

# Impact of thoracic multidisciplinary tumor boards on the management of patients with cancer: A retrospective study at the American university of Beirut medical center

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**Abstract.** Multidisciplinary tumor boards (MDT) provide an opportunity for experts from different specialties and expertise to pool and complement each other's experience and inputs. Several factors impact the MDT discussions, including the meeting's structure, time management, and expert leadership. The process of MDT, their utilization, and efficacy need continuous assessment and improvement. A retrospective study was conducted to review the process of thoracic MDT, their plans of therapy, and changes in diagnosis and treatment plans for patients with cancer at the American University of Beirut Medical Center (AUBMC) over the period of one year. The primary outcome measure was the percentage of patients presented at the thoracic MDT who had a change in their treatment plan after the presentation. A total of 214 cases were scheduled for thoracic MDT during the study period. The majority, 132 (61.7%) did not have a treatment plan before presenting in the MDT. Of the 195 cases presented, only 43 (22.0%) did not have a change in their plan, while 88 (45.2%) of the cases presented had a change in their treatment plan. A total of 64 (32.8%) cases consisted of discussion of the diagnosis during MDT with either confirmation or modification of the patients' diagnosis. Of the 195 cases that were presented, the majority, 170 (87.2%), had their recommended treatment plan implemented after the MDT discussion. There was an association between the stage of cancer at the time of presentation and requesting additional tests ( $P=0.021$ ), but there was no association between the stage of cancer and change in treatment plan ( $P=0.177$ ) nor with implementation of recommendation ( $P=0.217$ ). MDT are used to make upfront management decisions. In addition to considering change in

management plans as an indicator of the benefit of MDT, it is suggested that making upfront multidisciplinary plans shall be considered an additional component of indicators of the benefit of MDT.

## Introduction

With the significant advancement in diagnostic modalities and treatment options, providing care for patients with cancer has become increasingly complex. Input from various disciplines and specialties has become crucial for appropriate patient management (1,2). Multidisciplinary tumor boards (MDT) are a forum where several physicians from different specialties, meet to review and discuss the diagnosis, medical condition, and management of patients with cancer (3,4). This collaboration provides an opportunity for experts from different specialties and expertise to pool and complement each other's experience and inputs (5-8). Disciplines include medical oncology, radiation oncology, radiology, pathology, surgery, among others. Although the multidisciplinary approach in treatment of patients with cancer was first described in 1975, it was not until the late 1990s when it was formally implemented into the care of patients with cancer (2). Several factors affect the MDT discussions, including the meeting's structure, time management, and expert leadership (1). More recently, the technological advances, on one hand, and the COVID-19 pandemic, on the other, have facilitated the collaboration among tumor boards' members through virtual online and hybrid (live and online) meetings (2,9,10).

MDT have been considered the optimal model for management of patients with cancer. They are generally utilized in large academic centers and in specialized cancer care centers, including developing countries (2,9,11-13). A survey that included 338 oncology specialists from developing Arab countries showed that 60% of physicians resorted to MDT in order to seek the medical opinion of their colleagues to help with the management of their patients with cancer (14). Another survey conducted by the American Society of Clinical Oncology (ASCO) included 501 ASCO members. A total of 96% of respondents reported that the benefit of MDT outweighs the time and effort spent and that changes in surgery type and/or

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treatment plans generally occur in 25 to 50% of patients (11). Moreover, in a prospective cohort study that included patients with lung and esophageal cancer, MDT changed the treatment plan in 40% of patients and the staging and assessment plans in 60% of patients. Upon follow-up on patients, recommendations were followed in 97% of the cases (15). On the other hand, a survey by Keating *et al* (16) reported only little association between MDT and cancer care quality and survival and stressed the importance of improving the quality of tumor boards discussions.

The Thoracic MDT at the American University of Beirut Medical Center (AUBMC) is a weekly meeting that has been taking place since 2015. In order to assess the impact of thoracic MDTs, their utilization and efficacy, a retrospective study was conducted to review the process of thoracic MDTs, their plans of therapy, and changes in diagnosis and treatment plans for patients with cancer.

## Materials and methods

This was a retrospective study that comprised a chart review for all patients with cancer who were presented in the thoracic MDTs at AUBMC over the period of one year, from January 1, 2021, until December 31, 2021. The study coordinators reviewed the electronic medical charts for all patients presented over this period. They filled the 'Data Entry Form', provided in Tables SI and SII, which consists of 3 pages, namely data available in the chart prior to case presentation, data available after the tumor board presentation, and case discussion evaluation. In addition, study coordinators filled the patients' log sheet where each patient was provided by a study code. All information filled was treated as confidential. All of the analysis was performed using SPSS statistical software (version 23; IBM Corp.).

The MDTs are composed of members from the various specialties, including radiology, radiation-oncology, pulmonary medicine, thoracic surgery, pathology, in addition to medical oncology. At least one representative physician from each specialty should have been present in order for the MDTs discussion to be held. MDTs occurred on a weekly basis. The patients could be shared with other physicians, and the documentation of discussion was kept in the medical chart of the presented patients and accessible by all treating physicians who take care of the patient from the various departments. Discussion items that physicians included during MDTs were the presenting symptoms, revision of images, revision of prior treatment regimens, role of surgery, radiation therapy, and/or systemic therapy, among other pertinent items that arose during the discussion.

Data was obtained from the clinic chart and the hospital admission charts. These data were included in the page for data before case presentation in the data entry sheet: i) Clinical data related to the patient's cancer (brief history and physical findings) and ii) Other data (pertinent lab findings, radiological findings, pathology, diagnosis, and TNM stage). The primary outcome measure was the percentage of patients presented at the thoracic MDT who had a change in their treatment plan after the presentation.

The present study was approved (approval no. BIO-2022-0049) by the Institutional Review Board (IRB) at

AUBMC (Beirut, Lebanon). All measures to maintain confidentiality were taken, including a password protected database that is managed by the investigators. Patients were anonymized by using a log sheet as there was no need to include the patients' names in the data entry sheet. All records were stored in a locked file cabinet in the office of the principal investigator. Only the principal investigator and the study coordinators have access to the cabinet. Data will be stored for 5 years after which it will be shredded. Patients were not contacted by the study coordinators at any point, and the study consisted only of retrospective chart review.

## Results

A total of 214 cases were scheduled for thoracic MDT during the study period. Of these, 19 (8.9%) cases were scheduled yet not presented. These were patients who were placed on the MDT schedule before their imaging studies were uploaded on the electronic health record system for revision during the MDT. A total of 184 (86%) were scheduled by medical oncologists, 11 (5.1%) by pulmonologists, 11 (5.1%) by radiation-oncologists and 7 (3.3%) by thoracic surgeons. Only 1 case (0.5%) was scheduled by the Outpatient Department (OPD) team, which is an outpatient clinic led by clinical fellows in-training, that offers ambulatory cancer care to patients with limited income and with minimal charges (Fig. 1). 189 (88.32%) cases were for patients with primary lung cancer, while the remaining cases consisted of patients with head and neck cancer, lung metastasis from other primary cancers, or carcinoma of unknown primary. The distribution of cases across the 12 months of the year was homogeneous, ranging from 4.2% for March and 4.7% for December to the greatest percentage of cases scheduled, 13.1%, for the month of July. A total of 87 (44.6%) cases had the stage at diagnosis specified, 69 (79.3%) of which were stage III or IV.

Of the 214 cases scheduled, the majority, 132 (61.7%) did not have a treatment plan before presenting in the MDT (Table I). When it was observed whether the treatment plan and/or diagnosis were changed after presentation in MDT, of the 195 cases presented, only 43 (22.0%) did not have a change in their plan, while almost half of the cases presented, 88 (45.2%), had a change in their treatment plan. These changes included recommending observation in 21 (10.8%) cases, radiation therapy only in 11 (5.6%) cases, systemic therapy only in 26 (13.3%) cases, and both, radiation therapy and systemic therapy, in 14 (7.2%) cases. A total of 16 (8.2%) cases were recommended to have surgery combined with other treatments, namely systemic therapy and radiation therapy. A total of 64 (32.8%) cases consisted of discussion of the diagnosis during MDT with either confirmation or modification of the patients' diagnosis (Table II).

A total of 3 (1.4%) cases were referred to additional tumor boards for further discussion, 2 of which were referred to the Gastrointestinal (GI) Oncology MDT and 1 of which was referred to the radiation-oncology MDT. A total of 73 (34.1%) cases recommended additional tests, which included tumor biopsy, additional immunohistochemistry stains, molecular testing, lymph node sampling, and PET-CT scan. Of the 195 cases that were presented, the majority, 170 (87.2%), had their recommended treatment plan implemented after the

Table I. Treatment plan and diagnosis for scheduled MDT cases.

Treatment plan prior to presentation	No treatment plan prior to presentation	Total MDT scheduled
82 (38.3%)	132 (61.7%)	214 (100%)

MDT, Multidisciplinary Tumor Board.

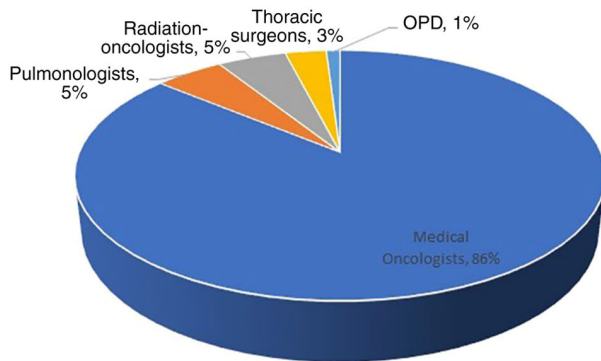


Figure 1. Distribution of scheduled MDT among physicians of different specialties.

MDT discussion, while 8 (4.1%) cases had a different treatment plan implemented after the MDT from that decided upon during the MDT. It is worth noting that 17 (8.7%) were lost to follow up. A total of 10 (4.7%) patients were not alive on last follow up at AUBMC at the time of data collection, while the majority, 204 (95.3%) were still alive on last follow up.

A total of 148 (69.2%) cases had the MDT decision documented by an MDT note only, while 16 (7.5%) cases had the decision documented only through the primary physician office note and 18 (8.4%) cases had the decision documented only through an inpatient note. A total of 32 (15%) cases had their decisions documented through more than one method, namely MDT note, office note, and inpatient note. All cases that were scheduled yet not documented had an MDT note documenting this.

There was no association between the presenting physician, on one hand, and whether there was a treatment plan prior to presentation or not ( $P=1.000$ ), whether additional tests were requested during the MDT ( $P=0.175$ ), whether referral to additional MDT was recommended ( $P=0.974$ ), whether the plan was changed during the MDT ( $P=0.310$ ), on the other. There was, however, an association between the stage of cancer at the time of presentation and requesting additional tests ( $P=0.021$ ), but there was no association between the stage of cancer and change in treatment plan ( $P=0.177$ ) nor with implementation of recommendation ( $P=0.217$ ). While the majority of patients with stage I, III and IV, did not require additional testing, with 81.8, 79.3, and 80%, respectively, not requiring additional tests, almost half, 42.9%, of those with stage II required additional tests as part of the MDT recommendations. Notably, there was also an association between the stage at presentation with scheduling yet not presenting a case ( $P=0.029$ ) and with diagnosis ( $P=0.001$ ). Of the 19 cases that were scheduled yet not presented, 6 cases did not specify the stage at presentation, and

8 (42.1%) had stage IV disease. Also, among the 10 cases that were not primary lung cancer and whose stage was specified, 6 (60%) were stage IV.

## Discussion

Although our study was designed with the primary objective of assessing changes of plans of patient management at thoracic MDT, the main finding of the present study was that, at our institution, the majority of multidisciplinary treatment plans are, in fact, made at the MDT. The majority of cases did not have a treatment plan before presentation in the MDT. Moreover, one-third of the cases presented discussed the diagnosis during MDT with either confirmation or modification of the patients' diagnosis on presentation, in addition to the almost half of the cases presented that had a change in their treatment plan. The present study showed that thoracic MDT at AUBMC is used as a forum for group multidisciplinary consultations for primary physicians that gives them the opportunity to involve specialists from different disciplines, including thoracic surgeons, pulmonologists, and radiation oncologists. This is considered as a positive trend towards improved integrative multidisciplinary care of patients with lung cancer. It was noted from the present study that plans made at the MDT did not only consist of systemic therapy but that also 75.9% of cases had plans such as radiation therapy, surgery, and systemic therapy, and 10.8% of cases had observation as the primary recommendation following the discussion of the MDT attendees. This indicated that the presence of attendees from several disciplines, in addition to medical oncologists, can contribute to recommendations that are not limited to systemic therapy. Our data parallels current trends published in literature for multidisciplinary management recommendations, including radiation therapy and surgery, for almost all cases, for both early-stage and metastatic lung cancer (5). Notably, almost half of presented patients with stage II required additional tests as part of the MDT recommendations with a statistically significant association. This suggested that patients within this stage category, that is neither considered very early not advanced disease, may need more diagnostic tests conducted prior to presenting in MDT.

It was also noted that medical oncologists were more likely to bring cases to the thoracic MDT than were pulmonologists, thoracic surgeons or radiation oncologists. This may be due to other obligations, including scheduled operations and sessions for surgeons and radiation oncologists respectively. A prospective observational survey by Kehl *et al* (7), from the Cancer Care Outcomes Research and Surveillance Consortium (CanCORS), which assessed care patterns of patients with lung and colorectal cancer, showed that surgeons are less likely to

Table II. Treatment plan and diagnosis for presented MDT cases.

Change in treatment plan							
88 (45.2%)							
Observation	RT only	Systemic therapy only	RT and systemic therapy	Surgery with other therapies	No change in treatment plan	Discussion of diagnosis	Total MDT presented
21 (10.8%*)	11 (5.6%*)	26 (13.3%*)	14 (7.2%*)	16 (8.2%*)	43 (22.0%)	64 (32.8%)	195 (100%)

\*Percentages in this row consist of proportions from the cases with change in treatment plan, n=88. MDT, Multidisciplinary Tumor Board; RT, radiation therapy.

attend weekly MDT than are medical oncologists and radiation oncologists. The CanCORS study showed that regular frequent physician attendance in MDT meetings was associated with more clinical trial participation and with higher rates of curative-intent surgery for early-stage non-small cell lung cancer, but not with overall survival. In its exploratory subgroup analysis, frequent MDT attendance was associated with enhanced survival among patients with extensive small-cell lung cancer and stage IV colorectal cancer.

The results from our institution revealed that the use of MDT enhances the implementation of multidisciplinary management of patients with cancer and should be helpful to health care providers worldwide, including those practicing in remote areas and in low- and middle-income countries. In a study by Saghir *et al* (14), the authors concluded that MDT are also beneficial rural areas or limited-resources settings, where only a small group of specialists is available. It was suggested that mini-tumor boards may still be considered with whomever is available to make improved management decisions and plans than when only the primary physician is involved (3,14). In a study by Charara *et al* (17) which prospectively investigated the impact of MDT on cancer cases at AUBMC, videoconferences were suggested by the authors at that time in 2017 in order to enhance multidisciplinary attendance. By the time the present study was conducted for thoracic MDT, and due to the COVID-19 pandemic, hybrid venues have been implemented over the past 2 years, instead of the in-person only venue. This is similar to regular educational MDT videoconferences that we usually conduct at AUBMC with Memorial Sloan Kettering Cancer Center and with MD Anderson Cancer Center (18,19). Videoconference platform could, in fact, be a useful addition to the live venue in circumstances where not all attendees can present in-person. Current advances in technology allows video meetings and virtual platforms to be made available, allowing all physicians, including those practicing in remote areas, to render multidisciplinary management plans for their patients (20).

El Saghir *et al* (21) conducted a survey for international ASCO members. It was showed that improvement in the efficiency of MDT is needed through more effective moderators of discussions, improved time management at meetings, improved criteria for the selection of cases, and the provision of written summaries of cases to attendees can better reduce the time and resources needed for MDT. Although medical oncologists presented the majority of cases at our institution and thoracic surgeons presented the least number of cases,

surgeons were essential in discussions and final management plans as seen in the cases where surgical management was recommended. The study by Charara *et al* (17) not only showed that upfront multidisciplinary decision making shall be considered as an indicator of benefit from MDT but also that, similar to our data, surgeons should be more involved in MDT (17). This differs from other institutions where surgeons or radiation oncologists may lead the MDT. All members of the multidisciplinary management team should be considered as important contributors to the success of MDT and should participate in cases preparation, presentation, discussion of management plans. Adding cases and actively presenting them should be viewed as important as the participation attendees other than medical oncologists and shall expand multidisciplinary care to patients with lung cancer at each institution.

A limitation to the present study is that its design is retrospective. Retrospective studies are susceptible to selection and memory bias. The included cases over the selected period of time may not be representative of all thoracic cases and reasons for non-selection may not be ascertainable. Moreover, MDT conclusions may have been influenced by the presenting physicians, who were from a variety of specialties. This may have resulted in anchoring bias whereby the primary specialty of the presenting physician could have influenced the discussion and decisions made.

Furthermore, data available in the charts were not collected for research purposes. As such, certain data may be missing for some patients. This was observed in the lack of stage on presentation of MDT in several cases, for example. Lack of homogeneity is another concern in a retrospective design. Different people are involved at different times in patient care and data entry, particularly when studies look at charts over several months such as the present study, which spanned 12 months. In addition, neither survival in a retrospective design nor the reason behind loss to follow-up can be determined. Reasons for lost follow-ups often cannot be ascertained in retrospective studies and can potentially bias the results as well. In the present study, 8.7% of patients did not follow up at our institution after the MDT discussion, which can be attributed to financial limitations and limited ability of numerous patients to afford treatment. This has recently become of particular significance in the setting of socio-economic challenges that have faced patients in our community over the past 2 years, particularly that our institution may be considered a referral center in the region that may not always be affordable to all socio-economic classes.

In conclusion, in the modern era of oncology practice, multidisciplinary management of patients with lung cancer ensues. The present data demonstrated that MDT are used to make upfront management decisions. In addition to considering change in management plans as an indicator of the benefit of MDT, it is suggested that making upfront multidisciplinary plans for patient management be considered an additional component of indicators of the benefit of MDT. Although thoracic surgeons presented the least number of cases at our MDT, they attended and actively participated in discussions of diagnosis and management plans as seen in the cases where surgical management was recommended. Utilizing hybrid meetings enabled more attendees to join and, hence, enriches the multidisciplinary discussions. Promoting multidisciplinary teamwork, including greater participation by clinical fellows from OPD, and more research are needed. The effects on management, outcome, and survival should be assessed prospectively at various centers and for different cancers.

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### Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

### Authors' contributions

FK and AT participated in data collection, analysis, and manuscript writing. AT participated in the study design. Both authors read and approved the final version of the manuscript. Both authors confirm the authenticity of all the raw data.

### Ethics approval and consent to participate

The present study was approved (approval no. BIO-2022-0049) by the Institutional Review Board at AUBMC (Beirut, Lebanon). Informed oral consent was provided by all patients prior to participation in the retrospective chart review.

### Patient consent for publication

Not applicable.

### Competing interests

The authors declare that they have no competing interests.

### References

- El Saghir NS, Keating NL, Carlson RW, Khoury KE and Fallowfield L: Tumor boards: Optimizing the structure and improving efficiency of multidisciplinary management of patients with cancer worldwide. *Am Soc Clin Oncol Ed Book* e461-e466, 2014.
- Specchia ML, Frisicale EM, Carini E, Di Pilla A, Cappa D, Barbara A, Ricciardi W and Damiani G: The impact of tumor board on cancer care: Evidence from an umbrella review. *BMC Health Serv Res* 20: 73, 2020.
- National Cancer Institute (NCI): Dictionary of Cancer Terms: Tumor Board Review. <https://www.cancer.gov/publications/dictionaries/cancer-terms/def/tumor-board-review>
- Soukup T, Sevdalis N, Green JSA, Lamb BW, Chapman C and Skolarus TA: Making tumor boards more patient-centered: Let's start with the name. *JCO Oncol Pract* 17: 591-593, 2021.
- Chang JH, Vines E, Bertsch H, Fraker DL, Czerniecki BJ, Rosato EF, Lawton T, Conant EF, Orel SG, Schuchter L, *et al*: The impact of a multidisciplinary breast cancer center on recommendations for patient management: The University of Pennsylvania experience. *Cancer* 91: 1231-1237, 2001.
- Petty JK and Vetto JT: Beyond doughnuts: Tumor board recommendations influence patient care. *J Cancer Educ* 17: 97-100, 2002.
- Kehl KL, Landrum MB, Kahn KL, Gray SW, Chen AB and Keating NL: Tumor board participation among physicians caring for patients with lung or colorectal cancer. *J Oncol Pract* 11: e267-e278, 2015.
- Wong BO, Blythe JA, Wu A, Batten JN, Kennedy KM, Kouaho AS and Wren SM: Exploration of clinician perspectives on multidisciplinary tumor board function beyond clinical decision-making. *JAMA Oncol* 8: 1210-1212, 2022.
- Dharmarajan H, Anderson JL, Kim S, Sridharan S, Duvvuri U, Ferris RL, Solari MG, Clump DA II, Skinner HD, Ohr JP, *et al*: Transition to a virtual multidisciplinary tumor board during the COVID-19 pandemic: University of Pittsburgh experience. *Head Neck* 42: 1310-1316, 2020.
- Blasi L, Bordonaro R, Serretta V, Piazza D, Firenze A and Gebbia V: Virtual clinical and precision medicine tumor boards-cloud-based platform-mediated implementation of multidisciplinary reviews Among oncology centers in the COVID-19 Era: Protocol for an observational study. *JMIR Res Protoc* 10: e26220, 2021.
- El Saghir NS, Charara RN, Kreidieh FY, Eaton V, Litvin K, Farhat RA, Khoury KE, Breidy J, Tamim H and Eid TA: Global practice and efficiency of multidisciplinary tumor boards: Results of an American society of clinical oncology International survey. *J Glob Oncol* 1: 57-64, 2015.
- El Saghir NS, Farhat RA, Charara RN and Khoury KE: Enhancing cancer care in areas of limited resources: Our next steps. *Future Oncol* 10: 1953-1965, 2014.
- Mano MS, Çitaku FT and Barach P: Implementing multidisciplinary tumor boards in oncology: A narrative review. *Future Oncol* 18: 375-384, 2022.
- El Saghir NS, El-Asmar N, Hajj C, Eid T, Khatib S, Bounedjar A, Ajarim D, Shamseddine A, Geara F, Jazieh A, *et al*: Survey of utilization of multidisciplinary management tumor boards in Arab countries. *Breast* 20 (Suppl 2): S70-S74, 2011.
- Schmidt HM, Roberts JM, Bodnar AM, Kunz S, Kirtland SH, Koehler RP, Hubka M and Low DE: Thoracic multidisciplinary tumor board routinely impacts therapeutic plans in patients with lung and esophageal cancer: A prospective cohort study. *Ann Thorac Surg* 99: 1719-1724, 2015.
- Keating NL, Landrum MB, Lamont EB, Bozeman SR, Shulman LN, McNeil BJ: Tumor boards and the quality of cancer care. *J Natl Cancer Inst* 105: 113-121, 2013.
- Charara RN, Kreidieh FY, Farhat RA, Al-Feghali KA, Khoury KE, Haydar A, Nassar L, Berjawi G, Shamseddine A and El Saghir NS: Practice and impact of multidisciplinary tumor boards on patient management: A prospective study. *J Glob Oncol* 3: 242-249, 2016.
- Snyder A, Kemeny N, Shamseddine A, Al-Olayan A, El-Merhi F, Kelsen DP, Jamali F, Sidani M, Mukherji D, El-Naghy M, *et al*: Liver-directed conversion therapy in metastatic colon cancer. *J Gastrointest Oncol* 6: 322-328, 2015.
- El Saghir N: ABC of Breast Diseases, Awareness, Prevention, Treatment (ed 3). Beirut, Lebanon, Arab Scientific Publishers, 2013, pp 261-267, 2013. <https://www.neelwafurat.com/itempage.aspx?id=lbbl32751-92883&search=books>
- Stevenson MM, Irwin T, Lowry T, Ahmed MZ, Walden TL, Watson M and Sutton L: Development of a virtual multidisciplinary lung cancer tumor board in a community setting. *J Oncol Pract* 9: e77-e80, 2013.
- El Saghir NS, Charana R, Eaton VJ, Litvin K, Farhat R, Khoury K, Breidy J and Tamim H: ASCO Survey: Use and efficiency of multidisciplinary tumor boards worldwide. *Ann Oncol* 25: iv373, 2014.