Cureus
Part of SPRINGER NATURE

Open Access Review Article

Multidisciplinary Team Meetings in Thoracic Oncology: An Update on the Evidence, Limitations, and Future Perspectives

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Review began 11/03/2026
Review ended 11/09/2026
Published 11/13/2026

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DOI: 10.7759/cureus.119620

Abstract

Multidisciplinary team (MDT) meetings are now a central component of contemporary thoracic oncology care. Lung cancer remains a major cause of cancer-related mortality, and its management involves increasingly complex decisions integrating accurate disease staging, comprehensive biomarker testing, and multimodal treatment strategies. This review synthesizes the published evidence on the impact of MDTs in thoracic oncology, discusses their methodological and organizational limitations, and analyzes recent developments: molecular tumor boards, virtual MDTs and telemedicine, quality indicators, artificial intelligence (AI) tools, and patient-centered decision-making. The literature is predominantly observational and retrospective; a systematic review of 29 lung cancer studies identified only one randomized trial. Overall, observational studies suggest that MDT discussion is associated with a greater likelihood of receiving active treatment and guideline-concordant care. Findings regarding survival are heterogeneous, and the available evidence does not establish an independent causal effect of MDT discussion on survival. The main weaknesses are heterogeneity of recommendations between centers, discordance between recommended and delivered treatment, time and resource burden, incomplete documentation of conclusions, and frequent lack of explicit consideration of patient preferences. Based on the current literature, the most promising proposed priorities for further evaluation include structured performance indicators, standardized documentation, wider adoption of hybrid meeting formats, and the integration of AI positioned as a decision support tool rather than an autonomous decision-maker. However, while these approaches identify potential areas for improvement, further research is required to conclusively establish their effectiveness on clinical patient outcomes.

Categories: Oncology, Pulmonology, Epidemiology/Public Health
Keywords: lung cancer, multidisciplinary team meeting, quality indicators, thoracic oncology, tumor board

Introduction And Background

The growing complexity of thoracic cancer care, involving multimodal staging (the assessment of disease extent through clinical, radiological, pathological, and, when appropriate, metabolic investigations), molecular profiling (the identification of tumor-specific molecular alterations and biomarkers that may guide treatment selection), immunotherapy, targeted therapies, stereotactic radiotherapy, and minimally invasive surgery, has transformed treatment decisions into a collective rather than an individual process.

While multidisciplinary care encompasses various organizational models, including multidisciplinary clinics and molecular tumor boards (MTBs), this review primarily focuses on standard multidisciplinary team (MDT) meetings in lung cancer and thoracic oncology. An MDT meeting is a structured clinical discussion in which specialists from different disciplines jointly review a patient's clinical, radiological, pathological, and molecular findings to establish a diagnosis and formulate an individualized management plan. MTBs, in contrast, focus specifically on interpreting complex molecular profiling results and translating them into potential therapeutic strategies. Many centers have adopted a multidisciplinary approach that draws on diverse specialist expertise to provide personalized, evidence-based treatment. National guidelines have been introduced to standardize care pathways and ensure timely diagnosis and treatment, strategies that depend on effective communication among team members [1].

Consequently, MDT meetings are widely recommended and adopted as an integral part of thoracic oncology care [2,3]. Yet, formal evidence of their effectiveness remains debated: the literature is dominated by observational studies, and the widespread adoption of this practice contrasts with the relative fragility of the available evidence [4].

This narrative review synthesizes the literature identified through a search of electronic databases and major oncology guidelines to address four objectives: (i) to describe the organizational models and recommended framework of thoracic MDT meetings; (ii) to synthesize evidence regarding their clinical

impact; (iii) to analyze their limitations, heterogeneity, and determinants of quality; and (iv) to discuss contemporary developments, notably MTBs, virtual meetings, performance indicators, artificial intelligence (AI), and shared decision-making.

Review

Organizational models and composition of the thoracic MDT

Two main models of multidisciplinary care coexist. The more common is the MDT meeting, in which a panel of experts reviews the case and reaches a collective decision. In the second, the multidisciplinary clinic, the patient is seen sequentially by the relevant specialists in a single centralized consultation; this model is often combined with an MDT meeting upstream or downstream [2].

Team composition varies but is consistent across the literature. In a Taiwanese series of stage III non-small cell lung cancer (NSCLC), the thoracic oncology MDT met weekly and comprised pulmonologists, thoracic surgeons, medical oncologists, radiation oncologists, radiologists, nuclear medicine physicians, pathologists, nurses, psychologists, and dietitians [5]. The virtual tumor board of the International Thymic Malignancy Interest Group (ITMIG) illustrates an international expert model: it includes at least one representative each from thoracic surgery, medical oncology, radiation oncology, diagnostic radiology, and thoracic pathology, and any clinician may submit a case with the clinical history, questions, and radiological and histological images [6].

At the care network level, an inventory of 10 centers (two academic centers and eight community sites) identified 53 tumor boards: 33 across the two academic centers (20 and 13, respectively) and 20 across the eight community sites (median, 2.5 per site; range, 1-6). Weekly meetings were the most common (30 boards), and all boards had a virtual component [7]. This work highlighted marked heterogeneity in organizational domains: coordination, referral procedures, and documentation [7].

Pulmonary nodule management has evolved notably. Recent practice guidelines recommend dedicated nodule evaluation teams and nodule-specific MDT meetings, which improve guideline adherence, streamline the diagnostic pathway, reduce unnecessary investigations, and shorten time to treatment [8].

Recommended framework and quality indicators

MDT meetings have evolved beyond their role as a clinical practice to become an established organizational standard in cancer care. In Germany, 97% of patients with cancer were discussed at an MDT meeting, with rates ranging from 91% to 100% across centers, according to the German Cancer Society criteria [9]. In the United States, the expected components of tumor boards are described by the American College of Surgeons Commission on Cancer program [10].

MDT performance measurement has been structured around a set of indicators. A dedicated review compiled, from the standards of accreditation bodies and learned societies, a list of performance indicators to improve the functioning and impact of tumor boards, with specific examples for lung cancer and non-Hodgkin lymphoma [11]. Similarly, assessing the clinical implementation of MDT recommendations has been proposed as an indicator of multidisciplinary care quality [12].

Real-world assessments of MDT functioning, however, reveal persistent organizational shortcomings. In a survey of 21 tumor board chairs (16 respondents; response rate, 76%) and 175 participants (111 respondents; response rate, 63%), 55% of tumor boards did not provide continuing medical education credits, and 60% did not document their recommendations. Key strengths included the participation of all relevant subspecialties, a respectful working environment, and a structured agenda. Areas requiring improvement included the documentation of recommendations and coordination of care after the meeting [10]. These data show that MDT quality depends less on its formal existence than on its internal processes.

Evidence of clinical effectiveness

Overall Level of Evidence

The most comprehensive review in lung cancer identified 29 studies published between 2000 and 2019: 11 evaluated multidisciplinary clinics, 14 multidisciplinary meetings, and 4 an undefined model. Only one was a randomized trial and three were prospective; the remainder were retrospective [3]. Despite these design limitations and confounding, multidisciplinary care was overall associated with improved outcomes, in particular better survival across all stages. Patients managed in a multidisciplinary setting were more likely to receive active treatment, made better use of all modalities (surgery, radiotherapy, and chemotherapy), and more often received guideline-concordant recommendations [3].

Survival

Survival data are heterogeneous but mostly favorable. In a study of 335 patients (median age 69 years; 82%

NSCLC, 14% small cell lung cancer, 4% without pathological diagnosis; 84% locally advanced or metastatic), MDT recommendations were compared with treatments derived from evidence-based guidelines [13]. An umbrella review of tumor boards reported, from the included studies, statistically significant survival improvements in several studies: a 3.2-month gain in median survival in patients with inoperable NSCLC, and an increase in one-year survival from 18.3% to 23.5% in patients older than 70 years. One study, however, found no association between tumor board discussion and overall survival [14]. In a British series, the multidisciplinary approach was associated with a doubling of survival in patients with stage III disease [15].

Further evidence supporting this association comes from a nationwide Taiwanese cohort study, in which MDT discussion was associated with a significantly lower adjusted hazard of death among patients with stage III-IV NSCLC compared with those not discussed at an MDT meeting (HR, 0.87; 95% CI, 0.84-0.90) [16]. Conversely, a North American study showed that physician involvement in tumor boards was associated with higher clinical trial participation and higher rates of curative-intent surgery for stage I-II NSCLC but not with overall survival [17]. An Australian study concluded that MDT discussion was associated with a higher probability of receiving treatment, which may improve quality of life, without improving survival [18].

An emerging finding concerns the timing of MDT involvement along the diagnostic and therapeutic pathway. In a prospective cohort of 1,920 patients followed between 2014 and 2024, earlier MDT involvement was associated with a greater survival benefit. Compared with patients referred after diagnosis, the adjusted HR for death was 0.87 (95% CI, 0.75-1.01) for patients discussed before diagnosis and 0.78 (95% CI, 0.66-0.92) for those discussed before radiological staging. By contrast, MDT involvement before treatment initiation was not significantly associated with improved survival (adjusted HR, 1.05; 95% CI, 0.87-1.26) [19]. These findings suggest that the potential benefit of MDT discussion may depend, at least in part, on its timing within the care pathway.

Guideline Adherence, Quality, and Time to Treatment

The multidisciplinary approach improves care coordination, reduces practice variation (a problem identified worldwide), removes barriers to treatment access, promotes standardization through guideline adherence, and allows audit of clinical services [4]. It is also associated with more accurate staging, better access to diagnostic investigations, better use of radiotherapy and palliative care, and better quality of life [4]. Integrated multidisciplinary care significantly shortens the interval between diagnosis and treatment and improves the patient experience [16].

These benefits are visible in real-world pathways. In a Tunisian series of 88 patients with stage III NSCLC discussed in an MDT, tumor-node-metastasis (TNM) stage was reconsidered after the meeting in 16% of cases, indications were consistent with European Society for Medical Oncology (ESMO) guidelines in 90%, and patients treated according to the MDT decision had a median overall survival of 49 months versus 22 months when the decision was not followed ($p<0.01$) [20].

Access to Clinical Trials and Treatments

The MDT facilitates the identification of patients eligible for clinical trials [21]. In one multidisciplinary program, 75% of eligible patients were enrolled in a clinical trial, representing 6% of the total patient population [22]. This is consistent with the structural limits on trial access: in a survey of 1533 specialist physicians, 87.8% of medical oncologists, 66.1% of radiation oncologists, and 35.0% of surgeons reported having referred or enrolled at least one patient in a clinical trial during the previous 12 months. The mean number of patients referred to or enrolled in MDTs was 17.2 (95% CI, 15.5-18.9) for medical oncologists, 9.5 (95% CI, 7.7-11.3) for radiation oncologists, and 12.2 (95% CI, 9.8-14.6) for surgeons ($p<0.001$) [23]. Roles in the process also differ: 79% of medical oncologists reported discussing trials with patients, 68% of radiation oncologists did so jointly with another clinician, and 55% of surgeons referred patients to another clinician for this discussion [24].

Table *1* summarizes the main studies evaluating MDT care in lung cancer, grouped into four conceptual categories: survival impact, process indicators (treatment use, guideline adherence, and timing of care), MTBs, and digital/AI tools. Within each category, studies are ordered by reference number. Most of the evidence on survival comes from observational studies, which limits causal interpretation, while data on MTBs and AI-based tools remain limited.

Study	Design	Population/setting	Outcome domain	Main result
A. Survival impact				
		29 studies published between 2000 and 2019: 11	Survival;	Multidisciplinary care was associated with improved

Heinke & Vinod [3]	Systematic review	multidisciplinary clinics, 14 multidisciplinary meetings, and 4 studies with an undefined model	treatment use; guideline adherence	survival, greater use of active treatments (surgery, radiotherapy, and chemotherapy), and better adherence to clinical guidelines.
Hung et al. [5]	Retrospective cohort	515 patients with stage III NSCLC, treated between 2013 and 2018	Survival	Median survival was 41.2 months with MDT discussion vs 25.7 months without (p=0.018). MDT discussion was an independent prognostic factor in multivariable analysis.
Specchia et al. [14]	Umbrella review	Five systematic reviews published between 2008 and 2017, covering multiple cancer types, including lung cancer	Survival	Evidence of survival improvement was inconsistent. Among the underlying lung cancer studies, one reported a 3.2-month increase in median survival in inoperable NSCLC, and another an increase in 1-year survival from 18.3% to 23.5% in patients older than 70 years. Three studies found no statistically significant improvement.
Pan et al. [16]	Retrospective nationwide cohort study	Taiwan Cancer Registry (2005-2010) linked to national health insurance data; patients with newly diagnosed NSCLC	Survival (by stage)	MDT participation was associated with lower mortality in stage III-IV NSCLC (adjusted HR, 0.87; 95% CI, 0.84-0.90), using a multivariable Cox model with propensity score adjustment. No statistically significant association in stage I–II (aHR, 0.89; 95% CI, 0.78-1.01).
Lin et al. [25]	Population-based retrospective cohort	9,628 patients with lung cancer, Victorian Lung Cancer Registry, Australia (2011-2020); 5,900 (61.3%) discussed at MDT	Survival; treatment use	MDT-discussed patients had higher rates of surgery (31.2% vs 22.1%), radiotherapy (44.4% vs 34.2%), and chemotherapy (49.0% vs 44.7%). Median survival was 1.70 vs 0.75 years; adjusted mortality risk was 25% lower (HR, 0.75; 95% CI, 0.71-0.80; p<0.001).
B. Process indicators (treatment use, guideline adherence, timing of care)				
Forrest et al. [15]	Single-center cohort	Patients with inoperable NSCLC treated before and after MDT implementation (1997 and 2001)	Treatment use; survival	After MDT implementation, chemotherapy use increased from 7% to 23% (p<0.001), associated with a doubling of survival in stage III disease.
Boxer et al. [18]	Cohort	988 patients with newly diagnosed lung cancer; 504 discussed at MDT and 484 not (Australia, 2005-2008)	Treatment use	MDT discussion was associated with higher rates of radiotherapy (66% vs 33%) and chemotherapy (46% vs 29%) but not surgery (12% vs 13%).
Shao et al. [19]	Prospective cohort	1,920 patients enrolled in a multidisciplinary thoracic oncology program (2014-2024)	Timing of care; survival	Early program entry before radiological staging was associated with improved survival (aHR, 0.78; 95% CI, 0.66-0.92).
Herbegue et al. [20]	Cohort	88 patients with stage III NSCLC discussed at a weekly MDT meeting (2011-2017)	Staging; guideline adherence; survival	TNM stage was reconsidered in 16% of cases; 90% adherence to ESMO recommendations. Median overall survival was 49 months with treatment consistent with MDT recommendations vs 22 months without (p<0.01).
C. Molecular tumor boards				
Kato et al. [26]	Real-world data	429 therapy-evaluable patients discussed by a molecular tumor board	Implementation of recommendations; PFS and OS	265 patients (62%) received at least one recommended drug and 86 (20%) received all recommended drugs. Those receiving the complete recommended regimen had better PFS and OS than those receiving physician-selected treatment.
D. Digital/AI tools				
Karabuğa et al. [27]	Comparative study	102 patients with various cancer types; tumor board decisions compared with ChatGPT-4o	Concordance with tumor board	Agreement between tumor board and AI was low (κ=0.211 and 0.376 for the two independent raters). Both raters more frequently validated tumor board decisions, supporting the continued importance of multidisciplinary expertise.

TABLE 1: Studies on multidisciplinary team care in lung cancer, grouped by conceptual category

AI, artificial intelligence; aHR, adjusted hazard ratio; CI, confidence interval; ESMO, European Society for Medical Oncology; HR, hazard ratio; MDT, multidisciplinary team; NSCLC, non-small cell lung cancer; OS, overall survival; PFS, progression-free survival; TNM, tumor-node-metastasis.

Limitations, heterogeneity, and controversies

Fragility of the Evidence

The main limitation is methodological: the reference review in lung cancer identified only one randomized trial and three prospective studies among 29 publications, the rest being retrospective [3]. This weakness explains the caution of the conclusions: although evidence is accumulating that MDTs contribute to better outcomes, higher quality studies are still needed. Comparisons between patients discussed and not discussed at MDT meetings are particularly susceptible to selection bias. These groups may differ in age, performance status, comorbidity, disease stage, diagnostic completeness, referral patterns, access to specialist services, and treatment eligibility. Residual confounding may therefore contribute to the associations reported between MDT discussion and outcomes. The absence of a survival improvement in some series [14,18] should be interpreted in light of these factors, as well as differences in staging practices and stage migration (stage drift), which may further complicate comparisons across centers and periods [15].

Inter-center Variability

Heterogeneity of decisions between teams is a robust finding. In a Norwegian nationwide case-vignette study, 35 hypothetical cases were presented to MDTs from 12 hospitals. The detailed analysis discussed here focused on 12 cases of stage III NSCLC. These standardized vignettes were designed to assess inter-center variation in staging and treatment recommendations; they did not represent real patients and did not evaluate clinical outcomes or survival. Differences in staging and proposed treatment were observed across centers. For 10 of them, differences in staging (from IIIA-B-C to IV) and in recommended treatment were observed, with curative treatment proposed by anywhere from zero to nine of the 12 MDTs. Factors associated with divergence were age above 75-80 years, comorbidities, performance status of 2 or its absence from the case summary, programmed death-ligand 1 (PD-L1) above 50%-75% in stage IV, and large cell neuroendocrine carcinoma. Notably, no difference was found between local and university hospital MDTs, and shared decision-making with the patient was frequently recommended [28].

Discordance Between Recommendation and Delivered Treatment

Translation of recommendations into practice varies by tumor site. In a multicenter study evaluating various tumor-specific MDTs to provide a broader context for implementation, concordance ranged from 84.5% for the lung MDT to 97.6% for breast MDTs, the most frequent reason for discordance across these cohorts being the decision of the patient or their representative (28.3%). The authors concluded that systematic measurement of recommendation implementation should be considered a quality indicator of practice [12]. In the Tunisian series, 27.3% of patients were referred without a histological diagnosis, and discordance between planned and delivered treatment reached 58%. The causes were patient refusal (14%), deterioration of general condition (8%), medical contraindications (4%), delayed radiotherapy initiation (8%), and loss to follow-up (33%) [20].

Workload, Time, and Cost

Time and workload pressures adversely influence MDT decision-making. Typical problems are lengthy discussions caused by missing information (comorbidities and patient wishes, stage, imaging, pathology, and prior treatments) and administrative tasks (incomplete forms, handwritten or dictated reports). MDT meetings are scheduled for one hour and may include up to 20 patients, with frequent overruns in duration and case numbers [9]. Running regular meetings or clinics incurs substantial costs in time, resources, and funding, which justifies rigorous assessment of their impact [3].

MTBs and precision medicine in thoracic oncology

The expansion of molecular profiling has created a specific organizational need: applying next-generation sequencing in clinical practice requires MTBs [29]. These bodies must define their objectives and composition, the tumor types to be discussed, the relevant molecular analyses, the methods for classifying actionability, an appropriate turnaround time, and cost management [29].

Real-world results are encouraging. In a cohort of 429 evaluable patients, 265 (62%) were matched to at least one MTB-recommended drug, including 86 (20%) matched to all recommended drugs (including combination approaches), whereas 38% received a physician-selected regimen that was generally unmatched or poorly matched [26]. MTBs are a specialized form of multidisciplinary discussion. Their principal purpose is to interpret complex molecular findings and assess potential treatment matching. Outcomes reported in MTB studies, such as access to matched therapies or progression-free survival, should therefore not be interpreted as direct evidence of the effectiveness of conventional thoracic MDT meetings. Other work reports that 54.2% of patients were candidates for on-label or off-label Food and Drug Administration (FDA)-

approved therapies, and that 99.6% of patients who underwent pharmacogenomic analysis had at least one gene alteration associated with dose adjustment or drug avoidance [30].

Several obstacles remain. Members cannot always meet in person, the MTB is not always accessible to community oncologists, and there is a lack of quality standards and guidance on how to run an MTB and make decisions; the virtual MTB has been proposed as a response to some of these problems [31]. Applying genomic results outside approved indications is often hindered by the lack of reimbursement, forcing patients into clinical trials or compassionate access programs, even though such trials cover only a minority of potential indications and apply strict eligibility criteria [30]. Institutional experience, such as that of the Moffitt Cancer Center MTB, stresses the need for explicit organizational structures and integration into personalized medicine services [32].

In thoracic oncology, complexity increases with the number of targetable alterations and associated therapies, and real-world experience shows differential efficacy compared with clinical trials [33]. Paradoxically, the MDT can also stabilize decisions: in the Norwegian study, agreement between teams was generally good for recommending tyrosine kinase inhibitors in the presence of an epidermal growth factor receptor (EGFR) mutation or anaplastic lymphoma kinase (ALK) translocation [28].

Clinical situations with high MDT added value

Stage III NSCLC

Stage III remains the paradigm of multidisciplinary decision-making. The optimal treatment of resectable disease is still debated, and the therapeutic choice reflects individual disease characteristics and the expertise and opinion of the thoracic MDT [34]. Based on selected studies, a multidisciplinary approach to stage III has been reported to allow earlier treatment initiation and optimization of modalities; however, because the available evidence is predominantly observational, associated outcomes such as lower healthcare expenditure and survival benefits should not be interpreted as universally established effects [35].

Oligometastatic Disease

Management of oligometastatic disease explicitly relies on a multidisciplinary approach, which is needed to identify eligible patients by considering symptomatic or potentially symptomatic brain metastases, targetable mutations, and PD-L1 expression. Treatment combines innovative systemic agents (tyrosine kinase inhibitors or immune checkpoint inhibitors, with or without chemotherapy) and local ablative therapy by surgery or stereotactic radiotherapy where appropriate [36]. The data remain contradictory; however, NRG Oncology Lung Cancer Study LU002 (NRG-LU002), the first randomized phase II/III trial in oligometastatic NSCLC without a targetable oncogenic alteration, in which almost all patients received immunotherapy, was negative for its primary endpoint (progression-free survival). By contrast, the phase III SINDAS trial, which evaluated the addition of radiotherapy to a first-generation tyrosine kinase inhibitor in synchronous oligometastatic EGFR mutant NSCLC, was positive for both progression-free and overall survival [33]. These discrepancies, attributable to differences in staging, selection criteria, treatment, and possibly biology, call for a better understanding of the biology and optimal management of this setting. Rather than supporting a uniform local treatment strategy, these contrasting results underline the importance of individualized MDT assessment. Relevant considerations include the molecular profile, number and distribution of metastases, response to initial systemic therapy, choice of systemic treatment, and the feasibility, modality, and timing of local ablative treatment [37].

In an institutional analysis of 272 patients treated with concurrent chemoradiotherapy, including 220 with stage III disease and 52 with oligometastatic disease (cT3/cT4 tumors or cN2/cN3 status), five-year overall survival was 28.3% (95% CI, 16.4-41.5%) in the oligometastatic group, with no significant difference compared with the stage III group (34.9%; 95% CI, 27.4-42.8%). However, five-year progression-free survival was significantly lower in oligometastatic patients (13.0% vs. 24.3%; $p=0.0048$), reflecting a higher cumulative incidence of distant metastases (50.2% vs. 20.4% at 48 months; $p<0.0001$). A prognostic classifier incorporating severe comorbidity, Eastern Cooperative Oncology Group (ECOG) performance status, sex, and pretreatment serum C-reactive protein (CRP) stratified the oligometastatic group into two equally sized subgroups, with four-year overall survival rates of 49.4% in the good prognosis group and 9.9% in the poor prognosis group ($p=0.0021$) [38]. These findings highlight the importance of careful patient selection and individualized risk assessment during MDT discussions.

Malignant Pleural Mesothelioma

Malignant pleural mesothelioma illustrates the value of formalized multidisciplinary expertise. The European Respiratory Society/European Society of Thoracic Surgeons/European Association for Cardio-Thoracic Surgery/European Society for Radiotherapy and Oncology (ERS/ESTS/EACTS/ESTRO) guidelines, produced by a multidisciplinary expert panel that appraised the 2009-2018 literature using the Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach, state that pleural biopsy remains the diagnostic standard and that standard stains are insufficient in approximately 10% of cases,

justifying specific markers, including BAP-1 and Cyclin-Dependent Kinase Inhibitor 2A protein (p16INK4a), to distinguish atypical mesothelial proliferation from mesothelioma [39]. In the absence of a uniform, robust, validated staging system, the 8th TNM classification (2016) with a pretherapeutic assessment algorithm is recommended, and patients who are candidates for a multimodal approach, including radical surgery, should be treated within clinical trials at dedicated mesothelioma centers [39]. The American Society of Clinical Oncology (ASCO) guideline, based on 222 studies, covers diagnosis, staging, chemotherapy, surgical cytoreduction, radiotherapy, and multimodal therapy [40], and the National Comprehensive Cancer Network (NCCN) guidelines now include bevacizumab combined with cisplatin and pemetrexed as first-line treatment in unresectable patients who are candidates for this agent [41].

Thymic tumors

Thymic tumors are rare, and the evidence derives mainly from pooled retrospective analyses. Resection is the cornerstone; radiotherapy and systemic treatments are used to facilitate surgery, prevent recurrence, or as primary treatment for unresectable or metastatic disease. Optimal results depend on multidisciplinary management that individualizes and integrates multimodal treatments [42]. Italian consensus work (the TYME group) and network analyses underline the need to organize this expertise for rare entities [43,44], and the international ITMIG tumor boards illustrate a model for discussing complex cases worldwide, for example, a 37-year-old man with a stage IVA type B2B3 thymoma according to the TNM classification [6,45].

Pulmonary Nodules

Nodule management has become a preferred field of application for structured multidisciplinary models. In a dedicated clinic, 1136 patients were evaluated between October 2012 and September 2019, with 95% adherence to clinic recommendations, 356 procedures recommended, and 271 patients referred for surgery and/or radiotherapy. Most interventions (74%) were recommended at the first consultation, and 211 patients (19%) had malignancy confirmed histologically or treated empirically with irradiation [46]. In a community program, the number of referred patients rose from 665 in the first year to 745 in the second, most nodules being incidental (62%-65%); in the first year, 27% (182/665) required a diagnostic intervention and 18% (121/665) were malignant [47]. A prospective cohort of 8800 patients managed in a nodule clinic reported a lung cancer diagnosis in 19.13% of monitored patients, of whom 77.40% had stage 0-I disease, with a diagnostic accuracy of 90.49% for CT-guided transthoracic needle biopsy of solid nodules [48]. Conversely, an evaluation of a tertiary nodule service, including 2203 patients, showed that 27% (368/1365) of new patients exited the pathway after the first MDT, 11% (246/2203) were referred to the multidisciplinary thoracic oncology service and, of these, 37% (92/246) subsequently exited the pathway; the lung cancer diagnosis rate was 7% (154/2203) [49]. While these data illustrate the dual expected benefit of early detection and fewer unnecessary investigations within multidisciplinary nodule clinics and pathways, the available evidence does not necessarily isolate the independent contribution of the MDT discussion itself [8].

Virtual MDTs and telemedicine

The COVID-19 pandemic changed the organization of thoracic MDTs and accelerated their virtualization. As in-person multidisciplinary consultation became harder to arrange, telemedicine avoided delays and changed care coordination while reducing infection risk; videoconferencing allowed the creation of virtual MDTs [16]. These formats remove geographical barriers and facilitate clinical communication and decision-making [16].

Structured experience is longstanding. The Duke Cancer Network developed an Internet conferencing platform for a multidisciplinary lung cancer tumor board, connecting providers at rural sites with an academic center two hours away by road, with an average of 10 participants and one to two case presentations per session [50]. Virtual MDTs extend the local team to a regional or national expert network and facilitate access to clinical trials; participants usually discuss 5 to 8 cases per meeting [51]. In a survey of 75 participants in a thoracic MDT between August and October 2022, 60% felt that the virtual format had improved their experience, as it allowed satellite centers to take part regularly. Concerns were raised, however, about reduced collegiality and feeling intimidated when speaking online, which led the institution to adopt a hybrid format from May 2023 [52].

The contribution is particularly important in resource-limited settings. The Global Cancer Institute telemedicine multidisciplinary tumor boards, launched in 2012, have involved a growing network of several hundred physicians in 22 countries, with cases from low- and middle-income country institutions discussed by American and European experts [53]. These approaches aim to narrow the gap between high- and low-income countries: approximately 70% of the 9.6 million annual cancer deaths occur in low- and middle-income countries, and the burden is expected to reach 22 million new cases per year by 2030, with 81% of new cases and nearly 88% of mortality in these regions [54]. Documented barriers in these settings include inadequate infrastructure, shortages of skilled staff, funding difficulties, lack of electronic health records, transport problems, and cultural norms; proposed solutions combine telemedicine, simplified formats, international partnerships, and integration into national cancer control plans [55]. National initiatives, such as the Tumor Board Establishment Facilitation Forum in Pakistan, have used virtual MDTs to fill a gap in in-person MDTs [56], and international tumor boards dedicated to rare solid tumors have proved useful where

local expertise is limited [57].

Governance, documentation, and efficiency

MDT efficiency is a documented organizational issue. A survey of international ASCO members showed that MDT efficiency needs to improve, through more effective discussion moderators, better time management in meetings, better case selection criteria, and written case summaries for participants, measures that could reduce the time and resources required [58]. The literature also describes efforts to improve the preparation, structure, and conduct of tumor boards, and research methods for monitoring their performance, teamwork, and outcomes; the concept of "mini-tumor boards" and more efficient methods of multidisciplinary discussion in resource-limited countries are also discussed [21]. In the United Kingdom, specific training of MDTs has been associated with better team dynamics and communication, improved patient satisfaction, and better clinical outcomes [21].

Documentation remains a weak link. Standardization of conclusions and their centralized accessibility were among the priorities identified in the evaluation of a US network, where the most anticipated changes concerned the availability and participation of subspecialists, with marked heterogeneity of coordination, referral pathways, and documentation [7]. Implementing tools integrated into the electronic health record that standardize case submission, worklists, MDT documentation, and scheduling is a concrete organizational response [7]. The finding that 60% of the tumor boards in one network did not document their recommendations and that 55% did not award continuing education credit illustrates the scope for improvement [10].

AI and decision-support tools

AI is regularly presented as a response to the growing burden on MDTs. The literature stresses that MDT integration is fundamental to delivering state-of-the-art care, but that the burden created by rising cancer incidence and financial constraints calls for innovative solutions, AI offering a promising route to support clinical decision-making [59]. Decision-support systems have been developed using multidisciplinary tumor boards as a conceptual model, but attempts at large-scale automation have not reached routine clinical practice because of the difficulty of extracting standardized recommendations from heterogeneous data [60]. AI-based clinical decision-support systems are deployed internationally, for example, Watson for Oncology and Chinese Society of Clinical Oncology (CSCO) AI, but ethical questions and the limits of human-machine interaction have not been fully resolved [61]. In a review of AI technologies in oncology, Watson for Oncology is described as recommending treatments similar to those of oncologists in more than 90% of cases, with limitations of data bias and interpretability. Crucially, AI applications in oncology encompass different functions: Watson for Oncology has been developed as a treatment decision-support system, whereas Flatiron Health is primarily associated with oncology real-world data and data-driven tools. These examples should not be considered equivalent systems, and their respective roles and evidence bases need to be evaluated separately. Consequently, Flatiron Health AI draws on electronic record data from more than 2 million patients [61,62].

The available comparative data call for caution. In a study of 102 patients with various tumor types, the treatment and follow-up decisions proposed by the MDT and by ChatGPT-4o were independently assessed by two medical oncologists. Inter-rater reliability was high (κ=0.722, p<0.001 for the MDT; κ=0.794, p<0.001 for the AI), but agreement between the MDT and the AI was low (κ=0.211, p=0.003 for rater 1; κ=0.376, p<0.001 for rater 2), and both raters more often validated MDT decisions (Z=+4.548, p<0.001 and Z=+3.990, p<0.001). In the cited study, recommendations generated by ChatGPT-4o were compared with decisions made by a tumor board. The findings provide an exploratory assessment of agreement within a heterogeneous oncology population; however, they do not establish the model's performance in thoracic oncology or demonstrate its clinical safety or effectiveness [27]. In practice, the most consensual role for AI is therefore that of a tool for preparing and supporting multidisciplinary discussion, under expert supervision [27,60].

The patient's place and shared decision-making

A persistent gap exists between the rhetoric of patient-centered care and the actual functioning of MDTs. In a qualitative non-participant observation study of 15 MDT meetings, physicians mainly exchanged medical information and based their decisions on it; individual patient characteristics and treatment preferences were rarely mentioned or discussed, and when they were, they did not appear to be taken into account in the decision. A persistent gap exists between the rhetoric of patient-centered care and the actual functioning of MDTs. In a qualitative non-participant observation study of 15 MDT meetings within the studied setting, physicians mainly exchanged medical information and based their decisions on it; individual patient characteristics and treatment preferences were rarely mentioned or discussed, and when they were, they relied on information provided by clinicians rather than direct patient participation, which remains uncommon in standard MDT frameworks [63]. This is consistent with a systematic review that identified the lack of patient-centered information as one of the main barriers to effective MDT decision-making [64].

Patients' expectations, however, are nuanced. The UK National Cancer Patient Experience Survey (2011/12),

completed by more than 70,000 patients, showed variable practices: between 62% and 100% of patients reported having had a choice of treatment before it began, between 56% and 83% felt that their views had been taken into account by the team, and nearly 1 patient in 10 (8%) did not even know that their treatment had been discussed by a team [64]. From the perspective of patient organizations, participation in MDTs is still limited: patient representatives reported not being invited to meetings, and only 47 (35%) had been informed that their case was being discussed. Clinicians' concerns relate to increased anxiety, damage to the doctor-patient relationship, and the effect on meeting dynamics, whereas patients report better information and the opportunity to express their preferences as benefits. Implementing shared decision-making in oncology therefore requires structured approaches and an understanding of its components by clinicians [65].

Perspectives and operational proposals

In light of the synthesized data, several priorities can be identified to improve the organization and effectiveness of multidisciplinary care in thoracic oncology. Bringing patients into the multidisciplinary pathway at an earlier stage is particularly important. The survival benefit appears clearest when MDT involvement occurs before radiological staging (aHR, 0.78; 0.66-0.92), and seems to diminish when referral occurs later [18].

Standardizing documentation and implementing systematic audits are also essential. Recording MDT recommendations and assessing their implementation represent actionable quality indicators [10-12]. In addition, particular attention should be given to high-value clinical situations, including stage III disease, oligometastatic disease, mesothelioma, thymic tumors, and indeterminate pulmonary nodules, where decision-making variability and clinical stakes are particularly high [8,25,36,39,42].

The organization of molecular MDTs should also be formalized. Their objectives, composition, types of molecular analyses, actionability classification, turnaround times, and associated costs need to be clearly defined [29], with appropriate support for less experienced centers [32]. Hybrid formats may further extend access to specialist expertise, particularly for peripheral centers and resource-limited regions, provided that the quality of collegial discussion and patient confidentiality are preserved [51,52,55].

AI should be positioned as a decision support tool rather than an autonomous decision-maker. Current evidence does not support delegating clinical decisions to a language model [27]; its potential contribution should instead focus on case preparation, information synthesis, and the identification of relevant clinical trials [59]. Finally, patient preferences should be explicitly integrated into MDT deliberations. The patient perspective is frequently underrepresented in these discussions [63], while concordance between MDT recommendations and the treatment ultimately delivered depends substantially on the decisions of patients and their representatives [12].

Conclusions

Multidisciplinary discussion has become an essential, normative component of thoracic cancer care. It is supported by international guidelines, integrated into performance indicators, and associated, in most studies, with better access to treatment, better guideline adherence, and improved survival. Its persistent weakness is the level of evidence and its heterogeneity, illustrated by divergent staging and recommendations between centers for identical cases. The priorities for the coming decade are therefore less about extending the MDT than optimizing it: standardized documentation, quality indicators, hybrid formats, articulation with molecular MDTs, reasoned governance of AI, and effective integration of the patient perspective.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

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Disclosures

AI use statement: The authors have declared that no AI tools were used during the work or in the drafting of this article. The authors take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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