

# Implementing effective and sustainable multidisciplinary clinical thoracic oncology programs

Raymond U. Osarogiagbon<sup>1</sup>, Richard K. Freeman<sup>2</sup>, Mark J. Krasna<sup>3</sup>

<sup>1</sup>Multidisciplinary Thoracic Oncology Program, Baptist Cancer Center, Memphis, TN, USA; <sup>2</sup>Regional Chief Medical Officer, Vice Chairman for Surgery, St Vincent Health and Hospital System, Indianapolis, Indiana, USA; <sup>3</sup>Corporate Medical Director, Meridian Cancer Care, Neptune, NJ, USA.

*Correspondence to:* Raymond U. Osarogiagbon, MBBS. Multidisciplinary Thoracic Oncology Program, Baptist Cancer Center, 80 Humphreys Center Drive, Suite 220, Memphis, TN 38120, USA. Email: rosarogi@bmhcc.org.

**Abstract:** Three models of care are described, including two models of multidisciplinary care for thoracic malignancies. The pros and cons of each model are discussed, the evidence supporting each is reviewed, and the need for more (and better) research into care delivery models is highlighted. Key stakeholders in thoracic oncology care delivery outcomes are identified, and the need to consider stakeholder perspectives in designing, validating and implementing multidisciplinary programs as a vehicle for quality improvement in thoracic oncology is emphasized. The importance of reconciling stakeholder perspectives, and identify meaningful stakeholder-relevant benchmarks is also emphasized. Metrics for measuring program implementation and overall success are proposed.

**Keywords:** Quality of care; model of care delivery; benchmarks; lung cancer; health service research

Submitted Jul 13, 2015. Accepted for publication Jul 15, 2015.

doi: 10.3978/j.issn.2218-6751.2015.07.05

**View this article at:** <http://dx.doi.org/10.3978/j.issn.2218-6751.2015.07.05>

## Introduction

The complicated nature of thoracic malignancies, specifically of lung cancer, esophageal cancer and complex diseases such as mesothelioma, thymic malignancies and pulmonary metastases of other malignancies mandates a unique level of care coordination. Lung cancer, the most common thoracic malignancy, is the most common cause of cancer death in men and women (1); survival is generally stage-dependent (2,3); but, within-stage variability in outcomes exists for reasons that are not completely clear (4,5). Multiple providers are involved in care, including a myriad of specialists. The expansion of available diagnostic, staging, and treatment options means that clinicians must choose, from a widening array of possibilities, the correct and most appropriate next step for the cancer patient at hand. Time is a perishable resource. Physicians are under constant pressure to be time efficient ('see more patients!'), and negative patient-centered implications of treatment delay raise expectations for timely and efficient care management.

## The complicated nature of lung cancer care-delivery, rationale for better care coordination

The public health burden of lung cancer is well documented. Worldwide, 1.6 million patients are diagnosed and almost 1.4 million die every year from this disease (6). In the US, where the incidence is slowly decreasing, 230,000 individuals are diagnosed and 160,000 die annually, and lung cancer accounts for 28% of all cancer deaths. This is as much as breast, colorectal, pancreas and prostate cancer (the next four most lethal cancers) combined (1). Over the past four decades in the US, the overall 5-year lung cancer survival rate has improved from 12% to 17% (7). This survival rate is expected to improve over the next decade with the implementation of effective population-based screening programs, and dissemination of more effective treatments (8,9). However, acceleration of this expected improvement in population-based outcomes requires a framework for effective and timely implementation of new discoveries. Therein lies both danger and opportunity.

Lung cancer care is complicated. The disease is common, lethal, afflicts patients with significant age- and tobacco-related comorbidities, diagnosis and proper treatment require access to relatively inaccessible tissue in the lungs and mediastinum. Furthermore, survival and treatment selection are heavily dependent on disease stage, but accurate determination of stage is difficult, hence the thoroughness of staging is hyper-variable, leading to well-described disparities in stage-stratified survival (4,5,10-14). Further compounding the complexity of the care-delivery problem is the rapidly expanding armamentarium of diagnostic, staging and treatment interventions, any of which may or may not be appropriate for specific patients (15-18).

Finally, each of the diagnostic, staging and treatment options involves different types of providers with different training, skillsets, and practice cultures. Involved clinicians in lung cancer care include primary care providers, emergency room providers and hospitalists (who control the portal of entry, namely the radiologic identification of the presence of a potentially malignant lung lesion); radiologists (diagnostic, interventional, nuclear radiologists); pulmonologists; thoracic surgeons; pathologists; medical and radiation oncologists; palliative care specialists; gastroenterologists; and nurses. It is not surprising therefore that patients and caregivers feel overwhelmed by the experience of seeking care for lung cancer, and frequently misunderstand the goals of management (19,20).

For all but the earliest stages of disease, multimodality therapy is the rule, not the exception. A large proportion of patients who undergo surgery for lung cancer today are candidates for pre- or post-operative adjuvant chemotherapy, or combination chemo-radiation, and almost a third of patients present with clinical stage III disease for which definitive combined modality chemo-radiation, or tri-modality therapy is recommended. Even patients with stage IV disease who receive chemotherapy benefit from early active involvement of palliative care specialists (21). Thus, the paradigm for thoracic oncology care today is truly multidisciplinary from diagnosis to treatment. Reflecting this reality, the National Comprehensive Cancer Network (NCCN) guidelines begin with a specific recommendation for prospective multidisciplinary decision-making (22).

The end result of this complex care-delivery challenge is the well-described delay in provision of definitive care, and delivery of sub-optimal (and sometimes, frankly, inappropriate) care (23-25). Although the timeliness of care

delivery has never been directly correlated with survival (26-28), delayed care in the face of a potentially life-threatening problem is a noxious experience for patients and their caregivers (20). Time is a perishable resource. Delay in care is a negative patient-centered outcome.

## Defining the three models of care

### *Serial referral care*

The standard method of cancer care involves serial referrals to specialists, one at a time. Additional referrals are recommended as the patient progresses through workup and treatment. This method is the least time efficient as it often takes weeks (to months) for patients to complete visits to all the necessary consultants involved (23,25,28). This approach often does not result in the correct choice of treatment plan (29,30). Either non-guideline-adherent therapy can result or, just as bad, the sequence of appropriate treatments may be incorrect as each specialist uses their familiar modality as the patient comes their way. Patient satisfaction is worst with this approach as the patient goes to multiple locations at different times over a long interval, and may hear along the way that perhaps the treatment just rendered was not "optimal" (20).

### *Conference-(tumor board) centric model of multidisciplinary input*

A tumor board can be an efficient platform to offer integrated multispecialty care. If patients are presented prospectively, before any treatment is begun, then a consensus can be reached on the treatment plan and its sequence. The timeliness of care problem may not be solved with this approach, as patients still need to make multiple visits over a prolonged period of time. Because they are not directly involved in the process, patients may not be aware of the existence of this forum. Thus, despite the possible generation of consensus, patient satisfaction may suffer in this model because of diagnosis and treatment delays and feeling of disjointedness in care-delivery. Because presentations are made without active interaction with the patients, decision-making is somewhat abstract, and the quality of recommendations relies heavily on the quality of the case presentation. Finally, close oversight of the post-discussion care is necessary, to ensure that it does not deviate from recommended management, which can dilute the patient benefit (31).

### *Group clinic model of multidisciplinary care*

This requires a centralized cancer care space within which providers concurrently interact with patients and their caregivers in real time. A dedicated physical space with in-person interaction is optimal, but a virtual group clinic facilitated by audiovisual telemedicine infrastructure is a potentially feasible variation, so long as patients and key specialists are able to interact at the same time. Care coordination is regarded by patients and referring doctors as a key component of good cancer care. As cancer care increasingly involves multimodality staging and treatment, the ability to accommodate all team members at one time in one place is a value increasingly recognized by patients and physicians. Multidisciplinary cancer care clinics seem to be the optimal expression of this approach to cancer care.

System navigation is especially valued by patients and their families (32,33). The availability of dedicated staff to explain the care process, the steps in diagnosis and treatment, and guide patients and caregivers through the physical locations of care delivery is crucial. The multidisciplinary, unified cancer care approach enables centralized, easy access for patients into the cancer care-delivery system (33). The goal should be to achieve consultation within a designated short timeframe from initial contact, and ultimately to expedite the onset of treatment (24,34). A dedicated cancer center space with a unified, strategic multidisciplinary team approach and healthcare system navigation facilitates longitudinal care throughout the course of the patient's cancer care journey, from the time of diagnosis, through survivorship, up to the end of life. This continuity of care is significantly inhibited when care is fragmented across multiple sites or discordant teams. The geographic identity allows the patient the sense of one-stop shopping for their cancer care which fosters convenience and peace of mind (20). The key to this approach is the implementation of a system in which practitioners revolve around the patient concurrently. This gives patients and their caregivers the feeling of a unified team approach and consensus around the care plan. This model expedites the consultation process, cutting the sequence of visits and the delays to receipt of definitive care from 'weeks to months', down to 'days to weeks'.

Critical structural considerations include a group clinic space with entrance separate from, but physical connected to, the treatment areas. The use of "pods", versatile, multi-functional, and reconfigurable space units, allows accommodation of more than one specialty or disease

specific group, thereby containing infrastructural cost and allowing for growth. Some have developed cancer centers with the radiation oncology facility, chemotherapy infusion centers and various physician offices located within the same physical building. This facilitates patient movement between consultations, chemotherapy infusion and radiation treatments. It also allows the clinicians to participate in multidisciplinary case conferences and clinic with the minimum of work schedule disruption. Such physician offices may be permanent or time-share spaces.

Cancer support services such as genetics counseling, psycho-oncology, social work, dietary, and pastoral care are also important considerations. In addition to technical innovation and excellent clinicians, patients often seek access to clinical trials. Multidisciplinary care clinics are an ideal environment within which to provide this service, which has been identified by the NCCN and the National Cancer Institute as the best form of cancer care ('the best care is a clinical trial'). The main drawback to this model of care delivery is the required investment: time, effort, infrastructure, and resources, all of which require a high level of institutional leadership commitment.

### **Quantifying the value: the evidence for and against multidisciplinary care**

#### *A paucity of data*

Although much recommended by experts and specialty groups (22,34-36), the penetration of multidisciplinary care into clinical practice is very shallow. With a few notable exceptions, this implementation gap is extreme in community care environments, where approximately 80% of lung cancer care is delivered in the US. Even in academic and managed care delivery environments, the use of multidisciplinary care varies significantly in both penetration and format. This gap between expert recommendation and actual clinical practice probably has a multifaceted aetiology. A key likely cause is the relative paucity of high-quality studies establishing the value of multidisciplinary care over the traditional serial care model; and the near-total absence of scientifically rigorous implementation studies to teach how to deploy it.

There are no good studies comparing the various subtypes of multidisciplinary care delivery, therefore the definition of 'multidisciplinary care' remains somewhat ambiguous. Most efforts to quantify the value of multidisciplinary care have focused on the timeliness of care

delivery and the rate of guideline-concordant care, or use of certain treatment modalities, such as surgery or multi-modal care (37-42). The few studies that have examined the impact of the multidisciplinary model of care on patient survival have reported mixed results (38,43,44). However, most studies have had major methodologic limitations (45,46). There are no randomized controlled model-of-care-delivery trials. Most studies have been single institutional retrospective analyses of processes and intermediary outcomes in patients before and after implementation of (variably defined) multi-disciplinary care programs. The multidisciplinary teams usually had no standard definition and often lacked key specialists (37).

The enormity of the implementation gap suggests the existence of additional obstacles to the successful deployment of the multidisciplinary care model, beyond the paucity of supportive evidence. Such obstacles may be broadly classified as legal, economic, political and cultural. In the US, the legal framework for establishing multidisciplinary care is uncertain. Federal statutes such as the anti-kickback law and Stark laws prohibiting self-referral are often cited as major obstacles to the establishment of multidisciplinary care programs. There are also concerns about the medico-legal implications of the decisions made in such an environment. Who is legally liable when things go wrong? In one extreme view, the answer could be 'everyone involved in the decision-making process, including those who never directly interacted with the patient' (47).

The efficiency of care within the multidisciplinary environment is a concern to clinicians under a reimbursement formula based predominantly on the volume of care delivery. An oft-cited reason why the multidisciplinary care model cannot gain traction in community-level institutions is that practitioners operate in a world in which 'time is money'. Most practitioners indicate that they can turn around clinic visits faster within their usual care environment than within multidisciplinary clinics (48,49). There is financial risk involved in expending time in a collaborative decision-making environment in which loss of direct control over care-delivery may dilute the opportunities for reimbursement per case. There are also potential concerns about the disruption of preceding referral networks, loss of physician autonomy, and uncertainty about the process for handling clinician dissent (47). This can lead to significant discordance between multidisciplinary recommendations and actual clinical practice, with potential dilution of the value of multidisciplinary care (31).

Therefore, there is a critical need for scientifically

rigorous comparative model of care-delivery studies, which will quantify the value of multidisciplinary care, followed by dissemination and implementation studies to provide blueprints for successful model deployment. Such studies must take a multi-stakeholder perspective, because the definition of optimal care delivery performance depends on the stakeholder's point of view. For example, patients may value survival impact and timeliness of care, caregivers may value the efficiency of care (which, for example, reduces the number of tests and doctor visits which interrupt their employment situation), healthcare insurance executives might be most concerned about the cost-effectiveness of care.

It is therefore important to define the key stakeholders in care delivery. Key stakeholders include patients, their home caregivers, patient-advocates, clinicians (referring and involved specialists), healthcare executives (who provide the environment of care-delivery), insurance company executives (who have to pay for the care delivered), large corporations (which buy health insurance coverage for employees as significant expense) and health policymakers (50). Each of these stakeholders' perspectives must be considered in order to rigorously compare the models of care delivery. Differences in perspectives and priorities must be reconciled before innovative and effective care delivery models can be sustainably disseminated and implemented.

### *Benchmarking care-delivery*

Defining successful implementation therefore requires the adoption of multifaceted, stakeholder-meaningful benchmarks. It is not sufficient to claim the existence of a 'multidisciplinary care program'. There must be standards required to avoid the use of this term as an empty marketing ploy. Such benchmarks may be structural, such as defining the minimum-required involved specialists, the minimum frequency of formal multidisciplinary interaction, mandating a process of careful data collection and analysis to quantify patterns and outcomes of decision-making. Process of care benchmarks might include the rates of deployment of guideline concordant care, use of optimal staging methods, surgical resection, stage-appropriate treatment selection, and the concordance between recommended and actually delivered care. Outcomes benchmarks might include survival, timeliness, and patient-reported endpoints such as satisfaction with the care experience. It is entirely possible that the multidisciplinary care model is superior in certain domains, and inferior in others. Comparative effectiveness

studies therefore have to incorporate multiple domains of quality care in order to provide meaningful evidence with which to quantify the value of each care delivery model.

### Measuring the impact of multidisciplinary cancer care

The ultimate goals of multidisciplinary care must be to improve patient-centered outcomes and the cost-effectiveness of care. Reliably measuring these primary goals is extremely difficult. However, this is a dragon that health services researchers, program administrators, and healthcare policymakers must slay if there is ever to be a groundswell of support across the land for the disruptive change that effective multidisciplinary care programs represent. Goals such as improved survival, decreased cost of care, improved patient satisfaction, improved appropriate use of palliative and hospice care, and accrual to research protocols are all reasonable. Some of these can be measured more easily than others (51). For example, it is difficult to achieve sufficient statistical power to identify what might be a modest improvement in overall survival in biologically aggressive malignancies such as lung or esophageal cancer at a single institution where two different models of care are concurrently in place, because of problems with intervention contamination, the Hawthorne effect, and other technical causes of bias. Consequently, the majority of investigations have sought to measure surrogate variables that are finite during the study period. These include outcomes such as time from diagnosis to treatment, adherence to treatment guidelines, completion of staging prior to the initiation of treatment and the cost of treatment. Very few have also measured patient satisfaction.

Multiple reviewers have summarized the existing literature regarding multidisciplinary care as, at best, inconclusive (52-56). This is not surprising. Malignancies with very different treatment complexity, natural history and survival are often grouped together for comparison. The definition of multidisciplinary care in some studies is varied, and generally, poor. For example, some reports do not include a surgeon in the multidisciplinary team for malignancies that are often treated surgically (37). Few reports directly compare patient populations with a single form of malignancy within a facility or healthcare system. Fewer still also use statistical methods to minimize selection bias.

Studies which incorporate a more rigorous design do show a difference between cohorts of patients treated with

or without multidisciplinary care (42). In one such example, age, stage and comorbidity index propensity-matching was used to compare patients with non-small cell lung cancer across multiple facilities within a single healthcare system. Over a 5-year study period, data analysis of more than 13,000 patients revealed that multidisciplinary care significantly improved adherence to national guidelines for staging and treatment, timeliness and cost of care (57).

How the outcomes of multidisciplinary care for patients with thoracic malignancies should be measured is a very important ongoing research question. Consistency of surrogate variables should be sought when designing future investigations. Furthermore, patient satisfaction, cost and adherence to treatment guidelines should be included in future studies. However, survival is the ultimate patient-centered outcome for lethal diseases and, difficult as it is, model of care studies must not forego this endpoint. Attempts at standardization will help identify whether multidisciplinary care is worth the opportunity costs and, especially, the financial investment inherent in the most advanced models.

### Successful implementation

Successful implementation of a multidisciplinary care strategy depends on multiple factors inherent in each facility including the level of physician alignment, availability of an integrated electronic health record, physical space for a group clinic, availability of navigation services and the presence of all required clinical specialty services. The models, as previously described, move from a less integrated form such as serial consultations and a prospective treatment planning conference to a completely integrated patient care clinic. Selecting the correct one for an institution will improve the likelihood of gaining acceptance and use of the multidisciplinary approach for patient care.

The concept of the “care team” is also important to recognize when initiating a multidisciplinary care program. The influence and impact of the entire team is greater than the sum of its individual members (58). The team dynamics involved in multidisciplinary cancer care is an important concept to consider when choosing team members, designing workflows and predicting accountability (59,60). No matter what level of multidisciplinary care is deployed, its initiation will require changes in behavior of team members and their support staff. There are several important tactical elements to successful implementation.

The first is to appoint representative leaders for each

key involved specialty. Such individuals are considered facilitators for their specialty and must agree to be present for the majority of clinics or conferences. Secondly, conference and clinic dates must be fixed, regular, and frequent, in order to embed the routine within key providers' and staff's schedules and to avoid delays in care management. Third, is the mandatory use of evidence, often in the form of treatment guidelines, to drive decision-making. Agreement on a specific, nationally recognized, set of guidelines is vital in establishing consistency and driving provider behavior. Multiple sources are available such as the American College of Chest Physicians, and the NCCN (15-18,22). The NCCN guidelines have the advantage of more frequent updating as evidence evolves. Treatment decisions that deviate from the guidelines should be documented, along with the rationale for the deviation, to allow for future auditing and quality improvement cycles.

Fourth, to foster accountability, a consensus treatment plan should be recorded and circulated to all providers involved in the care of each patient. This requires some administrative support, but can reduce duplicate or unnecessary testing, resulting in cost savings. It also allows patient navigators to review treatment plans with patients, and provides objective data for future audits and performance improvement. Additionally, it is also helpful to carve out a small amount of time from a multidisciplinary conference or clinic to review pertinent literature on clinically relevant issues, discuss ongoing and upcoming research trials at the facility, and to focus discussion on unusual or interesting cases. These discussions improve communication, may improve clinical research accrual, and assist in developing healthy team dynamics. Involving ancillary care providers is also often seen as a positive step in facilitating the care of these complex patients. Patient navigators, social service providers, palliative care specialists, financial counselors, wellness experts, and holistic practitioners can all deliver important components of care to patients with thoracic malignancy.

Successful implementation of the multidisciplinary cancer care approach is built on identifying effective leaders, regular meetings, establishing a template of treatment guidelines, building and recording consensus care plans, holding providers accountable to the treatment decisions made, and building the concept and framework of a care team. Although seemingly elusive at the onset, this approach to implementation can result in a grass roots effort that allows the multidisciplinary concept to grow to be bigger than any individual or specialty involved in the

delivery of thoracic oncology care.

The community-level thoracic multidisciplinary care program is, theoretically, an ideal infrastructure through which to improve the survival of thoracic malignancies at the broad population level. Properly implemented, it can provide a scaffold for effective tobacco control, screening, early diagnosis, optimal treatment, rapid dissemination of diagnostic and treatment innovations, palliative care, clinical and health services research, and the education of patients, caregivers, clinicians, and the general public about these complex and difficult malignancies.

### Acknowledgements

*Funding:* This work was (partially) supported through a Patient-Centered Outcomes Research Institute (PCORI) Award (IH-1304-6147) to Dr. Osarogiagbon.

### Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

*Disclaimer:* All statements in this report, including its findings and conclusions, are solely those of the authors and do not necessarily represent the views of the Patient-Centered Outcomes Research Institute (PCORI), its Board of Governors or Methodology Committee.

### References

1. American Cancer Society. Cancer Facts & Figures 2015. Atlanta: American Cancer Society; 2015.
2. Goldstraw P, Crowley J, Chansky K, et al. The IASLC Lung Cancer Staging Project: proposals for the revision of the TNM stage groupings in the forthcoming (seventh) edition of the TNM Classification of malignant tumours. Erratum in: J Thorac Oncol 2007;2:985.
3. Goldstraw P. New staging system: how does it affect our practice? J Clin Oncol 2013;31:984-91.
4. Osarogiagbon RU, Yu X. Mediastinal lymph node examination and survival in resected early-stage non-small-cell lung cancer in the surveillance, epidemiology, and end results database. J Thorac Oncol 2012;7:1798-806.
5. Osarogiagbon RU, Ogbata O, Yu X. Number of lymph nodes associated with maximal reduction of long-term mortality risk in pathologic node-negative non-small cell lung cancer. Ann Thorac Surg 2014;97:385-93.

6. Jemal A, Bray F, Center MM, et al. Global cancer statistics. *CA Cancer J Clin* 2011;61:69-90.
7. SEER Stat Fact Sheet: Lung and Bronchus Cancer. Available online: <http://seer.cancer.gov/statfacts/html/lungb.html>, accessed on July 13, 2015.
8. National Lung Screening Trial Research Team, Aberle DR, Adams AM, et al. Reduced lung-cancer mortality with low-dose computed tomographic screening. *N Engl J Med* 2011;365:395-409.
9. Ma J, Ward EM, Smith R, et al. Annual number of lung cancer deaths potentially avertable by screening in the United States. *Cancer* 2013;119:1381-5.
10. Bach PB, Cramer LD, Warren JL, et al. Racial differences in the treatment of early-stage lung cancer. *N Engl J Med* 1999;341:1198-205.
11. Lathan CS, Neville BA, Earle CC. The effect of race on invasive staging and surgery in non-small-cell lung cancer. *J Clin Oncol* 2006;24:413-8.
12. Backhus LM, Farjah F, Varghese TK, et al. Appropriateness of imaging for lung cancer staging in a national cohort. *J Clin Oncol* 2014;32:3428-35.
13. Ost DE, Niu J, S Elting L, et al. Quality gaps and comparative effectiveness in lung cancer staging and diagnosis. *Chest* 2014;145:331-45.
14. Cykert S, Dilworth-Anderson P, Monroe MH, et al. Factors associated with decisions to undergo surgery among patients with newly diagnosed early-stage lung cancer. *JAMA* 2010;303:2368-76.
15. Rivera MP, Mehta AC, Wahidi MM. Establishing the diagnosis of lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013;143:e142S-65S.
16. Silvestri GA, Gonzalez AV, Jantz MA, et al. Methods for staging non-small cell lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013;143:e211S-50S.
17. Howington JA, Blum MG, Chang AC, et al. Treatment of stage I and II non-small cell lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013;143:e278S-313S.
18. Ramnath N, Dilling TJ, Harris LJ, et al. Treatment of stage III non-small cell lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013;143:e314S-40S.
19. Weeks JC, Catalano PJ, Cronin A, et al. Patients' expectations about effects of chemotherapy for advanced cancer. *N Engl J Med* 2012;367:1616-25.
20. Kedia SK, Ward KD, Digney SA, et al. 'One-stop shop': lung cancer patients' and caregivers' perceptions of multidisciplinary care in a community healthcare setting. *Transl Lung Cancer Res* 2015;4:456-64.
21. Temel JS, Greer JA, Muzikansky A, et al. Early palliative care for patients with metastatic non-small-cell lung cancer. *N Engl J Med* 2010;363:733-42.
22. National Comprehensive Cancer Network Guidelines. Available online: [http://www.nccn.org/professionals/physician\\_gls/f\\_guidelines.asp#site](http://www.nccn.org/professionals/physician_gls/f_guidelines.asp#site), accessed on July 13, 2015.
23. Billing JS, Wells FC. Delays in the diagnosis and surgical treatment of lung cancer. *Thorax* 1996;51:903-6.
24. BTS recommendations to respiratory physicians for organising the care of patients with lung cancer. The Lung Cancer Working Party of the British Thoracic Society Standards of Care Committee. *Thorax* 1998;53 Suppl 1:S1-8.
25. Faris N, Yu X, Sareen S, et al. Preoperative Evaluation of Lung Cancer in a Community Health Care Setting. *Ann Thorac Surg* 2015;100:394-400.
26. Quarterman RL, McMillan A, Ratcliffe MB, et al. Effect of preoperative delay on prognosis for patients with early stage non-small cell lung cancer. *J Thorac Cardiovasc Surg* 2003;125:108-13; discussion 113-4.
27. Myrdal G, Lambe M, Hillerdal G, et al. Effect of delays on prognosis in patients with non-small cell lung cancer. *Thorax* 2004;59:45-9.
28. Salomaa ER, Sällinen S, Hiekkanen H, et al. Delays in the diagnosis and treatment of lung cancer. *Chest* 2005;128:2282-8.
29. Fergusson RJ, Thomson CS, Brewster DH, et al. Lung cancer: the importance of seeing a respiratory physician. *Eur Respir J* 2003;21:606-10.
30. Davies AR, Deans DA, Penman I, et al. The multidisciplinary team meeting improves staging accuracy and treatment selection for gastro-esophageal cancer. *Dis Esophagus* 2006;19:496-503.
31. Osarogiagbon RU, Phelps G, McFarlane J, et al. Causes and consequences of deviation from multidisciplinary care in thoracic oncology. *J Thorac Oncol* 2011;6:510-6.
32. Freeman HP. The origin, evolution, and principles of patient navigation. *Cancer Epidemiol Biomarkers Prev* 2012;21:1614-7.
33. Kedia S, Ward KD, Digney SA, et al. Organizational barriers to receiving quality health care: A qualitative study among lung cancer patients and caregivers. *J Clin Oncol*

- 2014;32:abstr 76.
34. Alberts WM, Bepler G, Hazelton T, et al. Lung cancer. Practice organization. *Chest* 2003;123:332S-7S.
  35. ASCO-ESMO consensus statement on quality cancer care. *J Clin Oncol* 2006;24:3498-9.
  36. Ost DE, Yeung SC, Tanoue LT, et al. Clinical and organizational factors in the initial evaluation of patients with lung cancer: Diagnosis and management of lung cancer, 3rd ed: American College of Chest Physicians evidence-based clinical practice guidelines. *Chest* 2013;143:e121S-41S.
  37. Riedel RF, Wang X, McCormack M, et al. Impact of a multidisciplinary thoracic oncology clinic on the timeliness of care. *J Thorac Oncol* 2006;1:692-6.
  38. Leo F, Venissac N, Poudoux M, et al. Multidisciplinary management of lung cancer: how to test its efficacy? *J Thorac Oncol* 2007;2:69-72.
  39. Lo DS, Zeldin RA, Skrastins R, et al. Time to treat: a system redesign focusing on decreasing the time from suspicion of lung cancer to diagnosis. *J Thorac Oncol* 2007;2:1001-6.
  40. Freeman RK, Van Woerkom JM, Vyverberg A, et al. The effect of a multidisciplinary thoracic malignancy conference on the treatment of patients with lung cancer. *Eur J Cardiothorac Surg* 2010;38:1-5.
  41. Freeman RK, Van Woerkom JM, Vyverberg A, et al. The effect of a multidisciplinary thoracic malignancy conference on the treatment of patients with esophageal cancer. *Ann Thorac Surg* 2011;92:1239-42; discussion 1243.
  42. Halpern MT, Spain P, Holden DJ, et al. Improving quality of cancer care at community hospitals: impact of the National Cancer Institute Community Cancer Centers Program pilot. *J Oncol Pract* 2013;9:e298-304.
  43. Stephens MR, Lewis WG, Brewster AE, et al. Multidisciplinary team management is associated with improved outcomes after surgery for esophageal cancer. *Dis Esophagus* 2006;19:164-71.
  44. Keating NL, Landrum MB, Lamont EB, et al. Tumor boards and the quality of cancer care. *J Natl Cancer Inst* 2013;105:113-21.
  45. Blayney DW. Tumor boards (team huddles) aren't enough to reach the goal. *J Natl Cancer Inst* 2013;105:82-4.
  46. Krasna M, Freeman RK, Petrelli NJ. Re: Tumor boards and the quality of cancer care. *J Natl Cancer Inst* 2013;105:1839-40.
  47. Sidhom MA, Poulsen MG. Multidisciplinary care in oncology: medicolegal implications of group decisions. *Lancet Oncol* 2006;7:951-4.
  48. Look Hong NJ, Gagliardi AR, Bronskill SE, et al. Multidisciplinary cancer conferences: exploring obstacles and facilitators to their implementation. *J Oncol Pract* 2010;6:61-8.
  49. Devitt B, Philip J, McLachlan SA. Team dynamics, decision making, and attitudes toward multidisciplinary cancer meetings: health professionals' perspectives. *J Oncol Pract* 2010;6:e17-20.
  50. McDonald PA, Mecklenburg RS, Martin LA. The employer-led health care revolution. *Harvard Business Review* 2015:33-50.
  51. Farjah F, Detterbeck FC. What is quality, and can we define it in lung cancer?—the case for quality improvement. *Transl Lung Cancer Res* 2015;4:365-72.
  52. Fleissig A, Jenkins V, Catt S, et al. Multidisciplinary teams in cancer care: are they effective in the UK? *Lancet Oncol* 2006;7:935-43.
  53. Tattersall MH. Multidisciplinary team meetings: where is the value? *Lancet Oncol* 2006;7:886-8.
  54. Houssami N, Sainsbury R. Breast cancer: multidisciplinary care and clinical outcomes. *Eur J Cancer* 2006;42:2480-91.
  55. Wright FC, De Vito C, Langer B, et al. Multidisciplinary cancer conferences: a systematic review and development of practice standards. *Eur J Cancer* 2007;43:1002-10.
  56. Lemieux-Charles L, McGuire WL. What do we know about health care team effectiveness? A review of the literature. *Med Care Res Rev* 2006;63:263-300.
  57. Freeman RK, Ascoti AJ, Dake M, et al. The effects of a multidisciplinary care conference on the timeliness, quality and cost of care in patients with non-small cell lung cancer. *Ann Thorac Surg* 2015. (In press)
  58. Fennell ML, Das IP, Clauser S, et al. The organization of multidisciplinary care teams: modeling internal and external influences on cancer care quality. *J Natl Cancer Inst Monogr* 2010;2010:72-80.
  59. Taplin SH, Weaver S, Chollette V, et al. Teams and teamwork during a cancer diagnosis: interdependency within and between teams. *J Oncol Pract* 2015;11:231-8.
  60. Taplin SH, Weaver S, Salas E, et al. Reviewing cancer care team effectiveness. *J Oncol Pract* 2015;11:239-46.

**Cite this article as:** Osarogiagbon RU, Freeman RK, Krasna MJ. Implementing effective and sustainable multidisciplinary clinical thoracic oncology programs. *Transl Lung Cancer Res* 2015;4(4):448-455. doi: 10.3978/j.issn.2218-6751.2015.07.05