Review Article

# Implementation of lung cancer multidisciplinary teams: a review of evidence-practice gaps

**Nicole M. Rankin[1], Elizabeth A. Fradgley[2,3,4], David J. Barnes[1,5]**

[1]Faculty of Medicine and Health Sciences, University of Sydney, Camperdown, New South Wales, Australia; [2]University of Newcastle Priority Research Centre for Cancer Research, Innovation and Translation, Callaghan, New South Wales, Australia; [3]University of Newcastle Priority Research Centre for Health Behaviour, Callaghan, New South Wales, Australia; [4]School of Medicine & Public Health, University Drive, Callaghan, New South Wales, Australia; [5]Sydney Local Health District, Royal Prince Alfred Hospital, Camperdown, New South Wales, Australia

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*Correspondence to:* Nicole M. Rankin, PhD. Research in Implementation Science and e-Health (RISe), Faculty of Medicine and Health Sciences, UNIVERSITY OF SYDNEY. Charles Perkins Centre (D17), Johns Hopkins Drive (off Missenden Road), Camperdown, NSW 2006, Australia. Email: nicole.rankin@sydney.edu.au.

**Abstract:** Multidisciplinary care (MDC) is considered best practice in lung cancer care. Health care services have made significant investments in MDC through the establishment of multidisciplinary team (MDT) meetings. This investment is likely to be sustained in future. It is imperative that MDT meetings are efficient, effective, and sufficiently nimble to introduce new innovations to enable best practice. In this article, we consider the 'evidence-practice gaps' in the implementation of lung cancer MDC. These gaps were derived from the recurrent limitations outlined in existing studies and reviews. We address the contributions that implementation science and quality improvement can make to bridge these gaps by increasing translation and improving the uptake of innovations by teams.

**Keywords:** Implementation science; lung cancer; multidisciplinary care (MDC); quality outcomes

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## Introduction

Multidisciplinary care (MDC) is considered best practice in cancer. This model of care is an integral component of coordinated cancer care in many health care settings (1,2) and is considered essential in patient-centred care frameworks (3-7). A multidisciplinary approach to lung cancer care is also highly applicable given the complexities of diagnosis and treatment of the disease.

Published studies use the terms MDC, multidisciplinary teams (MDT) meetings (or tumor boards) interchangeably; this is often without providing definitions or describing distinguishing features (8). In this review article, we focus on MDC specifically for lung cancer and use the following definitions. MDC is defined as focusing on 'an integrated team approach to health care' where the team will use various means of communicating about patient care (9). MDT meetings facilitate MDC and are defined as 'an alliance of medical and health care professionals related to a specific tumor disease whose approach to cancer care is guided by their willingness to agree on evidence-based clinical decisions and to co-ordinate the delivery of care at all stages of the process' (10,11).

In most settings, medical and nursing specialists are the 'core' team who participate in MDT meetings, usually with limited contributions from allied and supportive care health professionals, or primary and community care (12). A quorum of allied health sub-specialities is often required to be attendance at MDT meetings. There are significant variations in how models are applied across health services

and the composition of MDTs (13). It has been noted that MDT meetings were initially established without a strong evidence base (14). However, with several hundred studies now published in the area, there is evidence to demonstrate that a team approach provides benefits to patients, results in improved clinical and process outcomes (15), enables greater cooperation and communication across medical professionals and opportunities for professional development.

Studies about MDT meetings have examined various aspects such as: descriptions of their organisation, functioning, documentation and process outcomes (16-18); positive impact on clinical outcomes (19,20); receipt of treatments in accordance with clinical practice guidelines or quality indicators (21,22); quality assurance and the role of evidence in treatment recommendations (23); information sharing and communication within the team (24-26), including reciprocal team peer review (27,28); communication with primary care providers (29); patient engagement and patient exclusion from meeting processes (30-33); barriers to clinician participation and implementation of treatment plans (34,35); and the influence of policy and costs (36,37). MDC also offers an opportunity for patient recruitment into clinical trials (38,39). A number of systematic and scoping reviews have summarised these aspects (11,15,40-42). Our review does not seek to address the topic of survival, as this can be found in other publications (see article by S Vinod in this journal issue).

MDC and the commitment to MDT meetings is likely to be sustained over time because of the significant investment made by health care services and clinicians, along with the strong support of patients and consumer organisations. Given the substantial 'buy-in' and the inherent opportunity cost of this clinical activity, it is imperative that MDT meetings are efficient, effective, and sufficiently nimble to introduce new innovations to enable best practice.

The aim of this paper is to consider the 'evidence-practice gaps' in the implementation of lung cancer MDC. These gaps were derived from the recurrent limitations outlined in existing studies and reviews, and by conducting a synthesis of the future research directions proposed in systematic reviews, intervention and descriptive studies, as well as commentaries. We address the contributions that quality improvement and implementation science could potentially make to bridge these gaps by increasing translation and improving the uptake of innovations by teams. We conclude with potential directions for future research focused on improving the effectiveness of MDT meetings.

## Methods

We identified a number of existing systematic reviews (11,15,40,41,43,44) and scoping reviews (45) about lung cancer and/or MDC. Due to the recency of the field and the limited scholarship specific to lung-cancer (39), seminal research in other cancer types was included where relevant. We examined each review for nominated evidence-practice gaps. The scope did not extend to reviewing the extensive literature of all systematic reviews across multiple tumor streams nor use systematic literature review methods. A narrative review was deemed the most appropriate approach to collate and summarise the heterogeneous literature base related to both implementation science and MDC in lung cancer. As part of the review process, we conducted an update of the literature identified in the Pillay *et al.*'s review (11), replicating the search terms and extending the search period from April 2015 to December 2018. As a result, an additional 45 articles were identified, of which 17 were specific to lung cancer (45-61). We also reviewed references to identify seminal studies by leading clinician-researchers for further review.

## Results

### *Identified gaps in multidisciplinary lung cancer care*

We identified numerous gaps and have grouped these according to the level of impact: patient, team and health service and system gaps. Across these levels, a number of fundamental research gaps and limitations were recurrent.

### *Research and evaluation gaps*

#### Lack of control condition

Much of the MDC literature to date has focused on describing the processes, structures and outcomes of this model. The identified evidence-practice gap is reiterated as the need to establish a robust evidence base that can demonstrate the benefits of MDC over other standards of care (11,40,62). This presents a significant challenge as MDC has become the standard of cancer care in many developed countries. Consequently, systematic reviews note a proliferation of descriptive research studies and that it is challenging to design randomised study designs to 'unpack' the complexity of MDC to demonstrate positive outcomes

without an available control condition.

**Variation in definitions and outcome measures selected**

Many studies do not include definitions of the model of care being studied, which makes comparisons difficult to conduct. Furthermore, a wide variety of outcome metrics have been used to evaluate MDT meetings such as clinical outcomes (e.g., survival), process measures (e.g., proportion of treatment recommendations followed), and patient satisfaction (11). The field will struggle to compare, evaluate, and replicate research findings without operationalising the model of care and using standardised outcome measures for MDT meetings. A paradigm shift in both the design and reporting of research studies is required, along with greater attention being placed on defining the optimal MDT models needed in practice.

**Single-site studies**

The sample size and heterogeneity of MDT meetings also pose a barrier to conducting robust pragmatic trials. The majority of available evidence is derived from single-site studies that are likely to represent a limited snapshot of institution-specific workflows, resources, and patient groups within a limited catchment area (39). To compare the outcomes of MDT meetings for specific tumor types such as lung cancer, multi-centred studies that conduct extensive scoping of the characteristics of each individual MDT to ascertain baseline differences and similarities are required.

In summary, in order to bridge research and evaluation gaps there is an urgent need to support and fund pragmatic multi-centre trials that enable 'bench to bedside' translational research questions to be answered. Consensus on an operationalised definition for MDC and guidance on appropriate outcome measures for MDT meetings are also needed.

### *Patient-related gaps*

**Patient-centred MDC**

Many studies about MDC highlight the need for greater engagement with patients and caregivers in both practice and research processes (30-33,42,63). This includes practice-based considerations about how MDT meeting recommendations could impact shared decision making and if the process is guided by patient-centred care principles. For example, observational and self-reported data from a study of five MDT meetings (across different tumour groups) found patients' views and psychosocial issues were the least-commonly discussed when compared to case histories, radiological, and histopathological information (64). MDT meeting participants (n=67 clinicians, nurses and MDT coordinators) self-rated the content as being more patient-centred than the ratings from observers; this discrepancy suggests that MDT participants may struggle to critically reflect on the degree to which preferences and psychosocial issues are incorporated in practice (64). Observational data from another study of 15 MDT meetings suggested that even when patient treatment preferences were discussed, this information was seldom accounted for in treatment recommendations (63). Previous research strongly suggests MDT meeting recommendations that do not account for patients' preferences are less likely to be implemented (63). There is limited time allocated for each case and presentation of background knowledge about the patient. In light of this, the degree to which patient-centred care principles such as patient involvement and preferences can be incorporated in MDT meetings warrants further exploration.

**Patient evaluation of MDT meetings**

Along with consensus-driven clinical outcome measures and economic analyses, efforts to bridge implementation gaps should also include patient-related evaluation. This is a significant gap in knowledge of MDT processes with studies suggesting that patients may not be aware of being presented at an MDT meeting. Similarly, they may be unable to recall if their care was informed by team-consensus. For example, a survey of Australian hospitals reported that approximately one in the three cancer patients were not informed their case was presented at an MDT meeting and either verbal or written consent was not documented (12). Of the 27 studies reviewed by Pillay *et al.*, none evaluated how an MDT meeting influenced patient satisfaction or quality of life (11).

The limitations of the various patient-related measurement approaches must be carefully reviewed before incorporation into trial designs. Generic satisfaction tools are prone to ceiling effects, whereby the majority of patients will report high levels of positive experiences with their overall care, resulting in an inability to potentially hone in on specific areas of improvement within the data; furthermore insufficient data are collected to allow comparisons across patient groups (65,66). Many patient-experience questionnaires also do not provide actionable data to improve the quality of care (67). At the most basic level, patients should be asked to comment on the

acceptability of a team-based approach to their care; provided with information about how this model of care could be beneficial (such as increased confidence in treatment plans); whether it raises concerns (such as data privacy); and whether it impacts on their decision-making. The increasing awareness and testing of patient-reported outcome measures (PROMs) in cancer care may provide guidance on how MDTs could be evaluated from a patient-perspective (68).

In summary, subsequent research should explore the impact of MDTs on patient-centred dimensions of care including shared decision-making. This requires patient perspectives to be collected in a systematic and comprehensive manner. Given the emphasis on pragmatic research, well-designed implementation trials could provide an invaluable opportunity to explore patient acceptability of MDC approaches through qualitative and quantitative data.

### *Team-related gaps*

#### Difficulties in reaching consensus

A primary purpose of the MDT meeting is to generate consensus recommendations for each patient's treatment plan. Evidence about MDT effectiveness is based on non-randomised studies and indicates that meetings positively impact on patient outcomes (48,60,69). For example, an Australian study of about 1,000 patients showed that patients presented at MDT were more likely to receive treatments in accordance with clinical practice guidelines, including higher rates of treatment receipt for radiation therapy and chemotherapy (46). However, there is relatively little published about how meetings influence treatment recommendation outcomes (in comparison with any plan initially outlined by the coordinating clinician) and whether the administered treatments are implemented in concordance with the recommendations (42).

#### Variation in selection of patients for team review

A second gap in implementation is concerned with patient selection for meeting presentation. There is significant debate about whether all patients need to be reviewed in the setting of an MDT meeting and how MDC is offered outside the setting of a meeting; examples in other solid tumors include colorectal cancer (36,70,71).

In lung cancer, there are significant variations in international approaches to patient selection. Perhaps the best-known example is the mandatory presentation of all patients in France (72). In other countries, most health systems do not give policy mandates; decisions about patient selection may be on the basis of agreed team protocols, discipline preferences (e.g., curative patients eligible for surgical treatment are first presented), complexity (e.g., Stage IIIA and B patients are reviewed first) (18). Agreement within the team about selection is also needed given the volume of patients; some teams will not be able to meet the demand to review all patients within a weekly meeting. Selection may also include presentation of challenging cases for educational purposes to encourage learning for junior clinicians. As many MDTs were established prior to research-informed guidelines, referral processes may not be outlined in existing term of references (73). Without established referral criteria, processes may differ substantially across and within MDTs as each clinician may differ in how their criteria about how best to select patients for MDT review. These variations present significant challenges in comparing the MDC outcomes, particularly if protocols are not documented, change over time or are not explicitly declared.

Thus, the implementation gap about patient selection requires studies that provide specific evidence about where the greatest benefit from MDT review might be realised; this might include specifying those strategies that enable implementation of a consistent referral pathway while supporting clinicians to manage a balance across patient benefit and educational cases. One strategy may be the use of audit and feedback to evaluate patient referrals and outcomes; however, audit and feedback studies are infrequently published in MDC peer-reviewed literature (74).

#### Educational value of MDT meetings

The benefits of the MDT meeting as an education tool that provides a training ground for junior clinicians has not been thoroughly investigated (75). There is a lack of detailed information about how MDT meetings might be designed to contribute to building skills for junior doctors, nurses or allied health professionals or, indeed, skill maintenance for more experienced clinicians. An international survey of American Society of Clinical Oncology members found an overwhelming percentage (96%) of MDT participants agreed meetings have significant teaching value (76). Few single institution studies present data about proportions of cases presented for educational value (77). This gap indicates an untapped potential for research to better understand the value of MDTs as an integral educational resource in the clinical management of lung cancer.

### Communication within MDT meetings

The conceptualisation of an MDC approach provided by Soukup *et al.* emphasizes that individual clinician skill, team skill, environment, and patient factors all impact on quality of care (42). There is emerging evidence and guidance about how to improve and benchmark the interpersonal qualities of an MDT meeting (42). However, questions remain such as how to address the barriers to MDT implementation or quality improvement (35). These barriers include group dynamics such as decisional conflict, inertia or fatigue within MDT meetings. Strategies to improve communication in the multidisciplinary and hierarchical setting are also needed (42). A range of educational tools to assist in such tasks is summarised by Soukup *et al.* (42) Validated tools include observational rating scales, team evaluation and assessment scales, and quality improvement checklists and scales to facilitate clinical decision-making and the inclusion of patient preferences (42).

The MDT meeting chairperson is likely to play a large role in bridging communication gaps. The chairperson facilitates meeting discussion, often manages conflict, and provides clinical leadership in this time-constrained setting (78). This leadership may also include eliciting the views of meeting participants who may be hesitant to voice alternative opinions and a capable chairperson may be able to identify and prevent 'group think' (42). Group think occurs when a team seldom disagrees and individuals chose not to voice opinions counter to the collective opinion; it can be an indicator of poor team climate. More effective moderation of discussions has been identified as one of the most important strategies to improve meeting efficiency (76). Clinical leadership and change champions are acknowledged as an effective implementation strategy for creating change in health services (79). However, guidance is sparse on how to select for or provide training on these non-technical skills in the lung cancer setting (80).

## *Health service and system gaps*

Gaps in how MDC is implemented, measured and reported at health service and system levels are evident in the lung cancer literature. In this section, we review the literature about quality indicators and cost. We conclude with innovations that could help facilitate improvements into routine care.

### Quality outcomes

Literature about the measurement of quality outcomes in cancer services has evolved significantly in response to growing pressures to meet health care demands, provide quality care and demonstrate that interventions and models of care are cost effective. (81). The development and use of quality indicators (including performance and clinical indicators) in lung cancer has steadily increased in the past two decades. Quality indicators are defined as 'measurable elements of practice performance for which there is evidence or consensus that they can be used to assess the quality of care' (82). A significant investment to establish indicators in lung cancer management was undertaken in the Netherlands beginning in the mid-2000s (83), and numerous countries have also pursued this work to raise quality standards (84-86). For many MDT meeting participants, clinical outcomes will be of particular importance. While international efforts to collect these data are laudable, there is a notable gap in reporting about how these indicators drive an agenda for change. This lack of reporting may be attributed to the information source—for example, indicator data may be published at conferences or in the grey literature and not readily accessible.

### Lack of costing data

The cost of MDT meetings presents another evidence gap in implementation. Internationally, MDT meetings operate across a variety of health care systems that vary in universal health care coverage and fee-for-service structures. Across these structures, there is limited information on the cost-value of MDT meetings (or MDC more generally). For instance, MDT meetings may represent better value through efficient use of clinicians' time or reduction in unnecessary tests or treatments for patients. However, these meetings also incur substantial salary costs for attendance and a significant amount of time spent in preparation and coordination (87). We were unable to locate any systematic reviews specific to lung cancer care that analysed the cost benefits or cost-savings of implementing MDC or team meetings. We therefore summarise relevant observational or intervention studies.

In 2010, Bjegovich-Weidman *et al.*, reported on the development of a MDC in thoracic oncology, including a 9% increase in revenue over a 2-year period that was attributed to retention of patients within the local health system (88). However, this study has significant limitations in that it does not report patient outcomes data. In 2015, Freeman *et al.* reported a significant difference ($P<0.0001$) in health care costs for patients treated within the MDC setting compared to non-MDC across 27 cancer centres

in the United States (39). The greater costs in the non-MDC group were attributed to increased use of imaging investigations. More recently, a 2019 study of 297 patients with non-small cell lung cancer reviewed in a single-day clinic in one institution found a significant reduction in cost (23%) compared to patients seen outside the clinic setting (89). Little information has been published about gaining patient consent and billing practices.

These studies about cost highlight a gap in implementation regarding the benefit of potential reductions in repeat testing, an issue has not been thoroughly investigated or reported in the literature. As cost data are typically generated from administrative datasets, there may be limited insights into MDC cost because of calculation methods. Greater research efforts in conducting economic analyses of MDC could provide reassurance for service managers and policy makers that this model of care contributes better use of funds across health systems.

### *Examples of innovations focused on health service gaps*

#### The role of national lung cancer registries in reporting outcomes

One mechanism that holds significant promise for demonstrating the benefits of MDC is lung cancer registries, which are implemented at the national or jurisdictional level as part of a professional quality system (90-92). While registries are not a new innovation, the data generated is shifting from retrospective documentation of variations in outcomes to more active, contemporary reporting to enable clinical audits of practice (59). This use of outcomes data can focus more precisely on reporting of clinically-relevant items to improve patient outcomes (93). We highlight the example of the Dutch national lung cancer registry.

In 2018, Beck and colleagues reported on the Dutch Lung Cancer Audit, which builds on two decades of development of clinical practice guidelines, quality indicators and collecting clinical data across surgical, radiation and medical oncology disciplines (93,94). Data are reported for treatment and quality outcomes, including MDC outcomes. For example, this includes the proportion of patients with NSCLC discussed at an MDT meeting either prior to commencing radiation therapy treatment (95%) or post-operatively (97%). The latter was a 15% increase from 82% in 2012. However, the use of registry data is not without problems, with the authors noting significant barriers in reporting MDT outcomes due to data privacy and sharing of information.

#### Innovation in MDT data collection

The opportunity to introduce innovative technologies in MDC are emerging as part of broader initiatives such as Learning Healthcare Systems (95), which use operational and clinical information to drive health system change. For example, the use of dashboards for reviewing data has been trialled as one component of a transformational approach to the lung cancer Diagnostic Assessment Program in Ottawa (95). Digital health innovations as include development of a mobile app for scheduling cases in MDT meetings (96) have also been recently reported. As research into MDC matures, greater emphasis will likely be placed on developing innovations and interventions that will improve outcomes by using research methodologies from implementation science and quality improvement.

### *Implementation science and bridging the gap in MDT research and practice*

#### What is implementation science and how does it differ from quality improvement?

Implementation science is an emergent discipline within the broader spectrum of translational research (97). It is defined as 'the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice to improve the quality and effectiveness of health services. It includes the study of influences on healthcare professional and organisational behaviour' (98). Definitions and glossaries of terms help non-experts to navigate the distinctions between dissemination and implementation research and similar terms that are used across different settings (99-101). Research questions are typically focused on the 'how' 'why' and 'who' of implementation, rather than the creation and testing of new interventions (102).

Implementation research requires a strong evidence base that demonstrates the efficacy of an intervention, which warrants further scientific investigation and application in real-world settings (103). A goal of implementation science is to create generalizable knowledge that can be replicated across different settings and contexts (101,102), where context is broadly defined as 'the environment or setting in which the proposed change is to be implemented' (104).

Implementation strategies are the set of techniques used to promote or enhance the adoption and integration of an intervention into routine practice (105). Strategies are often grouped to address specific identified barriers to implementation success (101). There are several

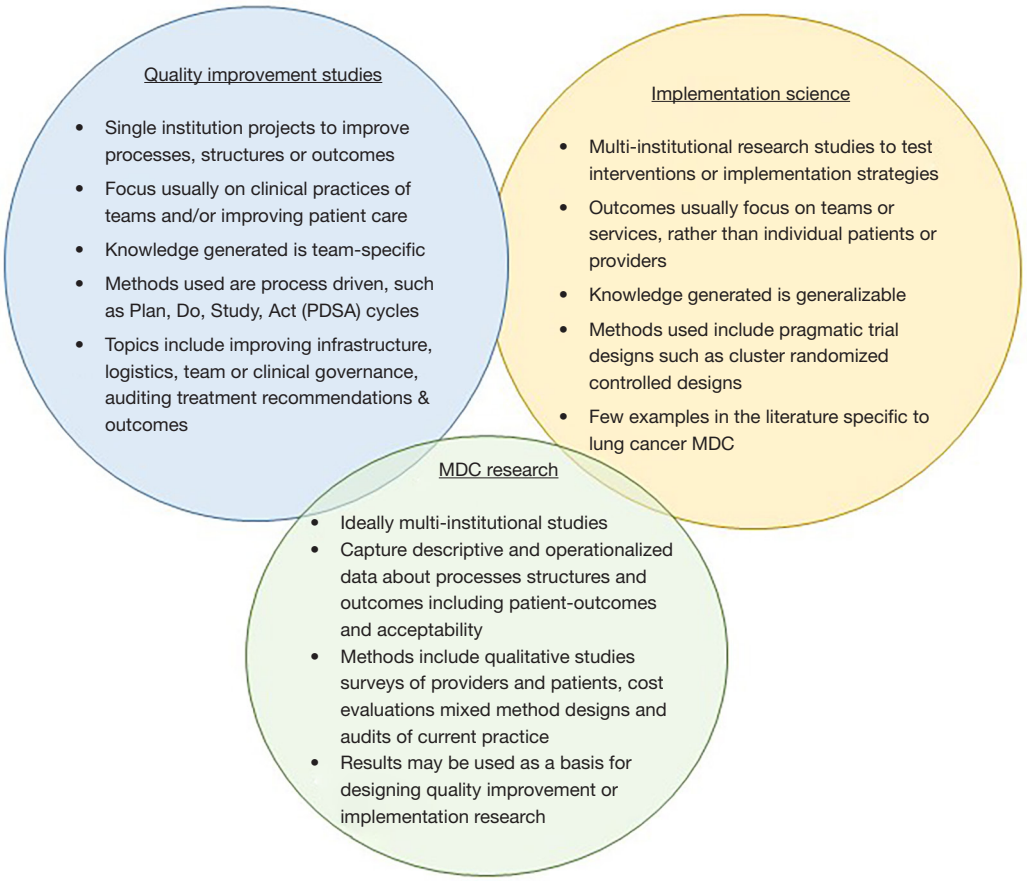


**Figure 1** The intersection of implementation science, quality improvement and foundational research in lung cancer MDC. MDC, multidisciplinary care.

taxonomies that provide descriptive categories including educational, professional, financial, regulatory and organisational implementation (106-108). Examples of implementation strategies that target behaviour change in health professionals include audit and feedback, educational outreach, education meetings, printed educational materials, local opinion leaders, computerised reminders and tailored implementation strategies (109). These implementation strategies are all relevant for consideration in designing MDC research projects.

In contrast, quality improvement (QI) initiatives focus on making immediate improvements in health system performance and/or managing change in a single unit or hospital setting (102). QI methodologies were historically informed by process methodologies that originate in manufacturing; these methods use repeated cycles of change to address a specific problem. Examples include the Plan-Do-Study-Act (PDSA) cycle, which provides "a structure for iterative testing of changes to improve quality of systems" (110). Similarly, 'Lean' processing originated in Japan from Toyota and focuses on eliminating wasteful activities (e.g., waiting times, duplication of tests) to improve outcomes (111). While QI initiatives are highly relevant to MDC practice, these approaches may offer limited insights about how to successfully implement an innovation across multiple teams, as many studies appear to only be effective in specific settings (110,112). *Figure 1* shows the intersection across implementation science, QI and foundational research in lung cancer MDC.

## Implementation science—what is the relevance for MDT meetings and MDC?

Implementation science is increasingly being recognised as

one approach to building the evidence base in lung cancer MDC (13,113). Implementation research requires effective collaboration across multiple disciplines of clinicians and researchers with expertise in health services research, health economics or behavioural science. Clinician-researchers interested in exploring questions about lung cancer MDC may have limited access or contact with these diverse disciplines to optimise the design and conduct of implementation research studies (114).

**What is required to close the implementation gaps?**

Future implementation research should focus on testing strategies across multiple MDTs and/or multiple hospitals or health systems to simultaneously generate evidence about MDT effectiveness and implementation outcomes. We contend that the focus should be on behavior change, with a foundation in relevant theories and collaboration that engages key stakeholders such as MDT members, intervention developers, patients and health service managers. While there is limited evidence that collaboration results in sustainable change in health services, engagement with stakeholders as being increasingly recognised as part of quality research methodology (115). We draw on our team's example of adapting a local generic template to improve communication between two MDTs and primary care physicians about treatment recommendations made within the meeting (54). By selecting and testing tailored implementation strategies through collaboration with MDT members, consumers and implementation scientists, we were able to successfully introduce and sustain the template as part of standard care.

**Strengths and limitations of this review**

The strengths of this review include that we consulted a broad range of literature sources, including updating search terms for an existing systematic review to identify new studies specifically about lung cancer MDC. We introduce implementation science and quality improvement concepts and highlight how the research methods from these disciplines could assist in creating knowledge about the most effective strategies to drive practice change in lung cancer MDC. The limitations include that we did not conduct a systematic review exclusively focused on evidence gaps in implementation. Instead, we have focused on those gaps that require particular attention and indicate how multi-center studies could address these gaps.

## Conclusions

In this review, we have synthesized information from numerous studies and reviews to provide a comprehensive summary of the 'evidence-practice gaps' in the implementation of lung cancer MDC. As MDC is an essential component of quality care, we consider that there are significant opportunities to improve outcomes for people diagnosed with lung cancer through the conduct of high-quality implementation research.

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## Footnote

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

*Ethical Statement:* The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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