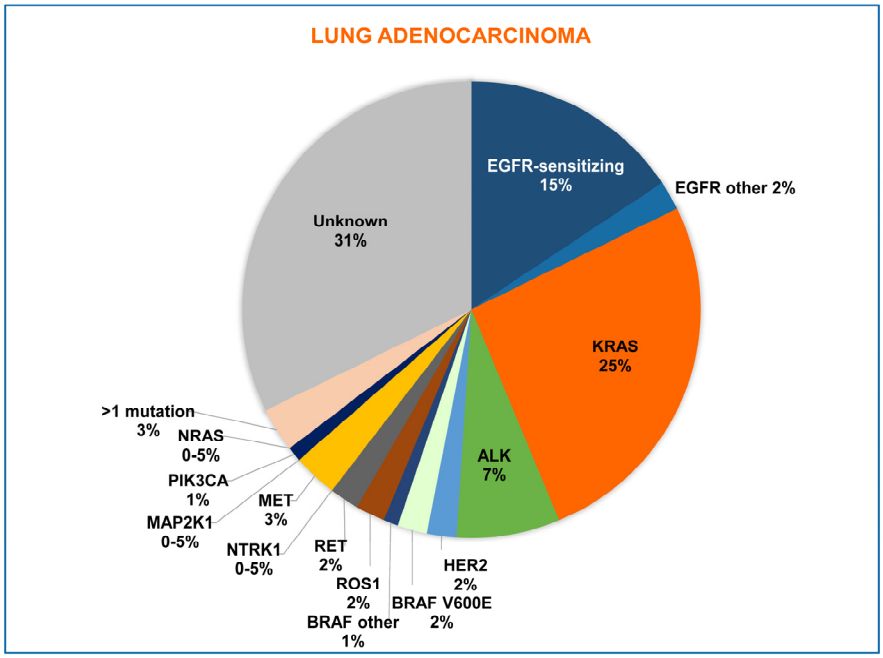
Table 1. Lung Cancer Advocacy Organizations Represented at the Roundtable Meeting	
American Cancer Society	https://www.cancer.org/cancer/lung-cancer.html
Cancer*Care*	https://www.lungcancer.org/
Caring Ambassadors Lung Cancer Program	http://lungcancercap.org/
Cancer Support Community	https://www.cancersupportcommunity.org/
Dusty Joy Foundation (LiveLung)	http://livelung.org/
Lung Cancer Alliance	https://lungcanceralliance.org/
LUNGevity Foundation	https://lungevity.org/
Prevent Cancer Foundation	https://preventcancer.org/
National Lung Cancer Roundtable	https://nlcrt.org/
Upstage Lung Cancer	https://upstagelungcancer.org/

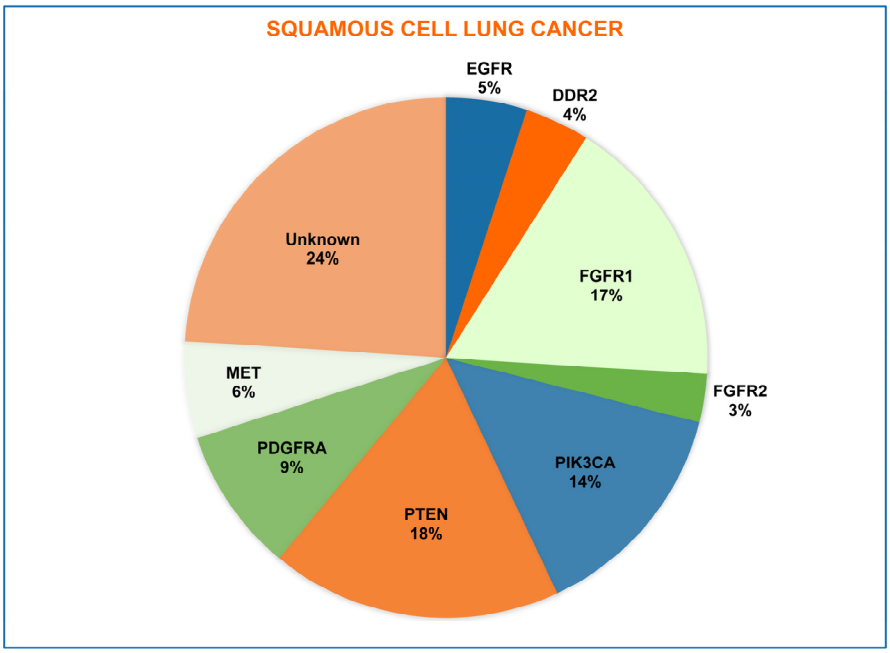
An Overview of Biomarker Testing

In the past 10 years, major advances have been made in our understanding and treatment of lung cancer. Lung cancer is not just a single disease, but rather describes many different types of cancer that develop in the lung. The two main types of lung cancer are non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). NSCLC accounts for ~ 85% of lung cancers and can be further classified as adenocarcinoma, squamous cell carcinoma, or large cell carcinoma based on the type of cell where the cancer starts.[1a] Within these categories, many additional subtypes have now been identified based on unique genetic changes (or driver mutations) that allow a specific cancer to develop and grow. These unique mutations serve as biomarkers that help doctors classify an individual's specific type of lung cancer and help determine the most appropriate treatment.[2b]

[a] Novello 2016 p.1 col2 para1
[b] Kris 2014 p.2 col1 para1

Figure 1. Driver Mutations in Lung Adenocarcinoma and Squamous Cell Lung Cancer





Progress in understanding the different subtypes of NSCLC, and the specific mutations and biomarkers involved, has led to a dramatic shift in how lung cancer is treated, from traditional chemotherapy to biomarker-driven targeted therapy and immunotherapy (therapies designed to stimulate the body's natural immune response to attack cancer cells). Of note, not all patients will have tumors in which a target can be identified and therefore may not be eligible for targeted therapy. Chemotherapy remains the standard of care for these patients.

The majority of new treatment options available and those under development are targeted therapies and immunotherapies. Clinical trials have shown significant improvement in survival and health-related quality of life when targeted therapy is used in patients with the applicable biomarkers.[a] For example, inhibitors of the epidermal growth factor receptor (EGFR) improve outcomes in patients with the EGFR biomarker compared with chemotherapy and are now the standard first-line therapy in patients with advanced-stage NSCLC and whose tumors express an EGFR mutation.[1,3-5b] Similarly, drugs targeting anaplastic lymphoma kinase (ALK) rearrangements are now recommended as first-line therapy in patients with the corresponding

[a] Kris 2014 p. 2001 col1 para2 and p.2003 Figure2; Mok 2009 p. 950 col2 para2; Peters p. 836 col1 para1; Solomon 2014 p.2174 col2 para2;
[b] Mok 2009 p. 950 col2 para2; Tan 2016 p. 947 col2 para2; Masters 2015 p. 3489; Novello p.7 Figure 2

biomarker.[1,3,6,7a] Approved targeted therapies are also available for patients with lung adenocarcinoma who have ROS1 and BRAF mutations.[8,9b] Immunotherapies that target PD-1 and PD-L1 (proteins that inhibit the immune system from attacking the cancer cells) also improve survival in patients with NSCLC and are approved for the treatment of patients with adenocarcinoma or squamous-cell NSCLC.[10-13c] Drugs targeting a number of other biomarkers found in patients with NSCLC are being investigated in clinical trials.

Currently, there are no available targeted therapies for patients with SCLC. However, several promising drugs are currently being tested in clinical trials for this disease.[14d] As such, SCLC may be the next frontier in lung cancer treatment, and the benefits of biomarker testing in these patients should continue to be evaluated.

Despite the increasing number of drugs available that target specific mutations in patients with NSCLC, biomarker testing is often viewed as an optional service by patients and presented as optional by their health care team. Too many patients with advanced-stage NSCLC -- especially those who are underinsured or have

---

[a] Peters p. 836 col1 para1; Solomon 2014 p.2174 col2 para2; Masters 2015 p. 3489; Novello p.7 Figure 2
[b] Shaw 2014 p. 5 para 1 and para 2; Planchard 2017 p.4 para 5 to p. 5 para 1 and p.7 para 4 and 5
[c] Brahmer 2015 p.128 Figure 2; Borghaei 2015 p. 1633 Figure 1; Ghandi 2018 p.9 col2 para2; Rittmeyer 2017 p. 258 col2 and p.260 Figure 2
[d] Byers 2015 p.10 para3

no health insurance, or who live in rural areas -- do not receive biomarker testing at diagnosis. For example, according to a recent study of an oncology practice comprising 15 community oncology centers, only 59% of patients with advanced-stage NSCLC received EGFR and ALK testing (as recommended by the College of American Pathologists, International Association for the Study of Lung Cancer, and Association for Molecular Pathology) and an even smaller proportion (8%) received comprehensive genomic profiling.[15a] Though these numbers only represent one oncology practice and the proportions are likely to vary widely across different practices and settings, the study underscores the importance of education around comprehensive biomarker testing at the time of diagnosis. Additionally, the Lung Cancer Alliance conducted a needs assessment survey for the lung cancer community, the results of which further support lack of testing and testing awareness among lung cancer patients.[16] In the survey, 1 in 6 patients reported not knowing if they had received molecular testing.

Barriers to biomarker testing include lack of awareness among oncologists, pathologists, and pulmonologists regarding the importance of biomarker testing for treatment selection[b] and suboptimal tissue sampling to run the test.[c17-19] Even when biomarker testing is performed, the slow turnaround time in some cases

[a] Gutierrez 2017 p. 652 col2 para2; p.653 col2 para1; p.654 col1 para2
[b] Sung 2016 p. 181 col2 para1
[c] Rao 2017 p.e149 col2 para4 and Figure; Lim 2015 p.1417 (diagnostic sample adequacy); Lim 2017 p. 104 col2 para3; Sung 2016 p. 181 col2 para1

results in the initiation of conventional therapies while waiting for results [18,19].[a] This can limit the ability of patients to fully benefit from testing (eg, unwilling to switch to new therapy once something else has been initiated or no longer meeting clinical trial eligibility criteria for first-line clinical trials). Patients also face significant challenges when acting as their own advocates, given the complexity of these new therapies.

[a] Lim 2015 p. 1418 col1 para2 and col2 para2; Sung p. 181 col1 para2

Lung Cancer Advocacy Biomarker Testing and Awareness Programs

Patient advocacy groups are well positioned to address the lack of patient awareness regarding biomarker testing with education campaigns. To this end, several advocacy organizations have developed programs to increase patient awareness of and access to biomarker testing. Two such programs were highlighted during the roundtable.

The Lung Cancer Alliance LUNGMATCH Program

In an effort to address the underutilization of biomarker testing in patients with advanced-stage NSCLC, the Lung Cancer Alliance has developed the LUNGMATCH program. The program includes three main parts: 1) personalized educational materials to increase patients' awareness of biomarker testing, including 1-page fact sheets and comprehensive pamphlets provided directly to patients upon request as well as being made available to them in the clinic through nurse navigators; 2) clinical trial and treatment navigation assistance through a patient-geared, easy-to-understand clinical trials search engine and a clinical trial matching helpline; and 3) A biomarker testing program in partnership with the company Perthera that provides oncologist-reviewed, comprehensive, multi-omic, testing reports to both patients and physicians, at no cost to patients. To date, over 100 patients have received biomarker testing and over 2000 have received clinical trial search results through the program.

The LUNGevity Take Aim Initiative

The LUNGevity Take Aim initiative works to ensure that all lung cancer patients have access to precision medicine, defined as biomarker-driven therapeutics. The initiative focuses on biomarker testing with the goal of having all patients tested at diagnosis for the profile of their tumors. This will provide patients and physicians with the information they need to identify appropriate targeted therapies and clinical trials that best meet the needs of the individual patient. As a multi-stakeholder initiative involving professional societies, clinicians, industry partners, payers and patients, Take Aim has a broad-reaching approach to address numerous barriers to biomarker testing. The initiative involves four parts: 1) improving patient education and awareness of the importance of biomarker testing; 2) increasing pulmonologist and interventional radiologist education regarding sufficient tissue acquisition; 3) collaborating with the pathology community to advance appropriate handling and testing of tumor tissue for speedy, comprehensive testing results to aid in better biomarker-driven treatment decisions by the oncologist; and 4) looking at potential changes needed in public policy.

Patient education and awareness activities have included:

- Biomarker education booklet, animated patient testimonials and physician interviews on biomarker testing, and enhanced information on biomarkers on the LUNGevity website

- Integration of information on biomarkers in the LUNGevity Lung Cancer Navigator App

- LUNGevity-driven media coverage on the need for rebiopsy and biomarker testing at recurrence

- Participation in the Harvard Business School Kraft Precision Medicine Accelerator program focused on making biomarker testing mainstream

- Planning for a social media-based public service campaign on biomarker testing

The Take Aim Initiative's pathologist, pulmolonolgist, and interventional radiologist education and coordination efforts include a toolkit on biomarker testing to help patient care teams improve and optimize biomarker testing at their sites, and dissemination of a whitepaper on patient attitudes toward rebiopsy.

Finally, public policy initiatives include efforts to change the Date of Service/14-day rule requiring hospitals to pay for testing if done within 14 days of outpatient admission, which can delay testing. Advocating for coverage of next generation sequencing, a briefing on the importance of advanced diagnostics on Capitol Hill, and ongoing work to include biomarker testing as a quality metric are also being done.

Biomarker-Focused Educational Materials: An Audit of Gaps and Unmet Needs

In addition to the initiatives noted above, the LUNGevity foundation conducted an audit of educational materials on biomarker testing produced by industry and

advocacy groups that were geared toward patients and physicians. The goal of the audit was to identify gaps and unmet needs in educational efforts designed to increase awareness of biomarker testing.

The audit found wide variability in the language used to describe biomarker testing, both in materials from different advocacy organizations and between materials developed by industry and advocacy groups. Even the term “biomarker testing” itself is not uniformly used. Genetic testing, molecular testing, genetic diagnostics, molecular diagnostics, and molecular pathways (among others) are all currently used to describe biomarker testing in materials from different sources. This finding highlights the need to establish a common terminology to avoid confusing patients. To this end, organizations and industry that participated in the audit agreed on the term “biomarker testing” as a standardized term, given that the term “biomarker” includes testing for driver mutations as well as immunohistochemistry-based tests such as PD-L1.

A subsequent audit also looked at how well various educational materials from different sources covered key aspects in terms of the WHO, WHAT, WHEN, WHERE, WHY, and HOW of biomarker testing (Table 2).

Table 2. Key Topics for Educational Materials on Biomarker Testing	
WHO	(which patients) should get tested?
WHAT	is biomarker testing?
WHEN	should I have a conversation with a physician? (for patients) should a patient get tested? (for physicians)
WHERE	is testing done?
WHY	is biomarker testing important? How is the information used?
HOW	is testing done?

The audit found that advocacy groups' materials geared toward patients were effective at addressing WHY biomarker testing should be done. Most also provided comprehensive information on the WHO, WHAT, and WHERE of biomarker testing. However, information on WHEN and HOW biomarker testing should be done was not consistently covered in a comprehensive manner. Likewise, patient-facing materials from industry were generally comprehensive in their coverage of WHY and WHO, and also did a good job describing HOW biomarker testing should be done. However, 50% or fewer of the patient-facing, industry-generated educational materials that were examined comprehensively described WHAT biomarker testing is and WHERE or WHEN it should be done. Finally, the majority of physician-facing materials (developed by industry)

comprehensively covered the WHY and WHO of biomarker testing, but 50% or fewer were comprehensive in terms of WHAT, WHEN, WHERE, and HOW.

The 5 Cs of Patient-Facing Materials: Consistent, Clear, Customizable, Comprehensive, and Checklists

The results of the LUNGevity audit highlight the need for consistent and comprehensive messaging related to biomarker testing for both patients and physicians. The roundtable participants further identified the need for patient-facing educational materials to be clear and customized (eg, in terms of amount of information provided or availability in different languages) based on the individual patient. Finally, checklists were discussed as important tools to help patients ask the right questions at the right time. Together, these features can be identified as the 5 Cs of patient-facing educational materials.

1. **Consistent:** A cohesive message across lung cancer advocacy groups is needed, starting with consistent terminology for the process itself (eg, biomarker testing vs genetic testing or molecular diagnostics). Easy-to-understand definitions that are consistently used and unified core key messages on biomarker testing are also critical to avoid confusing patients, many of whom access multiple sources for information regarding lung cancer. Finally, the key statistics related to lung cancer (eg, number of cases, number of deaths, mean survival) and biomarkers (eg, number of biomarkers identified, prevalence of a specific biomarker) need to be consistently reported. Collaboration with professional medical societies (eg, American Society of Clinical Oncology [ASCO], American College of Chest Physicians [CHEST]) to establish the core messaging and

definitions should be considered to promote consistency between patient- and physician-focused materials.

2. **Clear:** For educational materials to be effective, they need to be clear and easily understood by the intended audience. Simple messages and infographics are examples of easy-to-digest methods for presenting information. In addition, patient education materials should be developed aiming for a sixth-grade literacy level (including proper introduction and explanation of multisyllable words) so that they can be easily understood by most patients; software is available that can assist with achieving target literacy levels.

3. **Customized:** Individual patients (and caregivers) differ in terms of how much information they want, and can readily absorb, related to their diagnosis and treatment. Further, the appropriate amount of information for a given individual may change based on where the patient (or caregiver) is in the treatment continuum. As such, educational materials should include basic information as the starting point. This information can then be expanded upon in additional materials (or by clicking on the link/message for web-based materials) for patients who want additional information.

   Additional effort is also needed to make educational materials available in multiple languages. Cost and lack of industry funding for translation is often a barrier. One potential solution is for advocacy groups to

collaborate on basic information that industry agrees to fund for translation and cultural adaptation into multiple languages.

4. **Comprehensive:** It is critical to ensure that all materials are accurate and that no information is missing. Care should be taken to ensure all relevant topics (Who, What, When, Where, Why, and How) are covered. Further, educational materials should be regularly reviewed both internally and externally by experts in the field. Finally, educational materials need to be updated regularly to keep pace with the constantly changing treatment landscape, and outdated materials should be removed from circulation.
5. **Checklists:** Learning about a lung cancer diagnosis is an overwhelming experience. Patients often either do not know what questions to ask or forget to ask their questions during a doctor's appointment. A checklist detailing the critical questions to ask their physician regarding biomarker testing would help ensure that key information regarding biomarker testing is covered.

Challenges identified include reaching agreement and consensus across lung cancer advocacy groups, professional medical societies, and industry on the core definitions and messages, and ensuring that patients have access to educational materials related to biomarkers at the time of diagnosis (before initiation of therapy). Nurse navigators and oncology nurse practitioners were identified as a potential resource to provide information to newly diagnosed patients.

Initiatives Geared Toward Physicians

In parallel with efforts to increase patient awareness, initiatives geared toward physicians are needed to ensure that physicians have accurate and updated information on biomarker testing and are following practices recommended in guidelines in terms of which patients should receive biomarker testing and when, Information on how biomarker testing impacts treatment decisions is also needed.

Guidelines, yearly conferences, and continuing medical education materials are all important sources of information for physicians. However, many oncologists see patients with a range of malignancies, not just lung cancer, which can amount to a large volume of information to keep up with. Efforts to ensure that other members of a patient's care team, including pulmonologists and pathologists, are aware of and educated on biomarker testing and their role in the process of biomarker testing are also needed. Online sources of information, such as Up-to-Date or mobile applications, are increasingly being used as an easy-to-access source of information by physicians and could represent an avenue for providing information on biomarker testing. Other physician-directed initiatives to explore include a physician's checklist that covers the key steps needed in terms of biomarker testing and the role of each member of the care team in this process. Further, including biomarker testing rates (ie, percent tested, percent not tested and explanations for why not tested) as part of quality metrics could have a huge impact on ensuring that testing is done when it is appropriate.

Call to Action, Part 1: Develop Consensus Terminology and Messaging in Patient Educational Materials

The roundtable participants identified the lack of a unified message in patient educational materials as a barrier to effective patient education. Many lung cancer patients use multiple sources to obtain information about their diagnosis; if the information across sources is varied, patients can become confused or overwhelmed. To address this issue, patient advocacy groups, healthcare providers, and industry need to align on common terminology and messaging with regard to biomarkers and other patient educational materials. To achieve this goal, two potential avenues were outlined that patient advocacy groups could act on.

Option 1: Common Messaging; Different Wrappers

Under this approach, patient advocacy groups would combine forces and work together to generate joint educational materials on biomarker testing. Each advocacy group involved in the collaboration would have a seat at the table in terms of developing the materials. In addition to a unified and cohesive message for patients, benefits of a common core set of educational materials include the ability to pool resources to save on costs (ie, medical writing, design, project management, honorarium for reviewers, printing), the potential to cost-effectively translate the materials into multiple languages, and the benefits of individuals with various expertise working together.

Several possibilities were discussed in terms of how to package the educational content generated through this collaboration.

1. Common factsheets, brochures, and pamphlets could be generated with the logos of all collaborators included at the bottom. The presence of multiple logos was viewed as presenting a message of support and consensus among major advocacy organizations in the lung cancer arena.
2. The educational content could be created in collaboration, but each advocacy group would then package the information with their own branding. This approach would allow for each advocacy group to maintain a uniform look with all their educational materials.
3. A combination of the first 2 approaches could also be utilized (ie, a central, shared core fact sheet or pamphlet with individual organizations incorporating their own unique branding to additional materials to supplement the core materials).

Option 2: One Voice, Individual Identity

Under this approach, patient advocacy groups would work together to develop a shared consensus statement of best practices and common core items or "building blocks" for use by each organization to develop their own materials. The consensus materials would be developed in collaboration and would include agreed-upon terminology and definitions, aligned key messages, common numbers and facts, and checklists/questions for patients to ask their care team. Standards for the best way to develop and organize educational materials based

on these “building blocks” would also be developed (eg, the order in which to present information, overall tone, and aiming for a sixth-grade reading level). Educational materials developed based on the consensus statement could be identified with a unique tagline (eg, proud member of the Counsel of Cancer Education).

Many of the same benefits as Option 1 would also apply to this option (ie, uniform message, pooling expertise, potential to increase translation into different languages). In addition, this “building blocks” approach would allow organizations to maintain their autonomy and own identity by retaining a common agreed-upon terminology and message.

Common Messaging: Barriers, Solutions, and Strategies for Measuring Success

Both approaches described above present a paradigm shift in how educational materials are currently developed, requiring collaboration and agreement by patient advocacy groups and support from industry partners. Barriers to this approach include the fact that best practices for both nonprofits and for-profit corporations in terms of branding, marketing, and fundraising/development encourage each organization to create their own uniquely branded materials. Moreover, despite a common goal among lung cancer advocacy organizations and the many ways that they partner together on other efforts, competition for funding from individuals and industry does exist.

For the collaborative development of common messaging and materials to be successful, a point of contact to drive the project (write grants, project

management, follow-up, etc) is needed. Having a neutral party (ie, a consulting firm or a lung cancer coalition like LungCAN) in this role could be beneficial. Ultimately, funding will also be required. Industry sponsors frequently collaborate to support advocacy group initiatives and funding a single initiative for use by multiple groups could be beneficial for all involved. An effective communication plan among organizations is also critical, both to facilitate coordination on joint efforts and to avoid duplication of efforts and products. Effective communication could also facilitate simultaneous release and promotion (eg, on social media) of new information or materials, which could increase reach and impact.

Best practices for creating such collaborative materials would include soliciting input from advisory boards comprised of health care professionals, representatives from medical societies and other professional organizations, patient advocacy groups, patients, and caregivers to guide development of content. Once draft content has been created, testing the materials with patients and caregivers is essential. This could include focus groups of newly diagnosed patients to assess whether they find the information provided helpful and easy to understand as well as identifying areas where additional education is needed. Further, input gathered from patients and caregivers who have previously received biomarker testing will provide valuable insights about what patients found helpful to them when going through the process. All messaging, facts, and materials should also be regularly screened and updated. Even when updates are minimal, a timestamp noting when materials were most recently updated can provide confidence that the materials are relevant and current.

Finally, strategies to measure the effectiveness of a joint educational materials approach should be put in place at the onset. Some possibilities include tracking various metrics to quantify patients' use of the new materials (ie, track who orders print materials, monitor website downloads, monitor social media presence). For web-based materials, a simple survey could also be included (eg, was this information helpful, do you feel more comfortable asking your HCPs about biomarker testing after reading this, please provide your email for future [30-day] follow-up so that we can follow up with you on your conversation with your HCP about biomarker testing). Goals established at the beginning of the collaboration should also be tracked (eg, deliverable dates met, funding goals achieved, number of translations to other languages).

Call to Action, Part 2: Understanding and Addressing Physician Knowledge Gaps

Physicians play a key role in both educating patients and ensuring their patients with advanced-stage NSCLC receive biomarker testing at diagnosis. As such, it is important that physicians and other healthcare providers are involved in the development of, and encouraged to use, the core messaging and terminology developed by patient advocacy groups and industry, as described in the previous section.

In addition, it is essential to understand physician-related barriers (eg, insufficient sample collection at biopsy, physicians not sending patient samples for biomarker testing) to timely and accurate biomarker testing. The first step in addressing this issue is to gain a fuller understanding of physicians' knowledge gaps and other reasons to explain why biomarker testing is not being performed.

The roundtable recommended a comprehensive and well-developed physician survey to gather information in this regard.

Some examples of information to be collected through the survey include:

1. Is tissue being collected for biomarker testing during the biopsy? Why or why not?
2. If samples are being collected, is it being done correctly? If incorrectly, what are the contributing factors?
3. Is a lung biomarker panel test (comprehensive profiling) being ordered? Why or why not?
4. Are physicians comfortable recommending treatment based on the results of biomarker testing? Why or why not?

Results of the survey can then be used to identify gaps in physicians' knowledge and guide the development of educational initiatives to address gaps. Information collected during the survey could also be used to identify differences based on physician demographics (eg, years of experience, academic versus community physician, specialty, or geographic region). Physicians could be resurveyed after educational initiatives designed to fill the gaps identified in the original survey have been implemented. The effectiveness of the new educational strategies can be assessed by demonstrating changes in knowledge gaps, as well as change in clinical practice.

To be successful, the physician survey needs to be well developed and generalizable (ie, sufficient numbers from the community setting as well as

academic settings). Potential obstacles include securing funding to perform the survey, ensuring the quality of the survey, and obtaining a high rate of participation.

Finding a Unified Voice: Who, What, When, Where, Why, and How

As a first step in finding a unified voice for educational materials for patients, roundtable participants outlined the key points with regard to the Who, What, When, Where, Why, and How of biomarker testing (Table 3).

Table 3. Finding a Unified Voice: The Who, What, When, Where, Why, and How of Biomarker Testing
WHO should get tested?
• All patients with advanced or recurrent NSCLC • For patients with early-stage disease, testing could be beneficial for inclusion in certain clinical trials • As additional targeted therapies become available, biomarker testing for patients with SCLC may also be recommended
WHAT is biomarker testing?
• Lung cancer tumors can grow and spread in different ways • Biomarker testing identifies changes that may define your unique cancer • Biomarker testing is the first step in precision medicine, whereby your treatment is matched to your specific tumor
WHEN should a patient get tested?
• At diagnosis, progression, and recurrence/relapse • If biomarker testing is not done at diagnosis, it should be done as soon as possible following diagnosis and prior to treatment
WHERE is testing done?
• When possible, biopsy should be done by a dedicated thoracic physician at a facility that does many biopsies per week • Biomarker testing may be done in-house or sent out to a testing facility
WHY is biomarker testing important?
• The effectiveness of different treatments varies greatly depending on each patient's biomarker profile • Patients with tumors that express certain markers may not respond as well to standard chemotherapy • Patients matched with the appropriate treatment based on biomarker testing may live a better and longer life than those who receive standard chemotherapy treatment
HOW is testing done?
• At the time of diagnosis, the doctor should send the patient's tissue, fluid, or blood to a lab for appropriate testing* • The doctor may wait for the biomarker test results (~7–14 days) before starting treatment in order to identify the best treatment for the patient

*A comprehensive biomarker panel is preferred, including testing for both mutations with currently approved targeted therapies available for lung cancer and mutations for which targeted therapies are being tested in clinical trial.

Conclusion and Next Steps

Currently, biomarker testing is often viewed as an optional service by patients with lung cancer as well as their healthcare team. Additional education and awareness are needed to change this view and establish biomarker testing as part of standard of care in patients with advanced-stage lung cancer. The ultimate goal is that every patient with advanced-stage lung cancer has a full biomarker panel performed at the time of diagnosis, so it is available at their first appointment with an oncologist (or at least tests are in progress). This whitepaper summarizes opportunities to achieve this goal that were identified by a roundtable of directors from various lung cancer advocacy organizations and key opinion leaders. Next steps include reconvening the roundtable (via teleconference) to discuss strategies for moving forward with the opportunities identified in the whitepaper. Collaboration with an upcoming American Cancer Society National Lung Cancer Roundtable meeting that will focus on physicians' knowledge gaps and development of a consensus statement on biomarkers for physicians is also encouraged to ensure uniformity across organizations and in messaging for patients and physicians.

References

1. Novello S, Barlesi F, Califano R, et al. Metastatic non-small-cell lung cancer: ESMO Clinical Practice Guidelines for diagnosis, treatment and follow-up. *Ann Oncol* 2016;27:v1-v27.
2. Kris MG, Johnson BE, Berry LD, et al. Using multiplexed assays of oncogenic drivers in lung cancers to select targeted drugs. *JAMA* 2014;311:1998-2006.
3. Masters GA, Temin S, Azzoli CG, et al. Systemic therapy for stage IV non-small-cell lung cancer: American Society of Clinical Oncology Clinical Practice Guideline Update. *J Clin Oncol* 2015;33:3488-515.
4. Mok TS, Wu YL, Thongprasert S, et al. Gefitinib or carboplatin-paclitaxel in pulmonary adenocarcinoma. *N Engl J Med* 2009;361:947-57.
5. Tan DS, Yom SS, Tsao MS, et al. The International Association for the Study of Lung Cancer consensus statement on optimizing management of EGFR mutation-positive non-small cell lung cancer: status in 2016. *J Thorac Oncol 2016*;11:946-63.
6. Peters S, Camidge DR, Shaw AT, et al. Alectinib versus crizotinib in untreated ALK-positive non-small-cell lung cancer. *N Engl J Med* 2017;377:829-38.
7. Solomon BJ, Mok T, Kim DW, et al. First-line crizotinib versus chemotherapy in ALK-positive lung cancer. *N Engl J Med* 2014;371:2167-77.
8. Planchard D, Smit EF, Groen HJM, et al. Dabrafenib plus trametinib in patients with previously untreated BRAF(V600E)-mutant metastatic non-small-cell lung cancer: an open-label, phase 2 trial. *Lancet Oncol* 2017;18:1307-16.
9. Shaw AT, Ou SH, Bang YJ, et al. Crizotinib in ROS1-rearranged non-small-cell lung cancer. *N Engl J Med* 2014;371:1963-71.
10. Borghaei H, Paz-Ares L, Horn L, et al. Nivolumab versus docetaxel in advanced nonsquamous non-small-cell lung cancer. *N Engl J Med* 2015;373:1627-39.
11. Brahmer J, Reckamp KL, Baas P, et al. Nivolumab versus docetaxel in advanced squamous-cell non-small-cell lung cancer. *N Engl J Med* 2015;373:123-35.
12. Gandhi L, Rodriguez-Abreu D, Gadgeel S, et al. Pembrolizumab plus chemotherapy in metastatic non-small-cell lung cancer. *N Engl J Med* 2018;378:2078-92.
13. Rittmeyer A, Barlesi F, Waterkamp D, et al. Atezolizumab versus docetaxel in patients with previously treated non-small-cell lung cancer (OAK): a phase 3, open-label, multicentre randomised controlled trial. *Lancet* 2017;389:255-65.
14. Byers LA, Rudin CM. Small cell lung cancer: where do we go from here? *Cancer* 2015;121:664-72.
15. Gutierrez ME, Choi K, Lanman RB, et al. Genomic profiling of advanced non-small cell lung cancer in community settings: gaps and opportunities. *Clin Lung Cancer* 2017;18:651-9.
16. King J, Rigney M. Molecular testing in lung cancer. Patient and caregiver experiences [Abstract]. In: Proceedings of the 107th Annual Meeting of teh American Association for Cancer Research; 2016 April 16-20; New Orleans, LA. Philadelphia (PA): AACR. *Cancer Res* 2016;76:Abstract nr 3191.

17. Lim C, Sekhon HS, Cutz JC, et al. Improving molecular testing and personalized medicine in non-small-cell lung cancer in Ontario. *Curr Oncol* 2017;24:103-10.
18. Lim C, Tsao MS, Le LW, et al. Biomarker testing and time to treatment decision in patients with advanced nonsmall-cell lung cancer. *Ann Oncol* 2015;26:1415-21.
19. Sung MR, Ellis PM, Verma S, Duncan E, Leighl NB. Approach to biomarker testing: perspectives from various specialties. *Curr Oncol* 2016;23:178-83.