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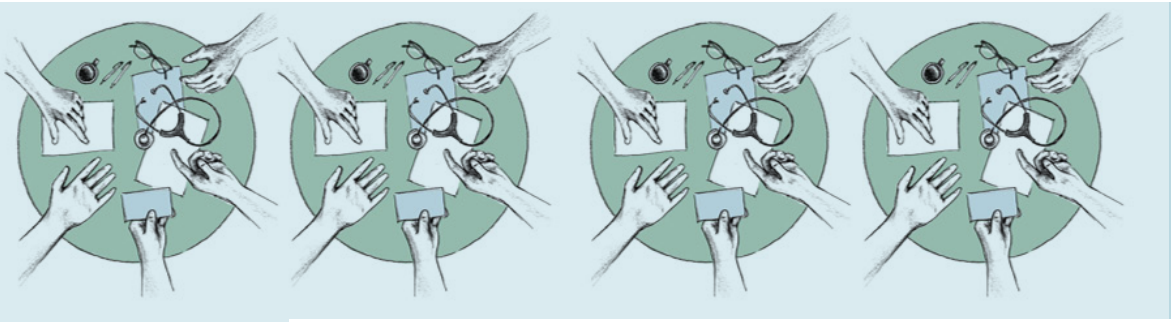

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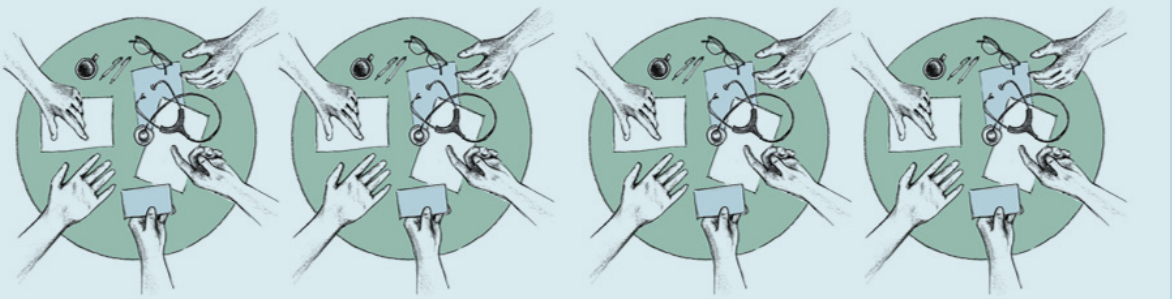

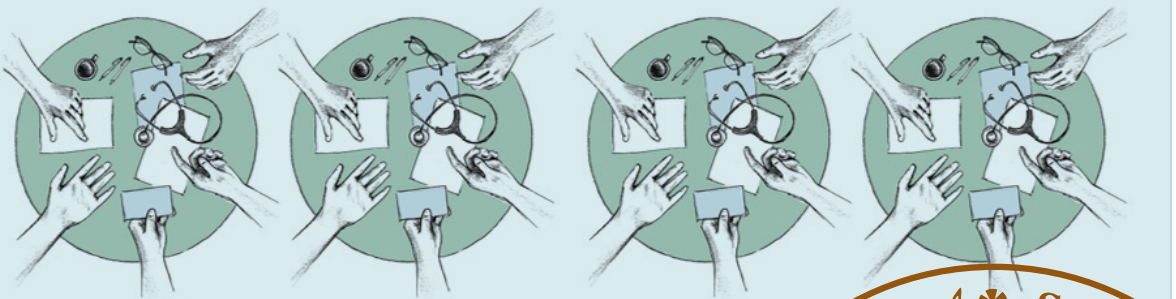

Multidisciplinary Team Meetings in Cancer Care

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Case Discussions, Patient Selection, Leadership

Jessica Wihl, MD

LUND
UNIVERSITY

DOCTORAL DISSERTATION

By due permission of the Faculty of Medicine, Lund University, Sweden.

To be defended in the Lecture Hall of the Radiotherapy Building, 3rd floor, Department of Oncology, Skåne University Hospital, Lund

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Faculty opponent
Ass Professor Pernilla Dahm-Kähler

Department of Obstetrics and Gynaecology, Institute of Clinical Science, Sahlgrenska Academy, University of Gothenburg

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Abstract: Multidisciplinary team meetings (MDTMs) provide treatment recommendations based on collective decision-making. Although multidisciplinary team (MDT) work is highly valued among participants, team performance varies and members experience challenges related to matter such as case selection, decision-making, team function, and resource constraints. This thesis work responds to research gaps in MDTM performance in Swedish cancer care. The aims were to map and evaluate available information and team members' contributions to case discussions, assess feasibility of a patient selection mechanism, and study leadership perspectives with the long-term ambition of improving MDTMs in cancer care.

The main data collection method was prospective, non-participant observational assessments in seven MDTs using standardized instruments. Data were collected from a total of 42 MDTMs for penile cancer, vulvar cancer, anal cancer, brain tumors, sarcoma, and hepatobiliary cancer. The instruments used included the MDT-Meeting Observational Tool (MOT) in study I, the MDT-Metric for the Observation of Decision-making (MODe) in studies I and II, A Tumor Leadership Assessment inStrument (ATLAS) in study III and the Measure of case Discussion Complexity (MeDiC) in study V. In study I we also collected participants' views based on an electronic survey, and in study IV free-text quotations collected during MDTMs were used. In study V, patient data were used for the case complexity instrument in prostate cancer care.

Information from MDT participants revealed positive views on team function and development of participants' competence and skills, whereas feedback related to meeting technology, information given to patients about the recommendations, and evaluation of the MDTMs was more negative (study I). Observational assessment showed that team members' contributions to case information predominantly included information on case history, radiology, and histopathology, whereas patient-related aspects were less represented (studies I and II). MDTM discussions were primarily influenced by the chair, surgeons, and oncologists, whereas contributions from nurses were limited (studies I and II). Leadership skills were shown to positively influence meeting quality (study II). Evaluation of MDTM leadership showed high scores for time management, case prioritization and provision of treatment plans, and lower scores for facilitation of case discussions, encouragement of team members' contributions and keeping the meeting focused (study III). Analysis of medical and non-medical information showed that information on comorbidity was provided in 48% of the cases, whereas patient preferences were rarely (4%) referred to, which suggests that case reporting standards could be relevant to develop to ensure structured and complete case information at MDTMs (study IV). The MeDiC case selection aid was found to be feasible with correlation to clinical case selection and our findings suggest that the application of MeDiC may provide added value in the clinical MDTM case selection process (study V).

In conclusion, we demonstrate disparities in contributions from MDT members to case presentations and case discussions during MDTMs, point to a need to define key case presentation elements, suggest that case selection structures may support clinical prioritization of patients for MDTMs, identify strengths and weaknesses related to leadership skills, and reveal a correlation between leadership skills and MDTM quality.

Key words multidisciplinary team meeting**,** information sharing**,** decision-making, treatment recommendation, case complexity

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Multidisciplinary team meetings

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When you talk, you are only repeating what you already know, but if you listen, you may learn something new.

Dalai Lama

Table of Contents

List of papers

This thesis is based on the following original publications, which will be referred to in the text by their Roman numerals:

I. Rosell L, Wihl J, Hagberg O, Ohlsson B, Nilbert M. Function, information, and contributions: An evaluation of national multidisciplinary team meetings for rare cancers. Rare Tumors. 2019;11:1-9.

II. Wihl J, Rosell L, Frederiksen K, Kinhult S, Lindell G, Nilbert M. Contributions to multidisciplinary team meetings in cancer care: predictors of complete case information and comprehensive case discussions. Journal of Multidisciplinary Healthcare. 2021;14:2445-2452.

III. Wihl J, Rosell L, Bendahl P O, De Mattos CBR, Kinhult S, Lindell G, Vult von Steyern F, Nilbert M. Leadership perspectives in multidisciplinary team meetings; observational assessment based on the ATLAS instrument in cancer care. Cancer Treatment and Research Communications. 2020;25:100231.

IV. Wihl J, Rosell L, Carlsson T, Kinhult S, Lindell G, Nilbert M. Medical and non-medical information during multidisciplinary team meetings in cancer care. Current Oncology. 2021;28:1008-1016.

V. Wihl J, Falini V, Borg S, Ståhl O, Jiborn T, Ohlsson B, Nilbert M. Measure of case complexity to guide selection of prostate cancer patients for multidisciplinary team meetings. 2022, submitted.

Related publications not included in this thesis:

Rosell L, Wihl J, Nilbert M, Malmström M. Health professionals' view on key enabling factors and barriers of national multidisciplinary team meetings in cancer care: a qualitative study. Journal of Multidisciplinary Healthcare 2020;14:179-186

Alexandersson N, Rosell L, Wihl J, Ohlsson B, Steen Carlsson K, Nilbert M. Determinants of variable resource use for multidisciplinary team meetings in cancer care. Acta Oncol 2018;57:675-680.

Thesis at a glance

Study	Research focus	Materials	Methods	Instruments	Key findings
I	National MDT functionality and team members' contributions	National, video-based MDTMs for penile cancer, vulvar cancer, and anal cancer N= 9 MDTMs and 67 case discussions	Non-participant observational assessment Questionnaire	MDT-Meeting Observational tool (MOT) MDT-Metric for the Observation of Decision-making (MODe)	National MDTMs are feasible. Participants rated MDTMs: high for development of individual competence and team competence low for meeting technology, principles for communicating treatment recommendations, and guidelines for evaluating MDTMs. Case discussions cover medical perspectives well, patient-centered aspects receive less attention. Observational assessment resulted in high scores for case histories, leadership, and teamwork.
II	Contributions to case information and case discussions Completeness of information during regional MDTMs	Regional MDTMs for brain tumors, soft tissue sarcoma, and hepatobiliary cancer N=32 MDTMs and 349 case discussions	Non-participant observational assessment	MDT-Metric for the Observation of Decision-making (MODe) A Tumor Leadership Assessment inStrument (ATLAS)	Team members' contributions vary. Patient history and radiology are predominant information sources. Limited provision of patient-related information. Leadership skills seem to influence quality of case discussions.
III	Leadership aspects	Regional MDTMs for brain tumors, soft tissue sarcoma, and hepatobiliary cancer N=33 MDTMs	Non-participant observational assessment	A Tumor Leadership Assessment inStrument (ATLAS)	MDT leadership is multifaceted, and the instrument captures various aspects. Strengths and weaknesses are identified. Time management and case prioritization are well-functioning. Facilitation of discussions and contributions from team members score lower.
IV	Reference to patient-related information	Regional MDTMs for brain tumors, soft tissue sarcoma, and hepatobiliary cancer N=30 MDTMs and 336 case discussions	Non-participant observational assessment Open notes and content analysis	---	Patient-related information is provided in a minority of the case discussions. Non-medical factors are rarely and randomly referred to. Patient preferences are rarely reported. Definition of data elements and development of consensus reporting standards could be relevant.
V	Possibilities for structured case selection for MDTM	Regional MDTMs for prostate cancer N=364 cases	Retrospective review of medical records with collection of key clinical and instrument-related data	Measure of case Discussion Complexity (MeDiC)	MeDiC is easy and feasible to apply in a clinical setting. The clinical materials reveal patient selection for MDTMs. MeDiC scores from 8 and up show strong correlation with clinic case selection for MDTM.

Abbreviations

ATLAS	A Tumour Leadership Assessment inStrument
CCC	Comprehensive Cancer Centre
CI	Confidence Interval
CNS	Central Nervous System
CPP	Cancer Patient Pathway
CT	Computed Tomography
DC	Discussion Checklist
HIPEC	Hyperthermic Intraperitoneal Chemotherapy
HPB	Hepatobilliary
ICC	Intraclass Correlation Coefficient
ICP	Integrated Care Pathway
IOA	Inter-Observer Agreement
IOR	Inter-Observer Reliability
IOV	Inter-Observer Variability
IRR	Inter-Rater Reliability
MATE	Multidisciplinary meeting Assistant and Treatment sElector
MCC	Multidisciplinary Cancer Conference
MDT	Multidisciplinary Team
MDT-QuIC	MDT-Quality Improvement Checklist
MDM	Multidisciplinary Meetings
MDTM	Multidisciplinary Team Meeting
MeDiC	Measure of case Discussion Complexity
MODe	Metric for the Observation of Decision-making
MOT	Meeting Observational Tool
MRI	Magnetic Resonance Imaging
MTB	Multidisciplinary Tumor Board
OECI	Organization for European Cancer Institutes
OR	Odds Ratio
QAT	Quality Assessment Tools
RCC	Regional Cancer Centre
SOP	Standard Operating Procedure
UK	United Kingdom

Abstract

Multidisciplinary team meetings (MDTMs) provide treatment recommendations based on collective decision-making. Although multidisciplinary team (MDT) work is highly valued among participants, team performance varies and members experience challenges related to matter such as case selection, decision-making, team function, and resource constraints. This thesis work responds to research gaps in MDTM performance in Swedish cancer care. The aims were to map and evaluate available information and team members' contributions to case discussions, assess feasibility of a patient selection mechanism, and study leadership perspectives with the long-term ambition of improving MDTMs in cancer care.

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In conclusion, we demonstrate disparities in contributions from MDT members to case presentations and case discussions during MDTMs, point to a need to define key case presentation elements, suggest that case selection structures may support clinical prioritization of patients for MDTMs, identify strengths and weaknesses related to leadership skills, and reveal a correlation between leadership skills and MDTM quality.

Background

Introduction to the thesis

Multidisciplinary decision-making is complex. Current principles for diagnosis, treatment, and follow-up of cancer evolve rapidly and require multidisciplinary and multiprofessional collaboration (Aizer et al., 2013, Kočo et al., 2021, Brown et al., 2022). With a team of skilled experts, numerous options should be weighed and discussed to provide the best possible treatment recommendations to the patient. Results from diverse diagnostic investigations should be reviewed, and data from different sources should be integrated in an open and efficient discussion within a multiprofessional and multidisciplinary environment. The potential for insufficient coordination and suboptimal communication in these complex processes is considerable.

As a clinical oncologist in the gynaecological oncology team, I have participated for several years in Multidisciplinary Team Meetings (MDTMs) in this diagnostic area. During recent years, my interest and curiosity about multidisciplinary collaboration, decision-making, and team interaction have deepened. As a medical advisor at the Regional Cancer Centre (RCC) South, I work with strategic development and evaluation of health-care processes in which the multidisciplinary team (MDT) is a central point of care. In the present research work I have linked these two areas of interest to develop research-based knowledge from cancer-related MDTMs, based on observational assessment and participants' input in various health-care settings and diagnostic areas.

The studies in this thesis focus on the different components and characteristics of MDTMs: teamwork, case presentations, contributions to case discussions, leadership aspects, team members' views on the MDTM, and possibilities to select patients that will benefit most from MDTMs. Hereby, I aim to contribute new information of clinical relevance for daily care as well as for process-based reflection and development within one of the main junctions of cancer care – the MDTM.

Swedish cancer care

In Sweden, with a population of 10,4 million, about 62 500 cancers are diagnosed annually. The population is aging, with a mean lifetime expectancy of 81 years for men and 85 years for women. Cancer incidence and cancer prevalence have increased during the last decades and will continue to increase. The seven most common cancer diagnoses - breast cancer, prostate cancer, skin cancer, colorectal cancer, lung cancer, melanoma of the skin and urinary bladder cancer - account for the majority (65%) of cases. Mortality from cancer is decreasing as an effect of early diagnostics, refined treatment options, and better follow-up. In Sweden, 22 500 persons annually die from cancer (Socialstyrelsen, cancerregistret).

Cancer care is largely provided by regional hospitals and university hospitals with traditional department structures, compromising general surgery, gynaecology, urology, oto-laryngology, orthopaedics, dermatology, haematology, oncology, etc. Rehabilitation and palliative care are provided at basic levels in primary care organized by the health-care regions or in the home-based care under the responsibility of the municipalities, whereas specialized rehabilitation and specialized palliative care are available through designated units within the hospital system. Swedish cancer care has a long tradition of internationally competitive results with favourable 5-year and 10-year survival rates (Global Cancer Observatory). The system has, however, suffered from long lead-times and suboptimal integration between disciplines. Patients report long and stressful waiting times, uncoordinated pathways, and uncertainties related to responsibilities between health professionals and point of contact (Robertson et al., 2017).

Sweden does not have a formal national cancer plan or a cancer control plan, but in 2009, a Swedish national cancer strategy was launched (Reports. A National Cancer Strategy for the Future, 2009). A major action herein was the establishment of six RCCs with responsibilities that span from cancer prevention and cancer registration to lead-times, coordinated care, rehabilitation, palliative care, and research. The RCCs support the development of evidence-based principles for diagnosis and treatment including cancer patient pathways (CPPs, also referred to as standardized care pathways, figure 1), national treatment programmes, and principles for level structuring, and manage clinical quality registries and follow up on quality data. The RCCs also support process-based improvement, actions, and initiatives to strengthen the patient perspective. Developments in these areas directly as well as indirectly influence the organization and planning in MDTs and the performance of MDTMs.

For the vast majority of cancer diagnoses, national Swedish treatment guidelines have been established by professional groups with support from the RCCs. These

treatment guidelines define principles for diagnosis, treatment, and follow-up, including MDTM participation.

In 2015, the first official CPPs were introduced in Swedish cancer care (figure 1). The CPPs are established by health professionals under the coordination of the RCC. Sweden has 30 CPPs that define symptoms for rapid referral and describe the diagnostic path for each diagnosis. The CPPs aim to decrease waiting times and secure efficient and standardized initial diagnostic investigations for patients with suspected cancer across the six Swedish health-care regions. The MDTM is a central point of care for coordinated decision-making in the CPP.

In recent years, several Swedish university hospitals have established comprehensive cancer centres (CCCs) and undergone external auditing through the Organization for European Cancer Institutes (OECI). The CCCs are intended to provide comprehensive cancer care under a governance model that bridges department structures and supports a seamless process from the patient's perspective. In this quality review, the establishment of CPPs and MDTMs is a central theme, with a view to provide services defined by standardized operating procedures and implementing mechanisms for internal review, follow-up, and quality improvement.

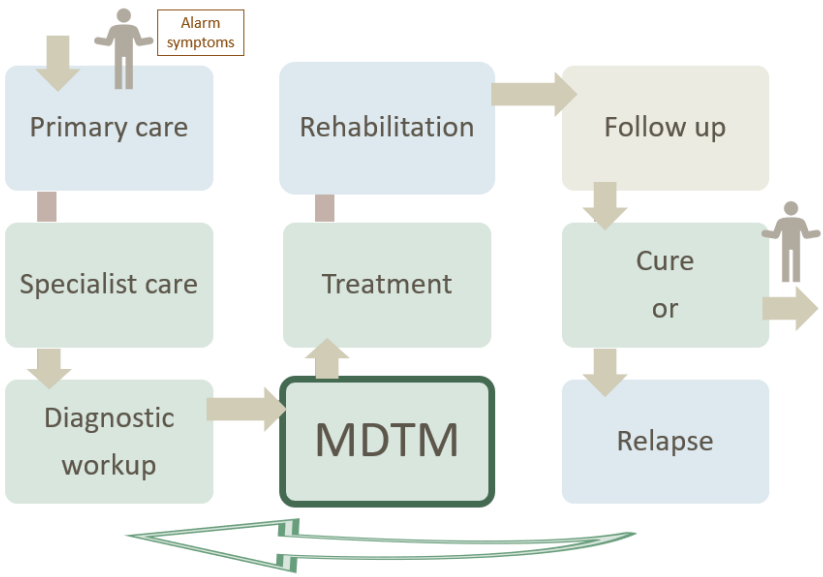


Figure 1. Overview of the cancer patient pathway, CPP.

Aims of MDTMs

The United Kingdom (UK) Department of Health defines an MDT as a group of people of different health-care disciplines that meet at a given time to discuss a given patient and who are each able to contribute independently to the diagnostic and treatment decisions about the patient (Department of Health, UK 2004).

In cancer care, patient management through case discussions at MDTMs, also referred to as Tumor Boards or Multidisciplinary Indication Committees, has developed into standard care to formulate treatment recommendations based on evidence, according to clinical guidelines, or based on best expert opinion. The MDTM infrastructure serves as a platform for the coordination of cancer care. It should ensure relevant investigations and high-quality treatment planning and should provide individualized and evidence-based treatment recommendations with minimal variation between caregivers. The MDTM gathers knowledge and experience through multidisciplinary input from various professions and should provide an individualized treatment recommendation (Lamb et al., 2011A, Soukup et al., 2018, Atwell et al., 2019, Fehervari et al., 2021). The treatment recommendations should align with national guidelines and treatment standards, but when evidence is scarce, the recommendations are based on best expert experience and opinion (De Ieso et al., 2013, Specchia et al., 2020). In Sweden there is no best practice document or generally agreed principles for MDTM referral, organized team training, leadership principles, or evaluation, which implies that the MDTs have individually and gradually evolved standards and structures suitable for their services based on local traditions, available resources, and perceived needs.

Historical background and international outlook

In Scandinavia, MDTs were developed within specialized areas of cancer care (e.g., head and neck cancer, brain tumors, sarcoma) in the 1980s by clinicians who aimed to gather experience and competence for better patient outcomes. At that time, participants typically included a few physicians with representation from radiology, surgery, and oncology. Gradually, MDTMs were established in other diagnostic areas, and MDTM discussions were defined as a quality parameter in national quality registries in the early 2000s. Between 2009 and 2019, MDTMs were incorporated into national treatment guidelines and CPPs (Kunskapsbanken www. cancercentrum.se).

In Denmark, the Danish Health Authority launched the first national cancer plan in 2000. Fast track CPPs, or “pakkeforlopp”, were introduced in 2009 to address the long waiting times and suboptimal outcomes with lower cancer-specific survival

in Denmark compared to the other Nordic countries. MDTMs soon became mandatory in most cancer diagnoses, and weekly MDTMs were broadly implemented (Bjørn et al., 2017, Boisen and Balslev, 2016, Mæhle and Smeland, 2021). The MDTM is an integrated part of the CPP, although structures and implementation vary depending on the diagnostic area and the clinical context (Boisen and Balslev, 2016).

In Norway, the first national report on cancer care and plans for improvements came in 1996 and in the early 2000s more resources were allocated to cancer care with investments in such as technology, screening, centralization of surgery, and education. CPPs were introduced in 2014, and MDTMs have broadly been implemented (Mæhle and Smeland, 2021).

In the UK, inadequate cancer care was described in the Caman-Hine report in 1995 (Calman-Hine, 1995). The National Health Service Cancer Plan from 2000, stipulated broad implementation of MDTMs and led to implementation and development of services in the following years. MDTM services have been structured and broadly implemented, guidelines for MDTM performance are in place, services are reviewed and evaluated and research on MDT decision-making and MDTM services has been developed (Griffith and Turner, 2004, Winters et al., 2021).

Many EU countries have seen MDTM developments similar to those described here, with gradual expansion and services closely linked to initiatives such as national cancer plans and service provision by CCCs (Holden et al., 2020, Fehervari et al., 2021)

In the United States, the concept of integrated care pathways (ICPs) was developed in the 1980s in various diagnostic areas and later served as a model for development of CPPs (Mæhle and Smeland, 2021). MDTMs for colorectal cancer were introduced in 2011, for example, and were made mandatory in Centres of Excellence in 2013 (Holden et al., 2020, Fehervari et al., 2021).

In Canada, the first MDTMs started in 2007 within a research project. It is not mandatory to discuss cancer patients at MDTMs in the Canadian health-care system, and case selection is physician-driven rather than system-driven, with consequent variability in patient referral patterns (Wright et al., 2007). Guidelines from the Canadian Partnership against Cancer suggest that complex cases should be presented at MDTMs (Corter et al., 2019).

In Australia, the government has financially rebated clinicians engaged in MDTMs since 2006, and MDT structures are described in the regional cancer plans (Holden et al., 2020). In Japan, the Ministry of Health, Labour and Welfare enacted a Cancer Control Act that advocates the use of MDTMs in 2008 (Ichikawa et al., 2022). In China, the multidisciplinary approach and MDTMs have been implemented in clinical routines (Yuan et al., 2018). From a survey conducted in

the Arabic countries in 2010, 60% of the respondents reported the use of MDTMs for exchanging opinions on management of cancer patients (El Saghir et al., 2011). In a number of other countries, MDT usage has increased lately with examples from Asia, South America, and Africa, but there is still a gap between recommendations of MDTMs and their implementation, especially in developing countries (El Saghir et al., 2014, Nazim et al., 2018, Alsuhaibani et al., 2018).

From diagnosis-specific meetings to molecular tumor boards

MTDMs are regularly scheduled, mostly weekly or sometime twice a week or every other week, depending on the health-care system and the diagnostic context (Fleissig et al., 2006, Pillay et al., 2016). MDTMs are predominantly diagnosis-specific, and most cancer-treating hospitals offer MDTs for common cancer types such as breast cancer, lung cancer, colorectal cancer, and urological cancer.

In some diagnostic areas, tumor types within the same anatomic area are discussed in a joint MDT, for example, urological cancer (prostate cancer, renal cancer, urothelial cancer, penile cancer) and gynaecological cancer (ovarian cancer, endometrial cancer, cervical/vaginal cancer, and vulvar cancer). However, these broad diagnostic groups are increasingly divided into specialized MDTs motivated by tumor-specific treatment principles, subspecialization among staff, and the need to consider potential clinical trial participation for each diagnosis. Other MDTMs focus on specialized procedures, such as treatment of liver metastases or lung metastases from various cancer types with participation from liver surgeons, thoracic surgeons etc. in addition to the responsible oncologist, pulmonologist, etc.

In some diagnoses, for example lung cancer, clinical questions and treatment plans may vary from surgery to radiotherapy, chemotherapy, targeted drugs, and immunotherapy depending on tumor stage and patient performance. To increase meeting effectiveness in such clinical settings, some MDTs have subdivided their meetings according to stage and clinical question. Early-stage patients should be considered for surgery with the presence of thoracic surgeons, whereas late-stage patients should be discussed related to best medical option with expert input from molecular experts, pulmonologists, oncologists, and palliative care experts. In diagnoses where surgery is a mainstay of the treatment, the MDTM typically divides cases that are preoperative for discussions on surgical options and postoperative to decide on potential adjuvant therapy and a follow-up programme.

In Swedish health-care, centralization of treatment for rare cancers has been linked to development and implementation of national virtual MDTMs to ensure equal access to highly specialized care, align treatment recommendations, and strengthen

professional networks and support research. National MDTMs have been established for vulvar cancer, anal cancer, penile cancer, soft tissue sarcoma, advanced oesophageal cancer, advanced pancreatic cancer and cytoreductive surgery/hyperthermic intraperitoneal chemotherapy (HIPEC) and hilar cholangiocarcinoma, for which national experts gather for weekly, virtual, MDTMs with participants from all expert centres.

MDTM-based decision-making is also applied for paediatric cancers with development of dedicated paediatric MDTs for more common malignancies, whereas paediatric cases in rare diseases such as sarcoma are included in the adult MDTMs with participation from paediatric oncologists. In paediatric case discussions, participation by rehabilitation experts may be relevant and access to national as well as international MDTMs has also been established to ensure availability of relevant expertise (Hjorth et al., 2015, Nooteboom et al., 2022).

MDTMs for fragile cancer patients have been established in some centres to consider best treatment options in relation to specific circumstances and comorbidities. Increased frailty and comorbidity can limit treatment options, and structures to determine risk of toxicity (e.g., based on biological rather than chronological age) is relevant though not broadly implemented (Bridges et al., 2015, Lane et al., 2019, Holden et al., 2020). Participants in these MDTMs include anaesthesiologists and geriatricians. Since the majority of malignancies are diagnosed in patients over the age of 65, such meetings may need to be developed as a supplement to the regular diagnosis-specific MDTMs (Bridges et al., 2017, Holden et al., 2020).

Molecular tumor boards have been introduced in recent years to provide expert advice on the functional implications and clinical relevance of various genetic alterations, most commonly related to precision medicine approaches. The molecular tumor boards typically include expertise in molecular pathology and genetics as well as oncology and surgery to support interpretation of the genetic alterations identified linked to clinical relevance as potentially actionable variants for targeted drugs and/or inclusion in precision medicine trials (El Saghir et al., 2014, Mano et al., 2022)

Benefits and impact of MDTMs

Studies that have assessed the clinical value of MDTMs have reached partly contradictory conclusions, which may depend on diagnosis, health-care setting, patient-related characteristics, and tumor-related factors. Reported patient benefits range from refined diagnostics and more precise staging to increased patient safety, better coordination of care, adherence to clinical guidelines, and improved survival (Patkar et al., 2011, Blay et al., 2017, Brandão et al., 2021).

Refined diagnostics and altered treatment plans

Patients discussed at MDTMs have been shown to have more accurate diagnostic workup with complete investigations and thorough review of the results (Acher et al., 2005, Pillay et al., 2016, Kočo et al., 2021). Treatment recommendations from MDTMs have been found to alter the diagnosis and/or treatment plan in up to half of the cases discussed, with particular relevance in complex cases, albeit with significant variation between tumor areas (El Saghir et al., 2014, Raine et al., 2014, Munro et al., 2015, Pillay et al., 2016, Basta et al., 2017, Jung et al., 2018). Overall, changes in diagnosis or treatment plans are more common in patients with advanced and metastatic disease, where guidelines cannot always guide treatment decisions (Kurpad et al., 2011, Rao et al., 2014, Murthy et al., 2014, Bayoud et al., 2015, El Khoury et al., 2016, Chen et al., 2018, De Luca et al., 2019, Krause et al., 2022). Interactive clinical decision support systems may support decision-making in line with clinical guidelines. The Multidisciplinary meeting Assistant and Treatment sElector (MATE) is one instrument that has been suggested for this purpose. MATE facilitate evidence-based decision making and has been tested in breast cancer MDTMs with a concordance of clinician decisions compared to computer decisions of over 90%. The system is generic and can be applied in areas other than breast cancer (Patkar et al., 2012).

In colorectal cancer, altered treatment plans have been demonstrated in an average of 10-20% (range of 6-29%) of the cases discussed (Chinai et al., 2013, Fernando et al., 2017, Karagkounis et al., 2018, Fehervari et al., 2021, Kočo et al., 2021, Krause et al., 2022). Newly diagnosed colorectal cancer patients had changes in <10% of the cases compared to about 16% in recurrent cases (Jung et al., 2018). Hence, MDTM case discussions seem to primarily benefit patients with advanced disease, with a more limited benefit for patients with early-stage tumors (Munro et al., 2015, Fernando et al., 2017). Increased use of MRI and CT imaging has been demonstrated for patients discussed in MDTMs (Anania et al., 2019, Fernando et al., 2017), whereas use of ultrasound and colonoscopies did not seem to differ in relation to case discussion at an MDTM (Anania et al., 2019). The choice of surgery has been shown to be affected by an MDT case discussion, with an overall reduction of surgery in colorectal cancer patients after MDTM discussion (Palmer et al., 2011, Lamb et al., 2011B, Richardson et al., 2016, Specchia et al., 2020).

In lung cancer, change of treatment plan after MDTM discussion has been demonstrated (Schmidt et al., 2015, Petrella et al., 2021). A study of 988 lung cancer patients from Australia showed that discussions at MDTMs predicted better treatment plans with radiation, chemotherapy, and palliative care but with somewhat longer waiting time and no effect on survival (Boxer et al., 2011).

In prostate cancer, changes in treatment plans have been reported in 26-43% of the cases (Acher et al., 2005, Kurpad et al. 2011, Rao et al., 2014, El Khoury et al., 2016, Scarberry et al., 2018, De Luca et al., 2019). Also in prostate cancer, altered

management is more frequent in patients with advanced and metastatic disease (Aizer et al., 2012, Rao et al., 2014, El Khoury et al., 2016, Scarberry et al., 2018).

In summary, there is considerable support for the argument that MDTM case discussions have a limited impact for early-stage tumours and that there are more frequent changes of treatment recommendations in complex cases, such as patients with treatment failure, advanced tumors, significant comorbidity and frailty, psychosocial issues, rare tumor types, or unusual tumor locations or presentations (Chinai et al., 2013, Munro et al., 2015, De Luca et al., 2019, Soukup et al., 2020A, Warner et al., 2021).

Adherence to clinical guidelines

Patients discussed at MDTMs have been demonstrated to have a higher likelihood of receiving treatment, and specifically, treatment according to clinical guidelines, compared to patients who are recommended treatment outside of MDTMs (Aizer et al., 2012, Boxer et al., 2011, Pillay et al., 2016). Increased use of chemotherapy has been documented in colorectal cancer discussed at MDTM, with particular effects in patients with early-stage tumors and when to consider postoperative adjuvant therapy (Ye et al., 2012, Lan et al., 2016, Foucan et al., 2021). For patients with advanced colorectal cancer, a French study suggested that treatment may depend on MDTM discussion, with postoperative chemotherapy more often recommended to patients discussed at an MDTM (Foucan et al., 2021). In lung cancer, no effect from MDTM on frequency of surgery has been reported, but patients discussed at MDTMs have been reported to receive chemotherapy, radiotherapy, and palliative care more often (Bydder et al., 2009, Boxer et al., 2011). In breast cancer, no significant differences in access to treatment have been found and MDTM implementation did not have a significant impact on the overall use of chemotherapy or endocrine therapy, whereas better coordination of care and follow-up has been shown (Tsai et al., 2020, Kočo et al., 2021, Brandão et al., 2021).

Outcome

To demonstrate outcome effects in case discussions at MDTMs is complex since the MDT structure has evolved parallel with other developments in health-care such as early and refined diagnostics principles, new surgical and radiotherapy techniques, precision treatment and new medical treatments. Furthermore, case selection for MDTMs may represent a major confounding factor for studies on outcome effects (Munro et al., 2015, Prades et al., 2015, Pillay et al., 2016, Pan et al., 2015, Chen et al., 2018, Tsai et al., 2020, Specchia et al., 2020, Brandão et al., 2021, Xiang et al., 2022).

A potential impact on patient outcome from case discussions at MDTMs most likely varies between diagnoses, disease stages and risk groups (Pillay et al., 2016, Kočo et al., 2021). In sarcoma, relapse-free survival has been shown to be significantly better for patients discussed in MDTM (Blay et al., 2017). In Mozambique, implementation of MDTs and MDTMs led to decreased mortality for patients with early breast cancer due to a combination of better coordination of care, increased used of adjuvant and down-staging chemotherapy strategies according to guidelines, and an increased focus on surgical margins and follow-up, which motivated implementation of MDTMs also in other diagnoses in Mozambique (Brandão et al., 2021).

In a French study, management of colorectal cancer was associated with tumor characteristics and comorbidities rather than the MDTM discussion since tumor characteristics influence patient selection for MDTMs (Foucan et al., 2021). Better survival for patients discussed at MDTMs has been suggested in studies of colorectal cancer and lung cancer, for example, with a particular impact on advanced disease (Bydder et al., 2009, Munro et al., 2015, Stone et al., 2018).

In summary, effects vary between studies as well as between treatment modalities and they are prone to bias. Hence, the level of evidence on the influence of MDTMs on patient outcomes is overall low (Pillay et al., 2016, Specchia et al., 2020, Kočo et al., 2021).

Clinical trial eligibility

The MDTM is a suitable time point to consider patients for eligibility in clinical treatment trials, for example, of new treatment techniques, medical treatments or interventions related to psychosocial support, rehabilitation, or follow-up. Since the MDTMs gather all relevant case information there is an opportunity for a systematic identification of eligible patients (Fallowfield et al., 2014, Miguet et al., 2019). An increased awareness of clinical trials during MDTM discussions can widen the treatment opportunities for patients and strengthen research collaborations within the team (Fallowfield et al., 2014, Miguet et al., 2019). Education and training in trial recruitment and workshops on communication have been shown to enhance the MDT's awareness of open clinical trials and lead to increased trial enrolment (Fallowfield et al., 2014). Support structures such as the interactive clinical decision support system MATE may increase the ability to identify suitable patients (Patkar et al., 2012).

Failure to implement treatment plans

In 7-10% of cases, the treatment plans formulated and suggested at MDTMs are not implemented. Causes of non-implementation have been reported to be

patients' preferences in 27-36% of cases, tumor progression in 20% of patients, patients' death in 26%, and clinicians' choice (e.g., motivated by comorbidity) in 22-30% of cases (De Ieso et al., 2013, Kinnear et al., 2017, Hollunder et al., 2018, Ameratunga et al., 2018, Ichikawa et al., 2022).

Complete biomedical information and updated information on the patients current circumstances and views on treatment could contribute to more robust treatment recommendations with a high likelihood of clinical implementation (Kinnear et al., 2017, Hollunder et al., 2018, Ichikawa et al., 2022).

MDTM logistics

Establishment of an MDTM

When an MDT and its MDTM are established, a number of considerations need to be made and decisions taken, related, for example, to regular meeting times, key participants, team members' roles and responsibilities, principles for screening patients for clinical trial eligibility, and routines for handling patient information. Issues for consideration are summarized in figure 2 and are also provided in table 1 in study I. Institutional support from hospital management and clinical leadership is crucial to recognize and acknowledge workload and responsibilities and to support evaluation and feedback as a basis for improvement initiatives and optimized services (Lamb et al., 2013A, Nancarrow et al., 2013, Winters et al., 2021, Nooteboom et al., 2022).

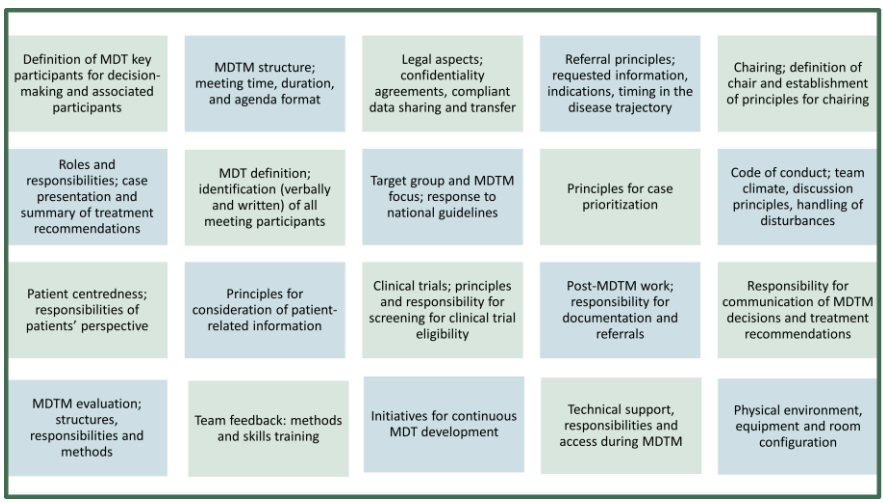


Figure 2. Examples of points for consideration when establishing an MDT and an MDTM

Key MDTM aspects of relevance to the analyses in this thesis are discussed below.

Referral principles

Patients are typically referred to the MDTM when the diagnostic workup is completed, and sufficient information is available to make a solid treatment plan. This usually implies completed imaging and confirmation of a malignant diagnosis based on cytology/pathology. Whereas most patients are subjected to an MDTM at initial diagnosis, principles for MDTM discussions at recurrence or progression vary between teams, diagnoses, and health-care settings.

Various countries have different guidelines for MDTM referral. For example, until recently it has been mandatory in the UK to review and discuss all newly diagnosed cancer patients and all recurrences at MDTMs. This is, however, not sustainable with an increased number of patients and treatment options (Soukup et al., 2018). In the UK, the national guidelines have been updated with guidance on streamlining with a preview for all patients followed by MDTM referral for selected cases to ensure referral of patients who will gain the greatest benefit from a case discussion at an MDTM (NHS England and NHS Improvement 2019, Winters et al., 2021).

The MDT Quality Improvement Checklist, MDT-QuIC, is one example of a tick box list from the UK to support referral and comprehensive, holistic, and patient-centred clinical decision-making (Lamb et al. 2012A). In Canada the Multidisciplinary Cancer Conference Checklist, MCC-checklist, for young women with breast cancer was launched in 2017 as part of a study on quality of breast cancer care. The aims were to promote and support patient presentation at the MDTM and to raise awareness of and support referrals to specialist areas such as fertility, genetics, oncoplastic surgery, and mental health support (Corter et al., 2019).

In Sweden, time points in the disease trajectory for MDTM-based decision-making are described in the national guidelines and CPPs. These steering documents also provide an overview of the MDT composition, referral principles, and documentation process (Kunskapsbanken www. cancercentrum.se). Based on data from the Swedish clinical cancer registries, MDTM case discussion rates vary from 98-100% in breast cancer and colorectal cancer to 86% (range 55-100%) in ovarian cancer, 77% (range 52-94%) in lung cancer, and 77% (range 35-95%) in urothelial cancer (Interaktiva rapporter, RCC). Variable case discussion rates are largely attributable to different traditions, policies and principles in the various diagnostic teams and health-care regions. However, resource constraints within radiology and pathology also influence case discussion rates. In some teams there is a cap on the number of cases that can be listed, which implies variable patient access to MDTMs.

Routines for MDTM referral are typically established locally or regionally. The diagnostic teams develop customized referral routines and check-lists to ensure availability of requested information such as case history, radiology, pathology, clinical information such as performance status, comorbidity, psychosocial information, and in some MDTMs also patients' views and preferences (Lamb et al., 2013A, Ottevanger et al., 2013, Ellis and Sevdalis, 2019, Corter et al., 2019, Horlait et al., 2019, Winters et al., 2021, Nooteboom et al., 2022, Walraven et al., 2022). An MDTM coordinator is typically responsible for listing patients and ensuring that relevant data and information are available.

Older patients have been demonstrated to have reduced access to MDTMs (Holden et al., 2020, Foucan et al., 2021). Also, patients from deprived areas have been shown to have a lower likelihood of MDTM referral, and social circumstances such as transport and assistance need to be considered in practical treatment planning (Foucan et al., 2021).

Technical requirements and virtual MDTMs

A well-suited physical environment is an important aspect of the MDTM. The room needs to be properly equipped to fulfil the purpose, with a seating configuration that promotes interaction and access to relevant technical systems for case presentation (Janssen et al., 2018). A U-shaped seating has been found to facilitate and encourage participation from all team members and reduce hierarchies in the group (Gandamihardja et al., 2019). Many MDTMs require access to an interactive communication platform for virtual participation from health professionals at external sites. Most systems enable sharing of medical images such as radiology images. Easily accessible technical assistance is important to avoid resource-demanding disruptions that risk negative effects on MDTM quality and safety (Janssen et al., 2018, Winters et al., 2021). Technology to improve and aid data collection is rapidly developing and has a potential to support MDT administration (Janssen et al., 2018). A digital dashboard that collects data from electronic medical records, such as laboratory results, pictures of the tumor, radiologic evaluations, histopathology, and basic comorbidities, has been shown to support MDTM preparations for team members, and such overviews of patient case, stage, comorbidity, etc. have been shown to improve meeting efficiency (Simo et al., 2009, Yuan et al., 2018, Mano et al., 2022). In the development of regional and national MDTMs, the possibilities to access and share health information from various systems is a key enabling factor, which needs to be weighed against patient data confidentiality and legal possibilities for data sharing (Janssen et al., 2018).

Team composition, roles, and leadership

Team composition

The MDT consists of a group of health professionals who possess necessary and relevant expert knowledge, skills, and experiences in the core disciplines of surgery, oncology, radiology, and histopathology. Specialist medical professionals participate depending on diagnosis, clinical question, and health-care setting. The team size naturally varies between regional hospitals and university hospitals. In Sweden, key MDT participants are defined in the national treatment guidelines. Based on these standard recommendations, local, regional, and national MDTs modify and optimize participation according to their needs and the clinical considerations addressed. For example, participants in an MDTM head-neck cancer could include surgeons and oncologists with specific competence on head-neck cancer surgery, radiotherapy, and chemotherapy and also radiologist, histopathologist, special dentist, dietician, speech therapist, jaw prosthetics and specialist nurses. Each MDT defines the required expert participants and specialists to ensure qualified case discussions and recommendations. In addition, staff in training such as residents and students may participate in the MDTM.

Radiologists and, potentially, specialists in physiology or nuclear medicine participate in MDTMs to demonstrate and interpret imaging results. Pathologists participate for review and update on diagnosis and relevant histologic and molecular risk factors. Some MDTMs also include experts in molecular pathology. Specialized surgeons participate where their skills are needed, for example, related to neurosurgery, thoracic surgery, plastic and reconstructive surgery, urology, head and neck surgery, vascular surgery, orthopaedic surgery etc. Internal medicine experts include oncologists (specialized in medical oncology and/or radiotherapy), haematologists, neurologists, pulmonologists, and dermatologists. Some teams with a high number of advanced and palliative cases, such as, lung cancer and pancreatic cancer, have palliative care experts as standing members.

When relevant, other disciplines such as nuclear medicine specialists, endoscopists, gastroenterologists, nutritionists, genetic counsellors, physiotherapists, occupational therapists, and psychologists may participate in the MDT and MDTM (Specchia et al., 2020, Edney et al., 2020). Further, extended MDTs may include general practitioners and members of home-based care teams. Whereas this resource may be important from the patient's perspective, extension of the MDT balances efficient use of health-care resources (Prades et al., 2015, Walraven et al., 2022).

Team members' roles

Knowledge exchange and input from various specialists in a team that utilizes joint experiences and shares responsibilities is at the core of multidisciplinary decision-making. A common understanding of the various roles and responsibilities at the MDTM is a basis for well-functioning communication and smooth decision-making (Ottevanger et al., 2013, Horlait et al., 2021). The individual participants' roles at the MDTM should be clear, meaningful, and identifiable. The MDT can be compared to surgical or emergency room teams, where clarity of roles and responsibilities is essential.

Responsibility for regular adjustment of work plans to allow case preparation, meeting participation, and relevant post-meeting work for participants needs to be defined. All participants are responsible for making relevant preparations ahead of the meeting, which means that time for preparation should be protected in clinical work (Ottevanger et al., 2013, Alexandersson et al., 2018, Nasir et al., 2017).

Examples of individual responsibilities for MDTM participants:

- MDTM coordinator: collects information and checks for completeness, monitors deadline for referrals, distributes case list to participants ahead of meeting and ensures availability of final reports and documentation
- Chair: conducts the meeting, summarizes the case discussions and is responsible for standardized documentation of treatment recommendation
- Radiologist/nuclear medicine specialist: demonstrates and interpret imaging in a pertinent manner
- Pathologist: reviews and demonstrates diagnosis, relevant histologic and molecular risk factors
- Attending physician and specialized care staff, e.g., oncologist, surgeon, psychologist etc, updated and prepared for discussions of preannounced cases, case presentation and case discussion
- Specialist nurse; updates on patients referral and planning, current personal circumstances, and patient preferences
- Staff in training (physicians, nurses, etc.): observe and listen in order to further educational aims
- Research staff/coordinator: screen and enrol patients in clinical trials
- Technical support: provides technical assistance; should be easily accessible

Leadership

Leadership can be defined as *a process of social influence to enlist and mobilize the aid of others to attain a collective goal* (Chemers, 2008).

Health-care systems are hierarchical by tradition, which may negatively influence team discussions. Democratic leadership is founded on cooperation and collaboration between team members. Therefore, leadership skills are relevant in the role as MDT chair. Effective leadership with an MDTM chair who facilitates constructive discussions and clarifies decisions is crucial for an effective MDTM work process (Taylor et al., 2010, Balasubramaniam et al.,2015, Prades et al., 2015, Jalil et al., 2018, Soukup et al., 2018, Fradgley et al., 2021, Evans et al., 2019, Rankin et al., 2020). Desired leadership style is seen as a combination of managerial, intellectual, and emotional competences and with mutual respect of all participating colleagues. Suboptimal chairing may relate to lack of preparation, poor time management, lack of clarity of next steps in the process or dismissing opinions of team members

The MDTM chair is most often a senior clinician. Estimates show that 70-80% of MDTMs are led by a surgeon and 25% by an oncologist (Lamb et al., 2011C). The chairs should be respected by the team members for their expertise and experience in the field and, ideally, should also have competences such as assertiveness, self-awareness, social skills, and good communication skills. The importance of the latter skills has been highlighted in other areas such as aviation service, where they complement technical skills and contribute to safe and efficient task performance (Flin and Patey, 2009, Ellis and Sevdalis, 2019, Keats, 2019).

Chairing imposes dual tasks, as subject expert and as team leader and coordinator, and it may be challenging to carry out both roles effectively (Jalil et al., 2018, Soukup et al., 2018). The complexity in team contributions, and the resultant need to have an overall view and pay attention to details at the same time, is demanding. When the chair is presenting the cases during the MDTM, interaction and open discussions have been shown to be less effective compared to case presentations by team members, which allows the chair to focus on coordination and team motivation (Horlait et al., 2019). The MDTM needs to run smoothly to ensure time for discussing all patients listed, and time management is an important aspect of successful leadership.

It is utterly important that the chair supports the MDT to reach consensus and a final decision to provide a clear and unambiguous treatment recommendation for each patient (Fleissing et al., 2006, Rusthaller et al., 2006, De Ieso et al., 2013, Jalil et al., 2018, Fradgley et al., 2021). A successful MDTM chair should be able to bring out the best in each team member, value team members' contributions and encourage participation in decision-making and open communication (Manser, 2009, Mano et al., 2022). A careful balance that recognizes expert opinions of all relevant team members and encourages contributions in a respectful climate is an

optimal MDTM scenario that supports well-founded treatment recommendations (Soukup et al., 2016A, Rankin et al., 2020). Although chairing and leadership skills are central to the quality of the decision-making process and successful MDTM work, few leaders of MDTMs have undergone formal education or training for the task (Lamb et al., 2011C, Soukup et al., 2016B). Efforts to train MDTM chairs in meeting management, communication, and interpersonal relations and negotiation may be relevant to further improve safety and quality aspects of MDTMs (Soukup et al., 2018, Fradgley et al., 2021).

MDTM decision-making

Teamwork

Teamwork can be defined as *a process of interaction between team members who combine collective resources and knowledge to solve a task*, that is, the formulation of an individualized treatment recommendation from the MDT (Manser, 2009, Lamb et al., 2011D). Teamwork defines *how* the team collectively solves the task in question (Schmutz et al., 2019). In modern healthcare, teamwork is essential. At the same time health-care teams are increasingly complex and agile and may expand across health-care institutions and regions. Health-care teams also work under conditions that are more dynamic than those of many other teams, which implies that effective team communication, a shared team culture, and clear roles and responsibilities are essential for successful teamwork. Well-functioning teamwork, including open communication and appreciation, should not be taken for granted but needs to be addressed actively and regularly to ensure appropriate and efficient provision of services (Fleissing et al., 2006, Nancarrow et al., 2013). However, these aspects have received limited attention in current cancer care, and few MDT members have undergone any formal education in teamwork, communication skills, or leadership skills.

The hierarchical structure and culture of many health-care systems can be a barrier in team discussions (Hahlweg et al., 2017). Group dynamics are influenced by the size of the team. Larger teams need more coordination from the leader to maintain structure and clear roles and responsibilities (Schmutz et al., 2019). Teams that seldom disagree and team members that don’t voice opinions that deviate from the collective opinion could be a sign of a poor team climate, false consensus or group-thinking and this should be recognized and addressed for development (Lamb et al., 2012B, Rankin et al., 2020). Poor emotional management of disagreements among team members can lead to a tense atmosphere that hinders open discussions and joint team development (Lamb et al., 2011D, Mano et al., 2022).

A confident team climate is essential for all participants to be able to speak freely, to improve the MDTM practice, and to learn from each other. It is recognized by an open atmosphere, where team members can reflect on doubts and limitations, and it requires a basic attitude of equity, mutual respect, trust, and integrity between all team members. These aspects of teamwork have also proven relevant for safety, including trust and mutual respect, a shared understanding of the team structure, participants' tasks and roles, and shared goals (Nancarrow et al., 2013, Lamb et al., 2011D, Jalil et al., 2018). Familiarity within teams, where members regularly interact and know each other's working styles, roles, and responsibilities, is often a strength but can be challenged by new team members, and then it needs to be addressed.

The MDT may contribute to shared patient responsibility, which can support team members in decision-making, especially in complex cases and psychosocially demanding situations. Recurrent training on non-technical skills such as leadership, teamwork, communication, acknowledgement of team management, shared teamwork principles, and awareness of team members' roles contributes to effective and safe teamwork (Nancarrow et al., 2013, Lamb et al., 2013A, Ellis and Sevdalis, 2019, Rankin et al. 2020). Responsible ownership of the MDT impacts the level of engagement, implementation of improvements, and team-based interventions (Bridges et al., 2017, Nooteboom et al., 2022).

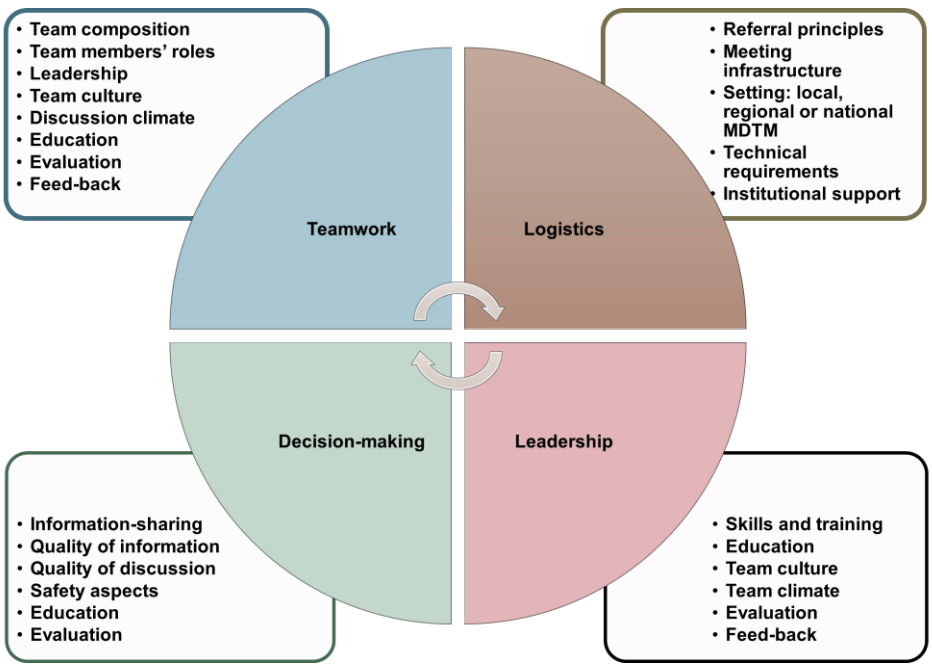


Figure 3. Key components of MDTM decision-making that should be secured and balanced for efficient teamwork

Information sharing

The aim of an MDTM is to formulate a treatment recommendation individualized to each patient discussed based on the collective decision-making within a team of dedicated specialists with complementary competences. The fundamental role of the MDTM is to improve coordination and quality and continuity of care (Specchia et al., 2020, Brandão et al., 2021). The decision-making process at MDTMs is becoming more demanding, with increased workload and time constraints in many health-care settings (Soukup et al., 2018, Edney et al., 2020). For complex and rare cases decision-making and provision of treatment recommendations are further challenged by a lack of clinical guidelines and limited evidence.

The Dual Processing Theory of decision-making describes two forms of reasoning when making a decision: instant pattern recognition and a more complex analytical process. These forms are often combined when experienced physicians make medical decisions. The pattern recognition is a fast-track process to solve problems based on years of experience and intuition and is often referred to as system I. The analytical process, called system II, is more complex, based on reasoning, and has a lower risk of errors but is more energy consuming. Not only objective medical information but also non-medical elements influence the clinical decision-making process, and both aspects can be influenced by time pressure, lack of concentration, fatigue, etc. (Tsalatsanis et al., 2015, Restivo et al., 2016, Soukup et al., 2019, Haimi et al., 2020, Schurmans et al., 2022).

To reach a tailored treatment plan for the patient, all relevant information needs to be presented in a structured and pertinent way suitable to the diagnostic area. Key information should be defined by the team, and it has been shown that structures to support presentation in a systematic way positively influence decision-making (Hahlweg et al., 2017, Fahim et al., 2020, Walraven et al., 2022). Incomplete diagnostic workup, such as insufficient imaging or missing pathology reports noted during the meeting, risks causing extra work and misuse of resources in the preparation, presentation, and discussion of cases that have to be deferred to the following meeting (De Ieso et al., 2013, Balasubramaniam et al., 2015, Nasir et al., 2017, Janssen et al., 2018, Balasubramaniam et al., 2020, Geerts et al., 2021). The literature highlights a frequent lack of information on important aspects such as frailty, comorbidity, physical status, and societal factors that influence the likelihood of realizing a proposed treatment plan (Jalil et al., 2013, Stairmand et al., 2015, Kunneman et al., 2015, Nazim et al., 2018, Holden et al., 2020, Ellis and Sevdalis, 2019, Geerts et al., 2021). The quality of information may vary depending on whether the patient has been seen by a team member present at the meeting or simply referred by another physician or health-care institution (Lanceley et al., 2008, Hahlweg et al., 2017).

Studies suggest that MDTs tend to overrate their insight into patients' circumstances, such as, comorbidity (Lamb et al., 2011B, Nazim et al., 2018, Lane et al., 2019). Considering that about 80% of the patients are above age 65 when diagnosed with cancer and a growing number of patients are above 80 years of age at diagnosis, refined assessments of frailty and individual vulnerabilities, collaborations with geriatricians, and updated knowledge about the individual patients' wishes become increasingly important (Lane et al., 2019, Bolle et al., 2019, Ellis and Sevdalis, 2019, Rollet et al., 2021). A comprehensive consideration of holistic patient information has the potential to provide a treatment recommendation that is robust, implementable, and acceptable to the patient (Lamb et al., 2011D). Patients' attributes that are mentioned, highlighted, and discussed can influence tacit knowledge and generalization and may have an impact on the decision-making process (Hahlweg et al., 2017, Lane et al., 2019, Haimi et al., 2020). Improved information structures to ensure relevant, holistic patient information can enhance the possibilities for a treatment plan to be implemented and contribute to MDTM effectiveness (De Ieso et al., 2013, Restivo et al., 2016, Lane et al., 2019, Hollunder et al., 2018, Fahim et al., 2020).

Development of strategies to improve MDTM decision-making is motivated by, for example, selection of patients who will benefit from more elaborate decision-making as opposed to more straightforward decisions following guidelines. One strategy is to discuss different treatment options and recognize if several alternatives are available to document in the MDTM report, rather than formulating a single recommendation (Hahlweg et al., 2017, Atwell et al. 2019). This leaves an opportunity for the physician in charge to discuss the alternatives and related uncertainties, and the pros and cons associated with the suggested treatment. Discussing treatment alternatives should not be a routine obligation but should review realistic alternatives. It should be noted that the MDTM also represents a forum to discuss therapeutic limitations for patient-focused recommendations with a high likelihood for clinical implementation (Nazim et al., 2018, Rollet et al., 2021). The MDT, supported by the chair, should make sure to check and agree on the recommendations at the end of each case discussion (Soukup et al.,2018, Geerts et al., 2021). Disagreements in decision-making should be recorded and formalized to decide on the final recommendation (Lamb et al., 2012A).

Quality and safety aspects

The quality and safety aspects of MDTM decision-making are central. The role of human factors in making errors in high-risk activities in medicine, for example, in surgery and intensive care, is well recognized, and initiatives and routines to enhance patient safety are implemented in operating rooms and intensive care environments. However, non-technical elements of MDT performance may be

critical for safe and effective MDTMs but are less well explored in cancer care (Oeppen et al., 2019, Fahim et al., 2020).

Distractions at the MDTM are common and should be minimized, but they are sometimes inevitable. Team members receive phone calls or may come into or leave the meeting room, and technical disruptions may occur. Observational studies have shown that disruptions during surgical procedures, for example, lead to significantly more errors (Undre et al., 2007). For the MDTM, this means that disturbances such as phone calls or discussions on matters other than those directly related to the MDTM should be avoided and postponed until after the meeting (Ottevanger et al., 2013). The team should define codes of conduct, and the chair has an important role in keeping the meeting focused and minimizing the risk of negative influences on patient discussions (Lamb et al., 2011D, Jalil et al., 2018, Schmutz et al., 2019, Mano et al., 2022).

At present, MDTMs may be lengthy and time consuming. They can entail a high workload; some MDTMs have been reported to last for several hours. Case overload may negatively influence the quality of discussions and decision-making. Cases discussed at the end of long MDTMs may not receive the same attention as those discussed in the first part of the meeting (Lamb et al., 2013A, Jalil et al., 2013, Soukup et al., 2019, Warner et al., 2021). It has been shown that the quality of information and team members' contributions to decision-making are lower in the second half of the MDTM as an effect of decision-making fatigue (Soukup et al., 2019). The MDTs' ability to process information and discuss treatment options diminishes over time but can be counteracted through intervention and by scheduling a short break in the middle of the meeting as an act of safety (Soukup et al., 2018).

Educational aspects

The MDTM is a platform for constant education, and although the educational aspects of MDTs are frequently referred to by team members, the roles of students and junior staff in the MDTM are rarely defined. Since time for teaching and educational discussion at MDTMs is often limited, the staff in training often passively listens to the case presentations and the case discussions (Rourke, 2018, Rankin et al., 2020, Walraven et al., 2022). Competence development and subject expertise relate to the team discussion in which clinical expertise is shared and updated guidelines and new information are discussed (Walraven et al., 2022). Besides the medical decision-making, the MDTM also provides educational aspects related to teamwork and leadership (Hahlweg et al., 2017, Rourke, 2018, Rankin et al., 2020, Walraven et al., 2022). The complex personal and professional skills needed to lead an MDTM are rarely taught as part of medical education,

training, or specialization (Ruhstaller et al., 2006, Soukup et al., 2018). The literature provides examples of organization of MDT and MDTM learning and mentoring events, workshops, and educational programmes, but in most health-care settings such efforts are not structured or regularly scheduled (Hahlweg et al., 2017, Jansen et al., 2018, Scott et al., 2020, Fehervari et al., 2021).

Resource use

Globally, significant resources are spent on MDTMs, but studies of resources and costs in relation MDTMs to effectiveness are few. Cost estimates are heterogeneous, which likely reflects differences in organisations, diagnostic areas, and health-care systems. Collective decision-making can reduce the number of unnecessary diagnostic tests and treatments. However, time spent on MDTM preparation, coordination and attendance is significant and also limits time available for other clinical tasks. The use of telemedicine and video conferencing saves travel costs and time but is linked to increased technology demands and investment costs (Alexandersson et al., 2018, Janssen et al., 2018). There is a global demand for radiologic, pathologic, and oncologic competences, which needs to balance with the benefits of participation in MDTMs (Chinai et al., 2013, Ke et al., 2013, De Ieso et al., 2013, Balasubramaniam et al., 2015, Munro et al., 2015, Nasir et al., 2017, Alexandersson et al., 2018, Edney et al., 2020, Rankin et al., 2020).

The total number of MDTM participants varies considerably with average of 8-14 health professionals engaged at each meeting (Hahlweg et al., 2017, Alexandersson et al., 2018, Lumenta et al., 2019). Meeting times range from 0.5 to 3 hours (Shah et al., 2014, Alexandersson et al., 2018, Gandamihardja et al., 2019, Lumenta et al., 2019, Edney et al., 2020). The time spent per patient discussed is average 4 minutes (range 2 to 8 minutes) (Sha et al., 2014, Hahlweg et al., 2017, Alexandersson et al., 2018, Lumenta et al., 2019).

Cost per case discussed depends on the complexity of the case, time spent, and number of specialists involved in the discussion, with the main costs derived from physician preparation time and attendance (De Ieso et al., 2013, Alexandersson et al., 2018, Yuan et al., 2018, Neves et al., 2019, Edney et al., 2020). A range of 70-595 euros per case discussed and 1440-4070 euros per meeting has been reported (De Ieso et al., 2013, Alexandersson et al., 2018, Neves et al., 2019, Edney et al., 2020). There is still limited evidence on optimal configuration of MDTMs from a cost-effective point of view (Edney et al., 2020). MDT-based clinical management is increasingly applied also in diagnostic areas other than cancer, which motivates further research on resource allocation (Edney et al., 2020, Holmes et al., 2021).

Streamlining and case selection

Resource constraints frequently apply to MDTMs, limiting the number of patients that can be listed for an MDTM, and motivates strategies to select and streamline cases.

Streamlining

Current treatment pathways and guidelines, support recommendations by an MDTM for the majority of treatment situations in the first line-scenario (Hoinville et al., 2019, Warner et al., 2021). In the UK, new guidelines for streamlining were published in 2020 (Hoinville et al., 2019, NHS England and NHS Improvement 2021). The guidelines distinguish between patients where needs can be met by standard treatment guidelines or protocols and so where MDTM discussion is not required and patients where MDTM is required due to, for instance, clinical complexity or psycho-social issues. Each MDT needs to ensure efficient referral and MDTM processes to ensure best use of resources (Specchia et al., 2020, Warner et al., 2021). Streamlining and patient selection evoke discussions in MDTs with concerns about patient safety. Resources and capacity for review of imaging by radiologists can also be a limiting factor that risks subjective and unequal referral to MDTMs (Nasir et al., 2017, Corter et al., 2019). Development of tumour-specific principles for streamlining MDTM discussions varies between hospitals (Hoinville et al., 2019, Rankin et al., 2020, Warner et al. 2021, Kočo et al., 2021). Various methods are applied to prioritize patients for MDTM discussions versus alternative decision-making structures. Some teams may list standard cases for quick decisions on recommending adjuvant treatment, for example. Other MDTs divide new cases and relapsed cases into different MDTMs (Restivo et al., 2016). Some teams also have mini-MDTMs; an example would be an MDTM with only a surgeon and an oncologist to discuss radiotherapy versus surgery for prostate cancer. Different alternatives to MDTMs, such as a smaller team discussions and triage structures pre-MDTM, are evolving to ease the workload at MDTMs (Winters et al., 2021).

Case complexity and frailty

To ensure patient centeredness, one option is to select patients who need more elaborate decision-making with contributions from several team members related to, for example, various treatment options, advanced or high-risk treatments, and challenges related to comorbidities (Geerts et al., 2021, Winters et al., 2021). To date, case selection for MDTMs is physician-driven rather than systematic. Patients with multidisciplinary treatment needs are more likely to be discussed in MDTMs (Walraven et al., 2019). Indicators of case complexity are relatively

stable across tumor types (Soukup et al., 2020A). Evidence and recommendations suggest that the complexity of each case needs to be considered to plan tailored cancer care (Warner et al., 2021). Structures for triaging cases for MDTM and use of support algorithms and screening tools can aid streamlining and reduce MDTM workload since physicians cannot reliably predict changes in treatment plans related to their MDTMs (Scarberry et al., 2018, Winters et al., 2021). Differentiation of complex cases that benefit from MDTM discussion from those that can be managed via treatment pathways is required to decrease MDTM workload (Nasir et al., 2017, Balasubramaniam et al., 2020, Walraven et al., 2022).

An example from China describes weekly MDTMs for gastrointestinal cancer, where cases are classified into three subtypes according to grade of complexity: general, moderate, and complicated due to, for example, serious comorbidities, several operations, distant metastases, and emergency complications. The introduction of electronic checklists to support preparation for the MDTM could reduce review time, prevent dual data collection, and allow physicians to focus further on evaluation of case complexity (Yuan et al., 2018).

MDTM evaluation

Recurrent assessment of the MDT with a focus on teamwork and decision-making can support robust and continuous development of the MDT service (Lamb et al., 2011B). There is a need for methodologies, strategies, and routines to assess various aspects of MDTMs to provide feedback to team members, stimulate reflection on MDT work, and drive change to develop and optimize services. Documentation of deviations from MDT recommendations is increasingly requested, for example, in accreditation and certification programmes. However, the definition of a deviation remains unclear since it could encompass alterations ranging from minor modifications to completely altered strategies and methods to assess implementation.

The MDT should explicitly discuss the intention and development of their MDTM (Nooteboom et al., 2022). To evaluate quality and effectiveness of health services such as MDT work and MDTMs, a number of different approaches can be used including observational studies (e.g., Soukup et al., 2016A) , surveys (e.g., Hoinville et al., 2019) interview studies (e.g., Fradgley et al., 2021) and outcome and cost-benefit evaluations (e.g., Blay et al., 2017, Neves et al., 2019).

Qualitative methods have been applied to assess teamwork, and participants' experiences and quantitative methods have been used to assess team performance in health-care environments. MDTMs have been implemented worldwide, which makes randomized approaches challenging. Most studies on MDTs and MDTMs

represent work performed at single intuitions or diagnostic areas (Rankin et al., 2020). Prospective data collected on a population basis would be relevant to control for confounding factors related to patient, team, and health-care setting and could be relevant linked to national quality registries (Pillay et al., 2016, Bjørn et al., 2017).

In the UK, annual audits for MDTs and at MDTMs are held to evaluate the work process and to provide feedback and support for continuous development (Balasubramaniam et al., 2020, Winters et al., 2021). In Sweden, as in many other countries, evaluation principles are not uniform or broadly defined and the improvement process of MDTMs thus depends on initiatives taken by individual MDTs or health-care providers. Study design and experiences from aviation service and military service of evaluation have been transferred to evaluation of specialties such as anesthesia and surgery (Undre et al., 2007).

To streamline evaluations and increase comparability between teams and health-care settings, a variety of quality-assessment tools (QAT), instruments for observational assessment and evaluation, have been developed. Researchers in the UK have been leading in this field and have developed several validated instruments (Lamb et al., 2011B, Lamb et al., 2012A, Taylor et al.,2012A, Harris et al., 2016, Jalil et al., 2018, Soukup et al., 2020A, Lamb et al., 2021). An overview of tools is listed in table 1.

These instruments can be used at different points of MDT work: in planning and preparing for the MDTM, to evaluate and optimize the actual MDTM, or to support development based on team reflection. An observational approach has been found feasible and useful in understanding different parts of the MDT work in real life, which is in line with observations from evaluations in other health-care settings, such as emergency care, intensive care, and operating rooms.

An initial inspiration in the development of quality assessment tools for MDTs came from a validated structured observational tool used in surgery, the Observational Teamwork Assessment for Surgery (OATS), which was based on Dickinson and McIntyre's model of teamwork (Dickinson and McIntyre, 1997). The model identifies dimensions of communication such as quality and quantity of information shared by operating team members, coordination of tasks and activities, and cooperation and support among team members and leadership (Undre et al., 2007, Sevdalis et al., 2009, Lamb et al., 2011D). Such observational assessment can be performed by independent reviewers or by team members to self-evaluate and stimulate reflection on roles, responsibilities, and team function. The assessment of team skills combined with feedback can help teams to reflect and improve their work in a structured development process. (Soukup et al., 2018, Brown et al., 2022).

A recent review identified 18 studies on available QATs, of which 89% were developed, validated, and tested in the UK and 11 % in other European countries.

Of these studies, seven were performed on novel MDT QATs or discussion checklists and 11 used a previously developed QAT in a new context, diagnosis, or health-care setting (Brown et al. 2022). In this thesis we used four of these QATs: MDT-MOT (MDT-Meeting Observational Tool), MDT-MODe (MDT-Metric for the Observation of Decision-making), ATLAS (A Tumour Leadership Assessment inStrument), and MeDiC (Measure of case Discussion Complexity), all of which were applied for the first time in Swedish cancer care.

Table 1. Overview of quality-assessment tools for evaluation of various aspects of MDTs and MDTMs

Abbreviation	Instrument	Instrument description	Instrument focus	Methodology	Reference
MDT-MODe	MDT-Metric for the Observation of Decision-making	Assesses team conduct at MDTMs in 12 domains in two parts: -availability of information -contribution of meeting participants per case discussed in MDTM	Quality of information and contribution for each patient	Observational assessment	Lamb et al., 2011B
MDT-QuIC	MDT-Quality Improvement Checklist	Checklist with tick boxes for full MDTM discussion of each case	To ensure comprehensive, holistic, and patient-centred clinical decision-making	Checklist	Lamb et al., 2012A
MDT-OARS	Observational Assessment Rating Scale	Rates 15 areas of MDTM process measured in four domains	Clinical decision-making Teamwork MDTM organization and logistics MDTM infrastructure	Observational assessment	Taylor et al., 2012B
TEAM	Team Evaluation and Assessment Measure	Team self-assessment of core functions of the MDT and MDTM	Core functions: Leadership and chairing Teamwork and culture Patient-centred care Decision-making process Organisation and administration	Team self-assessment	Taylor et al., 2012A
MDT-MOT	Meeting Observational Tool	Rates 10 domains of MDTM process	Attendance Leadership and chairing Teamwork and culture Personal development and training Physical environment Technology and equipment Organization and administration Post-meeting coordination Patient centred care Decision-making processes	Observational assessment	Harris et al., 2016
MDT-FIT	Feedback for Improved teamwork	Encompasses components of MDT-MOT and TEAM Three-stage process over 10-12 weeks, followed up Annual review	Holistic and individual team improvement Expert feedback Team-reflective discussion	MDT self assessment	Taylor et al., 2021
ATLAS	A Tumour Leadership Assessment inStrument	Rates leadership abilities of the MDT chair in 12 domains per MDTM	Time management Communication Encouraging contribution Ability to summarize Ensuring all patients have treatment plan Case prioritization Keeping meeting focused Facilitate discussion Conflict management Leadership Creating good working atmosphere Recruitment for clinical trials	Observational assessment	Jalil et al., 2018

Abbreviation	Instrument	Instrument description	Instrument focus	Methodology	Reference
MeDiC	Measure of case Discussion Complexity	Screening tool that gauges case complexity for MDTM Template of 26 complexity items in three different areas: pathology, patient characteristics, and treatment factors	Capture the case complexity for selection to MDTM referral	Medical record review and observational assessment	Soukup et al., 2020A
MODe-Lite	Update of MODe, shorter user-friendly version	Assesses team conduct at MDTMs in six domains	Clinical input Holistic input Clinical collaboration Pathology Radiology Management plan	Observational assessment	Lamb et al., 2021
MATE	Multidisciplinary meeting Assistant and Treatment sElector	Interactive clinical decision support system Concordance of clinician decisions compared to computer decisions	Facilitating evidence-based decision-making	Decision aid	Patkar et al., 2012
CDSS	Clinical Decision Support System	Clinical data presentation for precision in diagnosis and TNM classification	Facilitate cancer staging according to diagnostic evidence Provide warnings for contraindications	Decision aid	Pluyter et al., 2020
MCC checklist	Multidisciplinary Cancer Conferences checklist	Promotes patient presentation Raises attention to referral to diverse specialists	Support MDTM quality	Support quality of care	Corter et al., 2019
Maturity Matrix	MDT survey and maturity matrix	Identifies priority areas in need of support and improvement	Identify stages of maturity of the MDT	MDT self-assessment	Evans et al., 2019

Aims of the thesis

The overall aim of this thesis work was to contribute to the development and optimization of MDTs and MDTMs for efficient and robust decision-making in cancer care.

The studies aimed to explore team function and decision-making in cancer-related MDTMs with a focus on team members' contributions to case information and case discussions, leadership aspects, and selection of complex cases for MDTMs.

Specific aims

The five studies specifically aimed to:

- Apply observational assessment and the newly developed instruments MDT-MOT, MDT-MODe, ATLAS, and MeDiC to provide in-depth information on cancer-related MDTMs (studies I-III and V)
- Collect information on team members' experiences from virtual national MDTMs (study I)
- Assess MDTM performance and how various team members contribute to case presentations and case discussions (studies I-II)
- Provide insights on the complex and varied MDTM leadership role as a basis for leader and team feedback and development (study III)
- Correlate results from observational assessments with patient characteristics, health-care setting, and team characteristics (I-III, V)
- Correlate team function with leadership (study I-III)
- Map provision and content of medical and non-medical patient information with correlation to patient and team characteristics (study IV)
- Investigate case complexity scoring versus clinical case selection for MDTMs (study V)

Materials and methods

The methods used include observational assessment using four standardized instruments (studies I-III and V), questionnaire-based data collection from 125 team participants (study I), observational collection of oral information (study IV), and review of patient files and use of a case complexity instrument (study V). Data have been collected from seven MDTs, 42 MDTMs, and a total of 560 case discussions.

MDTs

National MDTMs

In 2015, work on level structuring for rare cancers was initiated in Sweden based on an initiative from clinicians and the RCC organization. Treatment, primarily surgery and radiotherapy with curative intent, for rare cancer types such as penile cancer, anal cancer, vulvar cancer, advanced gastroesophageal cancer, and cytoreductive surgery/HIPEC was centralized to two to four specialized centres with national responsibilities. This development raised a requirement for initiation of national MDTMs with rotating responsibilities and coordination from the respective expert centres. Our study of the national MDTMs was performed in 2017 when these teams had been running regular MDTMs for up to two years.

For study I, we selected the MDTMs for penile cancer, anal cancer, and vulvar cancer for non-participant observations of MDTM motivated by sufficient patient volumes, well established meeting structures, and weekly MDTMs (study I).

The questionnaire on participants' views of national MDTMs was sent to participants in all national MDTs in Sweden in 2017, which additionally included members in the teams for childhood cancer (previously established based on regionalized childhood cancer care), cytoreductive surgery/HIPEC, and advanced gastroesophageal and hepatobiliary cancer. Team members of different disciplines and professions were invited by email to respond to a questionnaire on participants' views on different aspects on national MDTM in study I.

Regional MDTMs

In studies II-IV, four regional MDTs were invited to the studies through contact with the team chair. All MDTs invited expressed an interest in participation. For practical reasons, the three teams for soft tissue sarcoma, hepatobiliary cancer, and brain tumors at the Lund University hospital were chosen. These teams covered various diagnostic areas and disciplines, had partly physical and partly video-based meeting structures, and represented areas where various treatment options (surgery, radiotherapy, and medical oncology) are considered. None of the teams had previously been evaluated, and team members had not received any formal support or training in MDTM work, roles, and leadership.

Table 2. Overview of characteristics of the MDTMs observed

Multidisciplinary Team	Number of meetings / cases	Mean time per case (min)	Mean (range) participants	Mean (range) cases discussed	Video-based participants	Leader speciality
Anal cancer	3/15	8.0	21 (18-25)	5 (4-6)	yes	oncologist
Penile cancer	3/34	2.7	19 (15-22)	11 (10-14)	yes	surgeon
Vulvar cancer	3/18	6.6	20 (15-25)	6 (6)	yes	surgeon
Neuro-oncology	12/120	6.0	12 (7-16)	10 (5-17)	yes	oncologist
Soft tissue sarcoma	11/125	5.1	10 (6-14)	11 (4-18)	no	surgeon
Hepatobiliary cancer	10/122	8.1	10 (7-13)	12 (7-14)	yes	surgeon

Observational assessment

The main data collection method for studies I-IV was prospective, non-participant observational assessment based on six different MDTs and 42 separate MDTMs using the instruments MDT-MOT, MDT-MODe, and ATLAS (please see further below). The observers were health-care professionals familiar with the work of MDTs and in MDTMs but were not part of the observed MDTs. During the MDTMs, the observers did not take active part in the ongoing discussion and were physically present at the back of the meeting room.

For the national MDTMs, we observed nine video-based national MDTMs for penile cancer, vulvar cancer, and anal cancer. All observations were done by two independent observers from the study team. For the regional MDTMs, we observed 434 case presentations and case discussions during 33 regional MDTMs,

the majority of which were video-based for extended regional participation. These MDTMs related to brain tumors, sarcoma, and hepatobiliary cancer. In seven MDTMs, data were collected by two independent observers.

QATs

In four of the studies standardized instruments were used: MDT-Meeting Observational Tool, MDT-MOT (study I); MDT-Metric for Observation for the Decision-making, MDT-MODe (studies I-II); A Tumor Leadership Assessment inStrument, ATLAS (study III); and Measure of case Discussion Complexity (MeDiC) (study V).

MDT-MOT, MDT-MODe, and ATLAS rate various MDT aspects from suboptimal (1) to optimal (5) on a Likert-type scale (Lamb et al., 2011D, Harris et al., 2016, Jalil et al., 2018).

Scoring for MDT-MODe is performed during the course of the meeting since the instrument collects data from each individual case. Also, scoring for MeDiC is case-based, although it is performed retrospectively in our study. Scoring for MDT-MOT and ATLAS was performed directly following a completed MDTM. The observers were familiar with the scoring of the instruments, which follows predefined descriptions.

MDT-MODe is one of the first QATs developed for MDT in cancer care (Lamb et al., 2011D) The instrument has been used in several other international studies (Jalil et al., 2014, Seretis et al., 2014, Shah et al., 2014, Lumenta et al., 2019, Gandamihardja et al., 2019). It is a validated observational assessment instrument of quality of MDTMs that assesses team conduct in 12 different domains in two categories: the availability of information and the contribution of the MDTM participants for each patient discussed (figure 4). The first part assesses presented information in six individual variables: patient case history, radiological images, histopathology, psychosocial issues, comorbidities, and patients' views on treatment options scored on a behaviourally anchored five-point scale where five is optimal and one is insufficient. The second part assesses contributions from participants on patient reviews in eight variables: chairperson, surgeons, oncologists, physicians, radiologists, histopathologists, specialist nurses, and MDT coordinator on a five-point scale where five is optimal and one is insufficient. The scoring follows predefined description. The sum of the scores for the variables in each part represents overall quality of information and contribution for each patient.

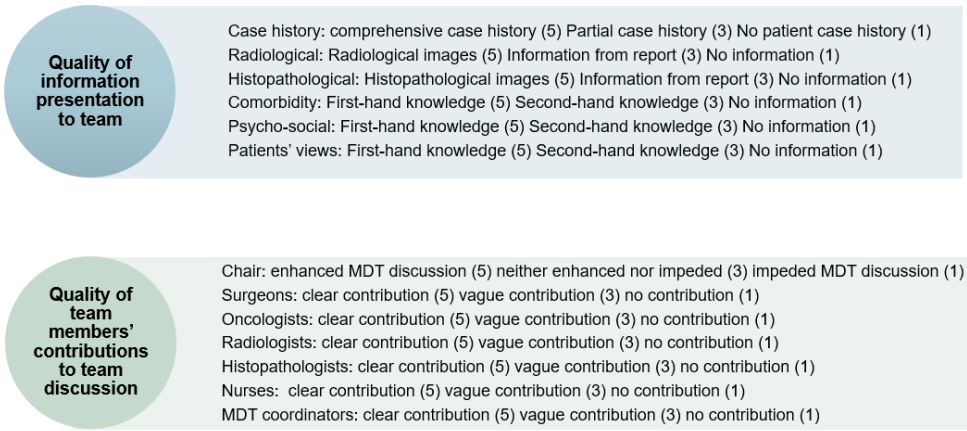


Figure 4. MODe assessment scores for each patient presented at MDTM (Lamb et al., 2011B)

MDT-MOT was developed to assess the MDT process and support team development and assess overall meeting effectiveness in 10 key domains (figure 5) (Harris et al., 2016). The different domains are attendance, leadership and chairing, teamwork and culture, personal development and training, physical environment, technology and equipment, organization and administration, patient-centred care, clinical decision-making processes, and post-meeting coordination. The domains are scored after a completed MDTM on a five-point Likert-type scale with a score of 5 for optimal and 1 for insufficient function of each domain.

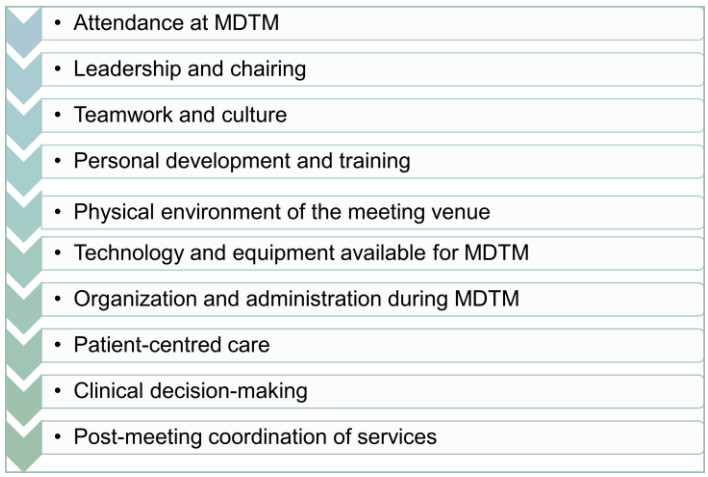


Figure 5. MOT assessment scores 1-5 for insufficient to optimal MDTM function (Harris et al., 2016)

ATLAS rates leadership abilities of the MDT chair in 12 domains (figure 6) (Jalil et al., 2018). The instrument was developed in the UK in MDTs within urological cancer. The development process was rigorous, with collection of evidence on the characteristics of effective chairing and leadership, input from senior specialists and team leaders, and review by a human factors specialist and MDT leaders. The definition of leadership elements used content validation through blinded review by MDT specialists, refinement and validation through an online survey sent to urology MDT specialists, and application in urological MDTMs. The one-page instrument rates leadership in the domains of time management, communication, encouraging contribution, ability to summarize, ensuring all patients have a treatment plan, case prioritization, keeping the meeting focused, facilitating discussion, conflict management, leadership, creating a good working atmosphere, and recruitment for clinical trials. The domains are scored after a completed MDTM on a five-point Likert-type scale with a score of 5 for optimal and 1 for insufficient function, thus MDTM leadership scores can range from 12 to 60.

Chairing criteria	1	2	3	4	5
Time management	Meeting started 15 min late, cases deferred due to time mis-management.		Meeting started 10 min late, 1 case deferred due to time mis-manage.		Meeting started on time, no case deferred due to time, chair acknowledges the time.
Communication & listening	Poor – detrimental effect to function/efficiency of MDTM.		Neither enhanced nor detracted from function.		Effective skills.
Encouraging contribution	Does not invite nor give space to embers to participate.		Invites or give space to only a few members to participate.		Invites and give space to members to participate.
Ability to summarize	Not summarizing/ cases left unclear.		Summarized some cases, still few cases remained unclear.		All cases that were unclear/inappropriately presented were accurately summarized.
Ensuring all patients have treatment plan	No clear decisions for many patients.		Some decision plans remained unclear.		Unclear plans were clarified. Gives clear closure to unclear plans.
Case prioritization	Cases were not prioritized.		Attempts to prioritized but inconsistent or ineffective.		Cases were prioritized as necessary.
Keeping meeting focused	Distractions affected the MDTM/ no attempt to keep MDT focused.		Some effort to refocus MDT but not consistent.		Refocuses the MDT when distracted. Keeps team to task.
Facilitate discussion	Not facilitating discussions when needed. Leads to dysfunctional/ unproductive conversation.		Attempts to facilitate but not always effective.		Effective facilitation of discussion and decision making.
Conflict management	Conflicts remain unsolved or/and difficult personalities dominate/derail meeting.		Attempts to resolves conflicts but affected /delayed the meeting.		Effectively resolves conflicts. Allow effective decisions despite conflict.
Leadership	Poor leadership, not obvious who was leading the MDT.		Some but inconsistent or ineffective leadership skills.		Effective leadership, clear who is leading the MDT inspirational, enthusiasm for the service.
Creating good working atmosphere	Poor atmosphere/climate during the MDTM. Unproductive, antagonistic.		Atmosphere and team climate mostly OK with occasional friction.		Very good atmosphere and team climate directly facilitated by the chair.
Recruitment for clinical trials	Most eligible patients were not identified.		Some eligible patients were identified for trials.		Ensured eligibility for relevant trials recruitment is considered for all eligible patients discussed.

Figure 6. Leadership skills measured by ATLAS (Jalil et al., 2018)

MeDiC is a screening tool for planning and quality assurance that gauges the complexity of each patient case (figure 7) (Soukup et al., 2020A). It was initially developed in the diagnostic areas of breast cancer, colorectal cancer, and gynaecological cancer by MDT experts in the UK to prioritize selected cases for MDTM referral. The instrument contains a template of 26 complexity items divided into three different areas: pathology, patient factors, and treatment factors, measuring clinical and logistical complexities. The instrument has been applied in MDTMs for breast cancer, colorectal cancer, and gynaecological cancers. The items are weighted 1 to 4 points for complexity, and the scoring system follows predefined descriptions. A summary MeDiC score is calculated for each patient.

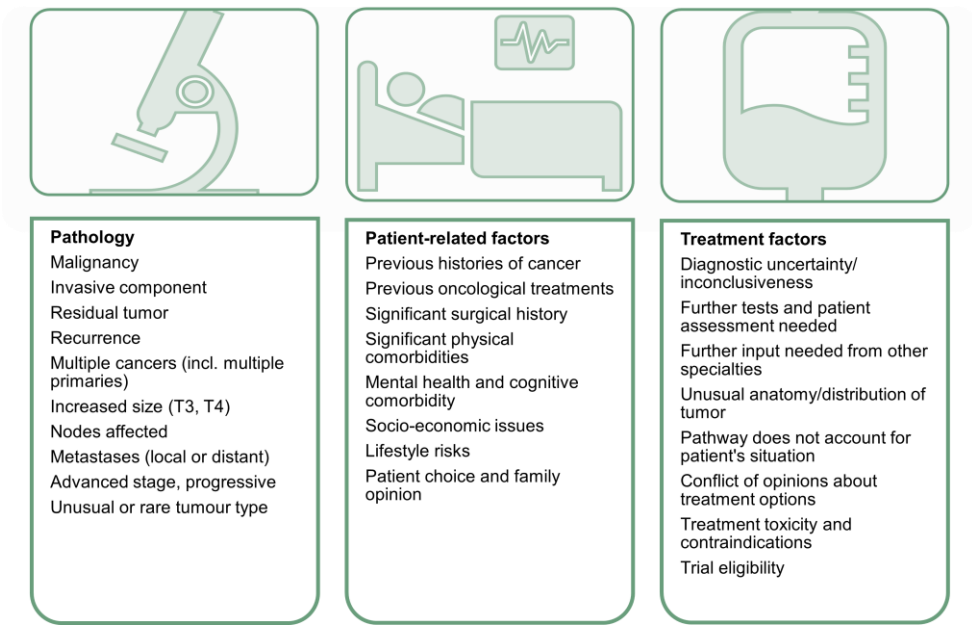


Figure 7. Measure of case Discussion Complexity (MeDiC) items weighted 1-4 points (Soukup et al., 2020A)

Likert scale

Many of the QATs use Likert scales to rate different aspects of the MDTMs with definitions of optimal (5) to suboptimal (1) practice. The Likert scale was developed as a psychometric scale by the American psychologist Rensis Likert to measure respondents' attitudes and opinions about different questions. Likert scales are most commonly from 1 to 5, though scales from 1 to 7 are sometimes used. There is an ongoing discussion as to whether the Likert scale is an ordinal scale or an interval scale. Parametric statistics can be used with Likert data even

with small sample sizes, non-normal distributions, and unequal variance, but their use is sometimes questioned, and it is important to be aware of the limitations (Bishop and Herron, 2015, Norman, 2010).

Inter-observer agreement and reliability

In studies I-IV we performed dual observations with application of the instruments to quantify the consistency between the observers in the study group. In studies using observations of quality and safety, internal validity is a key aspect of data consistency between different observers and occasions. At 16 of the 42 observations, dual registrations were made by two members from the study group who independently assessed and rated the MDTMs to allow assessment of inter-observer agreement and reliability.

Inter-observer variability (IOV) or inter-observer agreement (IOA) is based on the difference in the measurements between observers and describes the similarity between different observers measuring the same aspect. This can be quantified with measures such as Cohen´s kappa value, which calculates the possibility that the agreement occurs by chance. This is a more robust measure than a calculation of percent agreement (Gisev et al., 2013, Bobak et al., 2018, Walter et al., 2019).

Inter-observer reliability (IOR) or inter-rater reliability (IRR) measures conformity in parallel observations and determines to what extent data represent *true* observed activity in general or are in some way observer biased. If IOR/ IRR is high, the observers are interchangeable, and the data are free of observer bias. Levels of agreement between measurements are scored 0-1, with values below 0.5 indicating poor reliability, 0.5-0.75 moderate reliability, 0.75-0.90 good reliability, and above 0.90 excellent reliability (Gisev et al., 2013, Koo and Li, 2016, Bobak et al., 2018, Walter et al., 2019).

Questionnaire data

The questionnaire used in study I was developed by the study group, with inspiration from the approach and questionnaire in international studies that aimed to evaluate participants' views in local/regional MDTMs (Lamb et al., 2011B, El Saghir et al., 2011, Saini et al., 2012). A pilot questionnaire was performed on local MDT participants.

The questionnaire contained 14 questions on various aspects of the national MDTMs. The respondents were asked to rate agreement/disagreement on a seven-point Likert scale, where 1 corresponded to full disagreement and 7 to full agreement. The questionnaire was established in the SurveyMonkey engine and

distributed by email to 241 health professionals participating in national MDTMs in Sweden. Two reminders were sent within a period of two months.

In total, 125 (52%) participants responded. Although acceptable and at a level of many questionnaire studies, the response rate is on the lower side. Although we received lists of team members' email addresses, we do not know whether these members indeed regard themselves as part of the MDT and cannot exclude that ancillary staff may have disregarded the questionnaire since they may not regard themselves as key MDT members. The questionnaire also gathered free-text comments, which have been separately analysed using content analysis (Rosell et al., 2020).

Free-text quotations

During the observations of regional MDTMs, members of the study team noted in free text all occasions where MDT members mentioned or referred to patient-related aspects. This could relate to any information, from personal aspects to profession, social context, psychologic aspects, or other patient-related comments. Open notes were collected on all verbal statements related to 336 patients during 30 regional MDTMs. Three MDTM observers from the study group collected these data. All information on patient characteristics and patient-related factors, such as symptoms, comorbidity, physical and psychological status, family relations, and occupation, stated by the MDT participants during the case presentation and case discussion were gathered on a standardized study scheme.

Collected notes were initially analysed in an inductive process. Two researchers individually read the quotations, coded them, and identified common themes, and then categorized the themes into nine sub-categories inspired by a former study (Restivo et al., 2016). At seven of the 30 MDTMs, individual registrations were generated by two observers, resulting in overlapping observations from 101 of the 336 patients. Concordance was defined as the two observers identifying the same information and classifying it into the same distinct categories.

Patient file review

The data collection in study V was part of a validation process of the prostate cancer CPP performed by RCC South in 2021. Similar validation processes have been performed for other CPPs in various diagnostic areas to follow up on goal completion.

The patient files from 364 men with prostate cancer diagnosed through the CPP in 2020 were reviewed, and individual-level health data corresponding to quality parameters and waiting times were collected for the validation process. Data corresponding to the MeDiC instrument items, including data on comorbidity, psychosocial factors, stage of disease, lymph node involvement, and presence of metastases, were collected and used in study V.

Data analyses and statistical methods

Data presentation formats

Descriptive statistics were used to present baseline characteristics in tables in studies I-V.

To present data from Likert-type scales, we used stacked bar charts in study I of the distribution of the overall scores from MDT-MOT and MDT-MODe. The use of 0.5 intervals in the stacked bar charts was motivated by the use of the mean score from the two observers for each aspect evaluated. An overview of the distribution of the assessment instrument scores (mean/median) scores was presented in a box plot showing the evaluated 14 parameters of MDT-MODe in study II.

In study III, a differential plot presented the inter-rater agreement in MDT meetings with double observations and the individual ATLAS scores for the various domains with the median values marked for each evaluated aspect presented in a plot format.

Odds Ratios (ORs) were depicted in study IV to visualize whether comorbidity, physical information, psychological information, and non-medical information varied by sex, age, or by the MDT.

In study V, the influence of the various MeDiC items was plotted in descending order and the scores were further correlated with clinical case selection based on the difference in proportion scoring between the discussed and the non-discussed groups. Box plots were used for depicting distribution of MeDiC scores in different risk groups of prostate cancer.

Statistical methods

Data processing and statistical analyses were performed with the statistical software R version 3.2.2 (study I-II), 3.6.2 (study IV), and 4.0.5 (study V). The

Stata 16.1 application was used in study III and SAS, release 9.4, was used in study II.

In study I, IOV using correlation coefficient estimates was analysed for data collected from the MDT-MOT and MDT-MODe instrument by the two observers from the study group at the nine national MDTMs. For MDT-MOT, the total meeting scores from each participant were used. For MDT-MODe, IOV was estimated for each aspect based on all cases rated, followed by a total estimate of IOV for the tool as a whole.

In study II, IOR was assessed using the parametric intraclass correlation coefficient (ICC) and the weighted kappa statistics. Inter-observer agreement, (IOA), was assessed by mean differences with 95% limits of agreement and proportion with differences of more than two scale points.

Linear mixed models with observer, patient and MDT as random components were used to assess the distribution of scores according to patient and team characteristics including, sex, age, case order and leadership scores, while also controlling for observer. MDT-MODe data were correlated with case order during meetings with data dichotomized into the first nine cases discussed, versus subsequently discussed cases. To correlate MDT-MODe data on quality of case information and contribution in case discussion with the leadership skills at MDTM, the ATLAS scores were dichotomized at the median.

IOA were analysed using a one-way mixed-effects model as a total for score between dual observers and independently for each observed domain in study III. The mean ATLAS scores for the various domains are presented in a table with overview of ICC and mean and median ATLAS scores for the 12 aspects evaluated. The individual ATLAS scores were presented in plot format with the median values marked for each evaluated aspect.

In study IV, four multiple logistic regression models were used to assess the relationship between available information related to comorbidity, physical status, psychological status, and nonmedical information. The response variable was an indicator of whether information was available. Our independent variables of interest were the patients' age, gender, and MDT team. Adjusted odds ratios (OR) and corresponding 95% confidence intervals (CI) were used as inference for all variables in the models.

In study V, the items comprising the MeDiC instrument were collected from clinical record data and a total MeDiC score was computed for each case. Descriptive statistics of the study sample used Student's t-test with significance level set at 0.05. The MeDiC scores were correlated to clinical case selection for MDTM discussion using the difference in proportion falling into the discussed and the non-discussed group, respectively.

Methodological considerations

MDTM selection

For study I, national MDTMs were selected. The MDTMs should have been established and should be running on a stable weekly basis. All MDTMs were, however, quite new and may not have fully optimized their meeting structures. The national MDTs for penile cancer, anal cancer, and vulvar cancer had participation from two to four national centres with a total of 10-25 participants from different professions at each meeting. The observers physically participated in the meeting at the Lund University Hospital and had the other meeting participants available on video connection. The basic meeting concept was similar, although the teams showed minor differences in meeting formats, which is also reflected in the results obtained. Though slight differences were observed, we feel that selection of three national teams fulfilled our needs to draw conclusions on national MDTM feasibility and basic function. We cannot exclude, though, that similar meetings in different fields, such as, paediatric cancer, advanced oesophageal cancer, and sarcoma, would have provided other and complementary insights.

For studies II-IV, the regional MDTs for soft tissue sarcoma, hepatobiliary cancer, and brain tumors were selected due to complete MDTs in various diagnostic areas, well-established MDTM structures and an interest in participating in team development. Herein lies an inherent bias in the selection of teams that were willing to participate in evaluations of team function and leadership. Although we did not encounter teams that were unwilling to participate, such teams could potentially gain the greatest benefit from this type of evaluation. The MDTMs selected had a mean of 10 cases, which is a relatively modest case load compared to meetings on breast cancer and colorectal cancer, for example. This could potentially influence the results in that there was more time available per case discussion, which could reflect more complete discussions and broad participation. Using MDT-MODe, which rates each individual case, the results are generated from a case mix, and we did not have a mechanism to separately study standard versus complex cases.

For study V, we selected newly diagnosed prostate cancer, which was motivated by clinical needs to case selection in this diagnosis and also because of data availability. We deliberately chose a diagnostic area other than colorectal cancer, breast cancer or gynaecological cancer since these diagnoses had been part of the MeDiC development and our aim was to evaluate instrument performance in another diagnostic setting. An alternative option could of course have been to evaluate the same diagnoses in the Swedish health-care setting and compare it to the British setting (Soukup et al., 2020A).

All MDTs had well-defined meeting structures and established referral guidelines, and they comprised complete multidisciplinary and multiprofessional teams that considered a range of diagnostic and treatment-related options within surgery, radiotherapy, and medical oncology.

Research setting and timing

The studies were performed in Swedish health-care, for study I on a national basis and for studies II-V on a regional basis. The setting was in all cases a university hospital, which represents tertiary referral centres. Further studies would be relevant to compare MDTs and MDTMs between regional hospitals and university hospitals as well as MDTMs within the same diagnostic area between different countries. Not least, referral principles, meeting structures, principles for team evaluation and measures to develop high-quality efficient decision-making would be relevant to captures to share experiences. Studies II-V are single-centre studies, which limits the generalizability.

The national MDTMs had been established within two years of the study period and may not have had sufficient time to optimize their MDTs. The observations were performed from 2017 to 2019, prior to the Covid pandemic, which thereafter prevented further observations due to restrictions of participants at MDTMs and visits to health-care units during 2020-2021. Study V was for this reason replanned as a retrospective review, though a prospective approach would have been preferrable.

Methodology

The study group overall found non-participatory observational assessment to be an efficient and structured method for data collection. Drawbacks include a certain subjectivity in the scoring, though the scoring guides provided by the tools have been found helpful and clear. Yet, we do demonstrate a certain, though limited, discordance in scoring. Perhaps more important than the actual score is the notion of stronger and weaker areas for the MDT to discuss and implement improvement actions.

Observational assessment is somewhat time consuming since the observers need to participate in the entire MDTM. On the other hand, such observational assessment in an MDT other than the one a health professional normally attends may be educational and provide new insights into alternative case management and team arrangements. Observational assessment could thus be applied in twinning projects between MDTs that collaborate in development and improvement initiatives.

Study I provided a specific challenge in that the observational assessment occurred within the physical environment of one team, whereas the other teams were online.

Potentially, observational assessment could have been made through an independent online connection, however, that was not technically feasible at the time of the study.

The assessment of quality of case presentation and case discussion at MDTMs may also be influenced by the observers' opinions on what constitutes complete and high-quality case information or case discussion. The observers in our study were health professionals (physicians and a nurse). Observations by other experts, including leadership and teamwork experts, could be interesting in order to evaluate the impact of preconceptions. Additionally, some meetings are fast-paced, and it may be challenging to capture all information provided, especially in cases where the information is not provided in a structured and orderly way.

Observers need to be familiar with the instruments, the different aspects evaluated, and the rating system. In this regard, it may be advisable to hold training sessions before starting actual data collection in a study format. This may also motivate double observations to calibrate different members from a study team. We carefully studied background information and instruments and shared experiences after the first observations but did not formally perform pilot observations.

The so-called Hawthorne effect is a described limitation of direct observational studies. In the 1920's environmental factors were studies at the Hawthorne Electrical Company in Illinois, USA. The factory workers tended to change their behaviour when observed during the study, which implied data collection bias. Subsequent research on the Hawthorne effect has not been able to establish the mechanism, magnitude, and consequence of behavioural modifications during observational studies (McCambridge et al., 2014, Sedgwick and Greenwood, 2015).

The MDTM represents an environment where various experts, team members, and visitors participate. Our experience was that our presence was often noted and commented on at the start of the meeting, whereafter the team rapidly seemed to conduct the meeting according to routine without taking any notice of the observers. To minimize influence, the observers were physically located at the back of the room and collected data in silence. Data collection for studies I-IV took place over six months, covering several meetings with different team members and chairs. The observers were recognized as health professionals and colleagues by the MDTs but were not regular team members and did not have specific professional skills in the areas observed.

Study sizes

In study I, MDTs for penile cancer, anal cancer and vulvar cancer were considered to have sufficient patient volumes with a range of 4-14 cases per MDTM to apply the observational instruments MDT-MOT and MDT-MODe. All patients

discussed were assessed by two observers, which resulted in a total of 134 observations to analyse in study I. The study samples are comparable to those in other international studies (Lamb et al., 2013C, Shah et al., 2014, Jalil et al., 2014, Gandamihardja et al., 2019, Lumenta 2019)

In studies II-IV, we aimed to collect >100 cases for each MDT to obtain a solid pattern from each team. The study samples are comparable to those in other international studies in the field (Lamb et al., 2011D, Jalil et al., 2014, Shah et al., 2014, Jalil et al., 2018, Gandamihardja et al., 2019, Lumenta et al., 2019)

In study V, data from 364 prostate cancer patients were used for MeDiC evaluation. This was comparable to the patient groups of 185 colorectal cancer patients, 241 breast cancer patients and 396 gynaecological cancer patients in the original development study from the UK (Soukup et al., 2020A).

Choice of instruments

Our studies are, to the best of our knowledge, the first to apply the instruments MDT-MOT, MDT-MODe, ATLAS, and MeDiC in Swedish cancer care and are also among the first to apply these instruments in the diagnostic settings studied. Our aims differed between the studies, which motivated the selection of various instruments, from overall MDTM function to leadership and possibility for case selection.

MDT-MOT was applied in study I to assess overall meeting performance and link it to the measured quality by MDT-MODe of each case discussed in the national MDTMs and to the participants` views from the conducted survey.

MDT-MODe was applied in the national and regional MDTMs in studies I-II to measure the quality of case presentations and case discussions in these settings. The QAT has been used in other countries and diagnostic areas which allows some comparisons with international data (Lamb et al., 2011D, Jalil et al., 2014, Seretis et al., 2014, Shah et al., 2014, Hahlweg et al., 2017, Gandamihardja et al., 2019, Lumenta et al., 2019).

The ATLAS and MeDiC instruments applied in studies III and V were not previously tested in health-care settings other than the UK or in diagnoses other than the ones used for development of the instruments (Jalil et al., 2018, Soukup et al., 2019). The QATs provide more granular information on leadership and case complexity than, for example, MDT-MOT and MDT-MODe used in studies I and II for further observations of these aspects of MDT work. Our applications in Swedish health-care and in new diagnostic settings thus assess feasibility and reveal MDTM function in the Swedish setting.

Strengths and limitations of the studies

Table 3. Summary of strengths and limitations of the studies with regard to setting, design, methodology and data analysis.

	Strengths	Limitations
Context/ setting	• Swedish cancer care represents new settings for MDTM evaluation with the instruments applied • MDTs studied; new diagnostic areas for MDTM evaluation and newly established national MDTMs • First application of the ATLAS and MeDiC instrument in another health care system and diagnostic areas • Validation of MDT-MOT and MODe in a new setting and new diagnoses • Complete, multidisciplinary and multiprofessional MDTs	• Swedish cancer care limits generalizability • Norms and routines differ between countries and hospitals, the results are interpreted relative to the healthcare context studied
Study design	• Prospective data collection for studies I-IV • Non-participant observational assessment and questionnaires provide combined analysis of team members' subjective views and objective evaluation • Various MDT and MDTM aspects studied • Data collection from various MDTs, settings, and diagnoses • Dual observations for assessment of inter-observer variability	• Retrospective data collection in study V • Three selected national MDTMs observed, observations limited to three meetings • Standard versus complex cases not separately analysed • Individual chairs not assessed
Observational assessment and questionnaire data	• All instruments used rigorously developed • Four different instruments used • All observers health-care professionals and experienced MDTM participants	• Only information provided or referred to during the MDTM considered, though relevant information on e.g., comorbidity and patient-related aspects could be available elsewhere • Risk of Hawthorne effect • Limited response rate of 52% in questionnaire study • Limited input from nurses and MDTM coordinators prevents subgroup analysis
Data collection and data analysis	• Experienced, dedicated reviewer ensures consistent data collection for MeDiC • Statistics expertise involved in analyses • Double data collection by two observers in 16/42 MDTMs • High inter-observer agreement of 93% and consistent identification of information categories • Identification of strengths and weaknesses in MDTs/MDTMs • Composite scores fit well with results from previous studies	• Instruments new to the study group implies learning curve for scoring • Instruments do not provide detailed information on team performance related to communication, team interaction, discussion climate, or quality of decision-making • Data based on the MDTMs observed and on the cases identified in the prostate cancer study • Limited number of double observations renders inter-observer variability somewhat uncertain

Strengths and limitations of the studies are summarized in table 3 and are presented in detail below.

Norms, culture and routines differ between countries, health-care settings, and hospitals. The Swedish cancer care context is valuable for this health-care system but may limit generalizability. Our results, however, were comparable to the results from similar studies in other countries, including Germany, France and the UK (Lamb et al., 2011D, Jalil et al., 2014, Seretis et al., 2014, Shah et al., 2014, Hahlweg et al., 2015, Hahlweg et al., 2017, Restivo et al., 2016, Lane et al., 2019, Gandamihardja et al., 2019, Lumenta et al., 2019).

Studies I-IV were conducted prospectively, whereas study V was retrospective. Prospective data collection is a strength but for practical reasons it was not possible in study V. Overall, the studies contribute to identification of strengths and weaknesses, which can be translated into opportunities for MDT and team development. In study I we also combined team members' subjective views with objective evaluation using an observational instrument to identify areas of agreement and disagreement.

At present, 18 QATs are available (Brown et al., 2022). Methodological development is good but application in new settings is needed for evaluation. The instruments used in studies I-III, MDT-MOT, MDT-MODe and ATLAS, were at the time fairly new to the study group, and the evaluators may still be in the learning curve to some extent.

The observations of the national MDTMs in study I were limited to three MDT meetings per diagnosis, whereas ten to twelve meetings were observed for the regional MDTMs.

Observational data were analysed for inter-observer variability and reliability with documentation of favorable inter-observer agreement for the instruments MDT-MOT, MDT-MODe and ATLAS. Double observations with independent data collection in one-third of the cases in study IV showed a 93% agreement with consistent identification and reproducible classification of information categories. On the other hand, the number of double observations was limited to seven of the 33 observed regional MDTMs in study III, which makes interobserver agreement with ICC estimates uncertain.

Data analysis was performed with support from expert statisticians and, overall, the results are overall comparable to observations in other studies.

For the analyses using MDT-MOT, evaluating the MDTM as a whole, the total meeting score from each participant was used and the scores are in line with those in a former study (Harris et al., 2016).

The composite scores in the MODe observations in study II fit well with results from other international research teams (Lamb et al. 2011B, Jalil et al., 2014, Lumenta et al., 2019, Gandamihardja et al., 2019). The MDT-MODe instrument does not provide information on team performance related to communication, team interaction, discussion climate or quality of decision making as a whole. A general weakness is that we did not discriminate between standard or complex patient cases, which could have been relevant in assessing whether complex cases receive increased attention, more comprehensive case presentations, and in-depth case discussions.

The ATLAS instrument was applied in three different regional MDTs with different leadership principles and different professions chairing the MDTMs. The ATLAS instrument does not provide assessment of aspects of as team culture and team communication and were not evaluated in-depth in study III.

The response rate of 52% (125/241) for the electronic questionnaire in study I can be an expression of self-selection to some extent, depending on MDT members' interest in the topic of the survey as well as their propensity to respond to those types of questions. We received a limited number of questionnaire responses from nurses and MDTM coordinators, which precluded subgroup analysis of different health-care professionals' views.

The analyses of patient-related information in study IV were designed to map information but did not link these to a potential effect on decision-making quality, implementation of recommendations or patient outcomes. Information on, for example, comorbidity, patient characteristics and patient preferences could be available elsewhere but not mentioned in case presentations overheard in the observations.

Study V is the first study using the validated MeDiC instrument for case complexity outside of the UK and has not previously been applied to prostate cancer. The study included patients diagnosed through the CPP, managed in different health-care settings, and referred to the same virtual, regional MDTM. The reviews of the patient files for the validation of the prostate cancer CPP and then further used in study V were conducted by a dedicated and experienced reviewer to ensure consistent data collection correlated to the MeDiC items. The data in study V were collected within a quality and validation project of the prostate cancer CPP, which may imply missing data, due to lack of data in the records on comorbidities and psychosocial circumstances, for example. The focus was on prostate cancers, newly diagnosed through the CPP and did not evaluate prostate cancer patients with local recurrences or metastatic disease.

Ethical considerations

The studies were ethically reviewed and granted permission by the regional or national ethics committees (registration numbers 2016-195, 2019-04254 and 2021-01031).

The MDTM chair of each MDT was introduced to the study protocol and was asked to investigate their MDTs' interest in participating. All teams responded positively. Written consent was provided by the team leaders on behalf of the MDTs, and the study participation was also anchored in union meetings. In alignment with the ethical permission, written informed consent was obtained from the MDT chairs, whereas the other MDT members were orally informed of the study aims prior to the observational assessment. This approach was chosen for practical reasons since team members could vary between meetings.

The health professionals attending the MDTMs observed were orally informed about the overall aim, data collection, and use of instruments, and they had the option to opt out of the observational assessment studies. The detailed instruments were not shared with the MDTs prior to data collection in order to avoid the risk of information bias. MDT members thus were aware of our analysis of team function and roles but did not have information on the specific parameters, rates or aspects studied. The team members confidentiality was protected; no names or any personal information was collected about the individual health professionals. The information collected could not be traced back to an MDT participant, except for the study of leadership aspects using ATLAS in study III. However, here as well, several different chairs led the MDTMs during the study periods, which implies that the data can be traced back to a group of team leaders. All patient data were handled anonymously and presented at a group level. Identification of individual patients is not possible, and no names or personal numbers were noted.

Following studies II-IV we held meetings for each team and provided feedback on the results on a team basis. During these meetings the instruments used were presented and the team-specific information was shared, whereafter the team members discussed the results, reflected on the outcome, and came up with suggestions for improvement and further development.

The invitation to respond to a questionnaire in study I was sent by email with attached study information to all registered team members for the Swedish national MDTMs. Responses were obtained from 125 individuals who agreed to participate in the survey. Two reminders were sent within a period of two months.

Overall, it is our view that the ethical risks with data collection and analysis from MDTMs is considerably smaller than the risk of not evaluating and improving the MDTMs. Similarly, we believe that sharing information on experiences from the establishment of national MDTMs is important to inspire other health-care areas

and systems to adopt such approaches. The shortcomings identified, including provision of valuations and lack of patient-related information during case discussion and could potentially reduce patients trust in and respect for the health-care system. In this regard, it is important to initiate actions to improve the shortcomings identified. The study team initiated this process through the joint MDT feedback meetings.

Results and Discussion

The following presents the general results from studies I-V. The results will then be presented and discussed in relation to the subheadings of this thesis: case discussions, patient selection, and leadership, followed by a discussion on evaluation of MDTMs.

General results

In the 42 MDTMs observed, treatment recommendations were reached in 88% of the case discussions; in 61/67 of the cases in the national MDTMs and in 303/346 of the cases discussed in the regional MDTMs (studies I- II).

Observational assessment was found to be a feasible and efficient method to evaluate MDTMs. The instruments applied were overall found to structure the work, focus the evaluations, and provide an overview of each MDT's strengths and weaknesses. In relation to the specific quality-assessment instruments, we found the following:

- All instruments could feasibly be applied in the context of Swedish cancer care and could be used by study team members with a limited amount of training (studies I-III and V).
- MDT-MOT and MDT-MODe effectively capture and rate various aspects of MDTM members' contributions to case information and case discussion and provide an overview of team function (studies I-II).
- ATLAS captures and evaluates various aspects of leadership in the diagnostic areas studied (study III).
- MeDiC could feasibly be applied in cases with patients with prostate cancer to evaluate case complexity, and it showed correlation with case selection made in clinical practice (study V).

Studies of MDTM participants' views and experiences revealed the following:

- Team members provided positive feedback on individual clinical skills and team competences, but more negative feedback related to technology,

communication of recommendations and structures and principles for evaluation of MDT and MDTM work (study I).

- Participants found patient perspectives and comorbidity to be adequately considered during MDTMs, whereas observational assessment, open notes and ratings based on a standardized instrument revealed weaknesses in these aspects (studies I, II and IV).

Case discussions

The discussion of patient cases during an MDTM can broadly be divided into a case information part and a case discussion part (figure 4 and 8). Optimally, all relevant information should be provided, examinations demonstrated for a complete overview, and the clinical questions posed, whereafter a case discussion should consider treatment options. We explored information content and team members' contributions in various and complementary ways in the five studies.

- Patient history, including presentation of current disease and to various degrees previous diseases, radiology and histopathology were the predominant information sources at the 42 MDTMs observed (studies I and II).
- Among the team members, the chairs, surgeons and radiologists were the main contributors to case information (studies I and II).
- Information on patient-related aspects, such as, patient views and psychosocial aspects, was provided for a minority of patients. These aspects obtained low scores when assessed with MDT-MOT and MDT-MODe. Low scores (1-2) were provided in 72-95 % of the cases discussed (studies I, II and IV) and such information was recorded in 11% of newly diagnosed patients with prostate cancer (study V).
- Information on comorbidity was provided in 48.5% of the cases and referral to non-medical factors was done in 4-8% of the cases discussed in the regional MDTMs. In 32% of newly diagnosed prostate cancer patients information on comorbidity was recorded (studies IV and V).
- Patient preferences were mentioned or reported on in 4% of the cases in regional MDTMs (study IV).
- Case discussions were predominantly influenced by the chair, surgeons, and oncologists with limited contribution from nurses (study I and II).
- Cases presented in the later part of the meeting showed a tendency for lower scores related to completeness of case presentations (study II).

- The patients presented and discussed were not routinely considered for clinical trial eligibility (studies I-III).

Overall MDTM function

Our studies overall revealed well-functioning MDTM services. Application of MDT-MOT (figure 5) to the national MDTMs showed high scores for the clinical decision-making process, teamwork and culture (study I, figure 2). Availability of case history received somewhat lower ratings from the participants in the national MDTMs, which may suggest a need for structures to ensure availability of complete and relevant information at the time of the MDTM (study I, figure 1).

Most MDTs continuously develop their MDTMs with updated referral guidelines, team participation and meeting structures, for example. Formalized support from hospital leadership with access to HR support and process development skills could be relevant to consider in order to boost such actions. At present, having treatment recommendation decided at an MDTM is a quality indicator in most clinical registries in Sweden, but measures such as lack of provided treatment recommendations, disparate recommendations and lack of key information are not registered. Also, there are no requirements or structures for consideration of patient perspectives, joint team training, or leadership development. In the UK, yearly MDTM audits and MDT surveys investigate services and experiences and have contributed to gradual improvement and awareness of the importance of MDT work (Saini et al., 2012, Balasubramaniam et al., 2020, Soukup et al., 2018)

Team members' contributions to the case presentations and case discussions

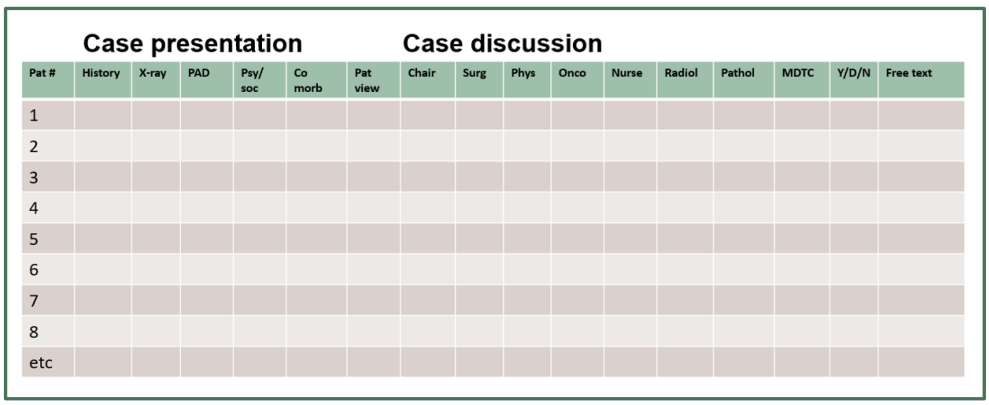
Our observations show that case information and case discussions are functioning overall well, but they also reveal an uneven contribution from team members, with limited contribution from nursing staff and other representatives from care professions. Patient history and findings in radiology assessments and histopathology were the predominant information sources at the MDTMs observed. Such key biomedical information is required to assess possibilities for surgical resection and to evaluate alternative treatment strategies using radiotherapy or medical oncology, for example. Further, patient-related aspects and consideration of eligibility for clinical trials is evaluated as insufficient.

Presentation of case history received high scores using MDT-MODe (study I, figure 3, study II, figure 1). The main contributions to patient information came from the MDTM chair, surgeons and radiologists (study II, figure 1). In the national MDTMs, oncologists and pathologists also showed significant contributions (study I, figure 3). Contributions to case discussions were predominantly from surgeons, the chairs and oncologists, followed by radiologists and pathologists (study I, figure 3 and study II, figure 1). Contributions to case discussions from radiologists and pathologists are naturally more relevant in the

case presentation, whereas their input to case discussions mainly relate to additional questions or diagnostic clarifications.

In recent years, many MDTs have broadened participation to include nurses, physiotherapists, psychologists, and research coordinators. Attending nurses and other health professionals seldom contributed to the case presentations, which was reflected by low MDT-MODe scores (study I, figure 3 and study II, figure 1). The MDT coordinator collects information, prepares for the MDTM, and then ensures that the meeting flows smoothly rather than engaging in each case discussion, which reflects the low scores for the MDT coordinator. Variable contributions from team members are likewise reflected in the participants' scores, with variable responses to the question on involvement in the case discussions and reported requests for the participants' competences (study I, figure 1).

It has been suggested that the quality of MDT-based decision-making is enhanced when case presentations include all relevant information and also consider other aspects to provide a holistic picture of the patient's situation. Such comprehensive case presentations have been proposed to increase the likelihood of implementation of the presented treatment plan (Lamb et al., 2011B, Saini et al., 2012, De Ieso et al., 2013, Shah et al., 2014, Hollunder et al., 2018, Nazim et al., 2018, Lumenta et al., 2019, Gandamihardja et al., 2019, Soukup et al., 2020B, Ichikawa et al., 2022, Winters et al., 2021, Geerts et al., 2021). Extended contributions from MDT members have been observed in complex cases, which may reflect a need to focus on key aspects from directly involved professionals in standard cases and extend the discussion with additional aspects and input from other team members in more complex cases (Lumenta et al., 2019, Soukup et al., 2020B, Winters et al., 2021). In our studies we could not discriminate between standard and complex cases, which would have been relevant for such analyses.



	Case presentation						Case discussion									
Pat #	History	X-ray	PAD	Psy/ soc	Co morb	Pat view	Chair	Surg	Phys	Onco	Nurse	Radiol	Pathol	MDTC	Y/D/N	Free text
1																
2																
3																
4																
5																
6																
7																
8																
etc																

Figure 8. MODe assessment scheme applied to each case presented at MDTM (Lamb et al., 2011B)

Impact from case order

Patient case order in the MDTM may influence the quality of case discussion. In particular, cases discussed in the latter part of the meeting may be affected. The quality of decision-making has indeed been reported to decrease over time during the MDTM, so-called decision-making fatigue (Soukup et al., 2019). The result is limited information, lower contribution, and a reduced ability to carry out effective decision-making (Jalil et al., 2013, Lamb et al., 2013A, Soukup et al., 2019, Soukup et al., 2020A, Warner et al., 2021). The MDTMs in our study were typically limited to 10-15 cases, which is a low-moderate case burden from an international perspective. Yet, in the regional MDTMs a tendency to contribute less to case discussions in the latter part of the meetings was observed (study II, table 2). In an intervention study by Soukup et al in 2019 a ten-minute break in the middle of long meetings was found to positively influence the ability to make decisions in the second half of the meeting. The MDT should develop strategies to consciously strengthen the quality of the meetings and thereby protect patient safety by ensuring that the last patient on the case list is treated under the same terms and conditions as the first patient listed.

Comorbidity and treatment-limiting factors

In study IV, information on comorbidity was provided for 48.5% of the patients (range 21-71%) (study IV, table 1). We did not identify differences in the reporting of comorbidity related to sex or age (study IV, figure 1). Significant variability was observed between the diagnostic teams, which may reflect the diagnostic setting. In the MDTM for the soft tissue sarcoma patients, comorbidities were rarely referred to and may be less relevant for more limited surgery, whereas in the hepatobiliary cancer MDTM, comorbidities were typically reported and may be decisive for the possibility to perform liver surgery and/or tolerate neoadjuvant treatment required prior to surgery. The lack of complete information on comorbidity may impede the ability of MDT members to make treatment recommendations (Hollunder et al., 2018, Nazim et al., 2018). Our findings support the note on this.

MDTs are reported to overrate their insight into patients' circumstances, which is in line with the findings in study I (Lamb et al., 2011B, Hahlweg et al., 2017, Stairmand et al., 2015, Nazim et al., 2018, Lane et al., 2019). An increasing number of patients outlive several malignancies, and previous treatment can influence choice of the new treatment, due to reduced organ function or overlapping radiotherapy fields, for example. Information on comorbidity may influence MDTM recommendations, and patients with known comorbidities are more likely to be recommended for further investigations and evaluations to determine, for example, whether the patient is fit for major surgery.

Inadequate and insufficient information on comorbidity and treatment-limiting factors is a well-known barrier to decision-making, with the risk that the suggested

treatment recommendation cannot be implemented in the next step (Jalil et al., 2013, Stairmand et al., 2015, Jung et al., 2018, Geerts et al., 2021). Factors such as disease progression and comorbidities are major reasons for non-implementation of MDTM recommendations in about 20-30% of all patients discussed (De Ieso et al., 2013, Kinnear et al., 2017, Ameratunga et al., 2018, Hollunder et al., 2018, Ichikawa et al., 2022). To prevent the risk of non-implementation and to enhance MDTM efficacy and quality, access to complete biomedical information in combination with updated information on patients' current circumstances could further optimize the decision-making process (Hollunder et al., 2018, Ichikawa et al., 2022). The decision-making quality increases as the contribution to case discussions includes more holistic but pertinent perspectives of the patients' situation, which enhances the implementation of the suggested treatment plan (De Ieso et al., 2013, Hollunder et al., 2018, Nazim et al., 2018, Ichikawa et al., 2022). Our observations suggest that the MDTM should also be a place to discuss therapeutic limitations to support well-founded decisions for certain patients, for instance, those who are elderly or who have a poor prognosis (Hollunder et al., 2018, Ameratunga et al., 2018, Nazim et al., 2018, Rollet et al., 2021, Ichikawa et al., 2022).

Lack of information may be especially harmful in elderly, comorbid, or frail patients who may then not be suited for the treatment recommended. Indeed, 80% of the patients diagnosed with cancer diseases in Sweden are over 65, and an increasing number of patients are over 80 years of age when considered for cancer treatment. It has been shown that older colorectal cancer patients are less likely to be discussed at all at MDTMs (Holden et al., 2020, Foucan et al., 2021). The engagement of specialists in geriatric medicine and geriatric structured assessments of frailty can support well-founded treatment plans for older patients (Lane et al., 2019, Bolle et al., 2019, Ellis and Sevdalis, 2019). Engagement of nurses may also be relevant and has been shown to increase effectiveness of treatment planning for older patients with complex circumstances (Bridges et al., 2017). Better mapping of treatment alternatives and use of screening tools to determine biological rather than chronological age may be relevant to identify older patients that are fit and would benefit from treatment and avoid unnecessary toxic exposure to those who are not fit (Bridges et al., 2015, Lane et al., 2019, Holden et al., 2020). In the MDTMs in our studies, no such screening tools were applied.

Patient perspectives

Several studies have identified insufficient patient-related information, such as on societal factors, needs for assistance and help with transportation, and personal preferences, which may be a barrier to providing relevant recommendations with a high likelihood of clinical implementation (Stairmand et al., 2015, Kunneman et

al., 2015, Bridges et al., 2017, Hahlweg et al., 2017, Lane et al., 2019, Holden et al., 2020, Horlait et al., 2019, Ellis and Sevdalis, 2019, Geerts et al. 2021).

Patient perspectives were rated relatively high by the MDTM participants with 71% agreement to consideration of patient perspectives (study I, figure 1). This observation stands in contrast to the results from the observational instruments MDT-MOT and MDT-MODe, which both suggested a weak consideration of patient perspectives and low focus on patient-centred care during the MDTM discussions (study I, figures 2 and 3, and study II, figure 1). In the national MDTMs observed in study I, patients were known to responsible MDTM members and had typically been evaluated by the presenting physician. This partly differed from the regional MTDMs, where some patients had been seen by a team member, whereas others had been referred by colleagues or regional hospitals with limited personal information (studies II-III). The variability in case information in this regard was not formally addressed in our studies, but input in case presentation has been demonstrated to depend on whether or not the patient is known to the team (Lane et al., 2019, Hahlweg et al., 2017, Nazim et al., 2018, Yuan et al., 2018). Various studies as well as our own observations support the notion that MDTs frequently overestimate their ability to consider patient perspectives (Lamb et al., 2013A, Hahlweg et al., 2017, Nazim et al., 2018, Kočo et al., 2021).

Study IV revealed random mentions and references to patient perspectives and wishes (study IV, table 1). The identification of positive and negative valuations in 8.6% and 2.7%, respectively, of the cases presented at regional MDTMs calls for reflection in relation to the knowledge of patient preferences in 4% (study IV, table 2). The rationale for such valuations is not established and was not within the scope of our study. Similar observations have been reported by Restivo et al. (2016), who documented positive as well as negative valuations. Family relations were often mentioned in the context of a family member with a health-care occupation and relatives that were found to be demanding (Restivo et al., 2016). We hypothesize that mention of our findings of more or less irrelevant curiosities related to the patients are mostly done without specific aims or attention to its impact but could potentially raise the attention or engagement of team members to the specific case. Such valuations should, however, be avoided since the information does not provide added value to the decision-making process and could potentially harm a neutral treatment recommendation.

Sparse or missing information on patients' personal circumstances, such as physical and psychological status, relevant psychosocial circumstances, and patients' views on treatment, has also been identified in other studies (Hahlweg et al., 2017, Nazim et al., 2018, Lumenta et al., 2019, Gandamihardja et al., 2019). We found that information on physical status and comorbidity was provided in half of the cases discussed at the regional MDTMs studied. Information on psychological status was provided in less than 10% of the cases, and patient

preferences were mentioned in only 4% of the cases (study IV, table 1) and even less in the prostate cancer patients files (study V, figure 1). This is similar to observations in breast cancer MDTMs in the UK, where limited information on psychosocial aspects and views on treatment was documented (Gandamihardja et al., 2019).

The MDT-Quality Improvement Checklist (MDT-QuIC) with tick boxes was developed with the aim of supporting full discussion of each case. The checklist can be used during MDTM preparation as well as during the discussion to ensure comprehensive, holistic, and patient-centred clinical decision-making (Lamb et al., 2012A). Another checklist, the MCC checklist, has been used to support the quality of patient presentation at MDTMs, with a specific aim to promote referrals to different specialists such as specialist in fertility, genetics, plastic surgery, and mental health and to ensure the engagement of these extended team resources when expressed as needed (Corter et al., 2019).

Improved and updated information on patients' views of treatment options could optimize MDTM effectiveness and increase the likelihood of implementation of treatment recommendations. About 7-10% of the treatment plans recommended by MDTMs are shown not being implemented, and in one-quarter to one-third of the cases, non-implementation was due to patient preferences (De Ieso et al., 2013, Hollunder et al., 2018, Nazim et al., 2018, Ichikawa et al., 2022).

There is an increasing focus on and interest in follow-up of deviations from MDTM decisions and recommendations, although there is no clear definition of what constitutes a deviation; it is not clear, for example, how slight modifications of intentions versus a complete lack of implementation should be evaluated. Studies that have optimized MDTM information to also include patient-related data and information on patients' preferences have indeed demonstrated decreasing deviations (Taylor et al., 2010, Hollunder et al., 2018). Improvement points relate to responsibility among team members for having personal contact with the patient and for collecting key information on patient-related factors (Geerts et al., 2021). In the Swedish health-care system where patients diagnosed with cancer are assigned a specific contact nurse, the role of this nurse could include collection of such information for presentation at the MDTM.

More knowledge and better structures for how and when to consider patient preferences in the MDT decision-making process are needed. Holistic patient consideration and early recognition of potential barriers to treatment is an important basis for shared decision-making. and can help to ensure the implementation of treatment recommendations. It can, however, be questioned at what time point this could be secured, that is, whether these aspects should be considered during the MDTM or whether they should be deferred to a later discussion between the responsible physician and the patient. Defining the best possible system for this represents a task for all MDTs since recommendations on

treatment need to balance risks and benefits and should be targeted to and acceptable to the individual (Ameratunga et al., 2018, Lane et al., 2019, Nazim et al., 2018, Spinnewijn et al., 2020).

Patient eligibility for clinical trials

In the MDTMs assessed in our studies, patients were not routinely considered for inclusion in clinical trials (studies I-III, V). Consequently, this also received low scores using MDT-MOT (study I, figure 1), ATLAS (study III, figure 2) and MeDiC (study V, figure 1). Swedish MDTs have not typically included the clinical trial aspect in the case discussions. However, at the time of the MDTM, all clinical information has been collected and the multidisciplinary meeting as such constitutes an opportunity for systematic selection of patients who should be screened for treatment within clinical trials (Mano et al., 2022). If this aspect is considered, it could potentially also strengthen research collaboration within the MDT (Fallowfield et al., 2014, Miguet et al., 2019). A research group in the UK studied the impact of a one-day workshop on communication of clinical trials for MDTs and found a significant increase in the team members' communication skills, knowledge, and awareness of the teams' ongoing trials after the intervention (Fallowfield et al., 2014). More complex cases and frail patients are not always suitable or eligible for clinical trials, but clinical computerized decision support systems could enhance identification of patient data and all patients potentially eligible for a clinical trial (Patkar et al., 2012, Winters et al., 2021).

Provision of treatment recommendations

Treatment recommendations were provided in 91% of the case discussions in the national MDTMs and in 88% of the regional MDTMs (studies I-II). These rates are comparable to observations from other studies (Lamb et al., 2011B, Taylor et al., 2012B, Jalil et al., 2014, Gandamihardja et al., 2019, Lumenta et al., 2019). The most common reasons for postponing a recommendation are lack of key information or a new decision during the MDTM to ask for additional investigations (Stairmand et al., 2015, Kunneman et al., 2015, Holden et al., 2020, Geerts et al., 2021). Deferring patients to a new MDTM due to incomplete information implies inefficient use of resources, particularly related to preparatory time for radiologists and pathologists. At the next meeting, a new expert in these areas may need to review the material, with resultant extra workload (Nasir et al., 2017, Janssen et al., 2018, Geerts et al., 2021). To have an effective MDTM for all experts and resources involved, it is important to ensure that all relevant diagnostic workup is prepared with a set deadline for availability of key information. Here, the MDTM coordinator has a key role to ensure that all relevant information is available prior to finally accepting the patient for the MDTM.

In study I, 24% of the respondents scored low on guidelines for informing patients of the treatment recommendations from the MDTM (study I, figure 1). This aspect

is one of the key factors for the MDT to define for efficient and patient-centred care, although the practical handling may differ between teams. On the other hand, MDT-MOT-based evaluation provided high scores for post-meeting coordination, organization, and administration in the national MDTs (study I, figure 2). This discrepancy may suggest that teams, especially when geographically dispersed, may need to clarify responsibilities and safeguard procedures to inform new team members.

Technology

Technical issues are among those reported as challenging and suboptimal by MDT participants (study I, figure 1). This may reflect the quite recent establishment of these MDTMs and also the fact that these meetings run across health-care regions and have experienced difficulties related to connections and possibilities for sharing information (e.g., images) between regions. Easy access to technical support staff when relevant is essential to avoid costly delays of the MDTMs, since technical issues still frequently hinder their smooth operation (Lamb et al., 2011D, Janssen et al., 2018).

Well-functioning technologies that can easily show structured patient information and relevant pathology and radiology imaging, for example, are supportive for the MDTM process and have the potential to enhance the quality (Janssen et al., 2018, Winters et al., 2021). Further improvement in technical support such as digital data dashboards and decision aids could refine data collection, decrease preparation time, and support quality of information presented at MDTMs (Patkar et al., 2012, Janssen et al., 2018, Yuan et al., 2018, Pluyter et al., 2020, Mano et al., 2022).

One example is the Multidisciplinary meeting Assistant and Treatment sElector (MATE), an interactive clinical decision support system to facilitate evidence-based decision-making tested in breast cancer MDTMs with a concordance of clinician compared to computer decisions of over 90%, but with limitations in costs and storage of the increasingly large data volumes. The system is generic and can be applied in areas other than breast cancer (Patkar et al., 2012). The Clinical Decision Support System (CDSS) is another example that was developed and has been pilot tested to support decision-making at lung cancer MDTMs. The system presents relevant clinical data in an accessible view to ensure precision in diagnosis and TNM classification. It has possibilities for cross-validation of diagnostic findings to identify discordance between diagnostic tests and facilitate cancer staging according to diagnostic evidence, and it may also provide warnings for contraindications for unfavourable treatment recommendations (Pluyter et al., 2020).

Patient selection

In study V, we applied the case complexity selection aid MeDiC, which was found to be feasible and could effectively aid collection of information from patient files and provide an overall case complexity score.

- MeDiC was found feasible for screening of complex circumstances and supporting the clinical selection process to MDTMs.
- High-risk and low/intermediate-risk prostate cancer tumours presented different MeDiC profiles with correlations to clinical case selection to MDTM.
- Structured selection and standardized prioritization need to be targeted to the specific diagnosis and health-care setting.
- Definition of patient subgroups that stand to benefit most from full MDTM discussions can be supported by QATs.

Study V focused on newly diagnosed prostate cancer patients who had been referred and diagnosed through the CPP process. We observed significantly higher MDTM referral rates for patients diagnosed at regional hospitals compared to the university hospital (study V, table 2). Whether this is due to differently skilled expertise in regional and local hospitals, or whether university hospitals have established in-house expert panels that can substitute for an MDTM is not known, and further investigation into mechanisms that ensure equal access to expert opinions irrespective of health-care setting is needed (Hoinville et al., 2019, Warner et al., 2021, Kočo et al., 2021). The implementation and cut-off scores in MeDiC need to be defined by the specific cancer diagnosis and MDT (study V, figure 3).

With an increasing cancer burden and growing possibilities for treatment, the MDTM case lists as well as the discussions tend to grow longer, constraining MDT resources. In some MDTMs, caps that limit the number of patients that can be discussed have been implemented. Mechanisms to select patients likely to benefit most from MDTM discussion are therefore relevant and requested by MDTs. There is also a risk of treatment delay when waiting times to MDTMs rise due to lack of available expert resources, which naturally calls for balanced prioritizing within and between diagnostic areas (Hoinville et al., 2019, Balasubramaniam et al., 2020).

In several diagnostic areas in Swedish cancer care, including breast cancer, colorectal cancer, and sarcoma, all newly diagnosed cases are by tradition referred to MDTMs for treatment decisions. In other diagnostic areas, such as urological and gynaecological cancers, selected cases are referred to MDTMs, which is motivated by limited resources as well as agreement of defined standard cases,

where MDTM discussion is considered to provide limited rather than significant added value.

In Sweden, national treatment guidelines have been established for more than 40 cancer types. Some MDTs therefore rely on these guidelines for clinical handling outside of an MDTM. Typically, two or more specialists review the clinical files and sometimes also discuss the case to decide on treatment recommendations according to standard of care. National guidelines do not always support management of complex cases, which implies that complex cases may not be suited to a standardized approach.

Various strategies can be used to select and prioritize patients for MDTM discussions (figure 9). Structures for triaging cases to MDTM in advance and using the support of algorithms and screening tools and selection aids have been suggested to streamline work and reduce the MDTM workload (figure 9) (Winters et al., 2021). Less complicated cases could preferably be handled last or outside the MDTM by clear, evidence-based clinical guidelines and pathways (Jalil et al., 2013, Soukup et al., 2019, Lamb et al., 2013A, Hoinville et al., 2019, Warner et al., 2021, Tran et al., 2022). A standardized case selection process for MDTs that identifies and prioritizes complex cases for MDTM discussion, wherein standard cases are treated according to guidelines or are subject to more limited forms of cross-disciplinary evaluations, has been suggested (Soukup et al., 2020A, Winters et al., 2021). At present, MDTM case selection is predominantly physician-driven rather than systematic, which implies a risk of subjective treatment recommendations and MDTM referral based on available resources rather than patient needs (Corter et al., 2019, Walraven et al., 2019).

In order to triage cases for MDTM discussion a case review needs to be organized to ensure clear selection criteria (Soukup et al. 2020A, Warner et al., 2021). Such a review will by necessity also imply a certain use of resources, which should, however, be more modest than those required for a full MDTM. Indicators of case complexity are relatively stable across different tumour types, which is a basis for development of case complexity measures such as the MeDiC instrument (Soukup et al., 2020A, Warner et al., 2021).

Another example of efficient identification of complex cases is an electronic checklist developed in China. The checklist is described as supporting the MDTM preparations, with the cases intentionally classified into three subtypes according to grade of complexity: general, moderate, and complicated (e.g., serious comorbidities, several operations, distant metastases, emergency complications). This system demonstrated reduced time and cost in review of standard cases and spared the cost of collecting data several times, and it allowed physicians to focus on patient communication (Yuan et al., 2018).

Complex cases could be prioritized to be discussed first in MDTMs to ensure quality of discussion. It is reported that the quality of decision-making decreases at the end of long MDMs (Soukup et al., 2018, 2019). This tendency was also seen in our study II (table 2). Other studies have also shown that time constraints and increased workload negatively affect quality of decision-making (Hahlweg et al., 2017, Soukup et al., 2020A). Another model relies on joint specialist clinics or mini-MDTs, where at least two specialists from relevant disciplines review the case and recommend treatment without full access to a complete MDTM (Betschart et al., 2019).

Streamlining and patient selection raise discussions in MDTs and concerns about patient safety. Hence, implementation of streamlining should be followed up and scientifically evaluated. At the same time, it is important to allocate MDTM time and resources for the more complex situations, such as rare tumours or unusual histology, and for special situations such as very young patients, pregnant patients, and also older and frail patients (Bridges et al., 2015, Corter et al., 2019, Rollet et al., 2021, Warner et al., 2021). Effects and outcomes from streamlining likely differ between diagnoses and health-care settings, and future studies should address efficacy and safety of different configurations and processes (Rogers et al., 2017, Edney et al., 2020).

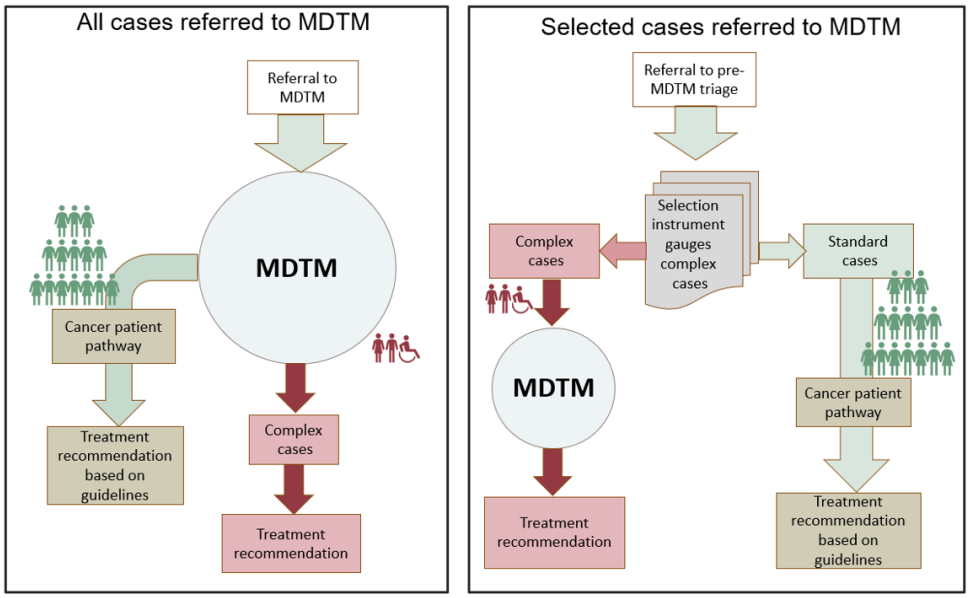


Figure 9 All patients reviewed at MDTM (left) and use of a selection aid to streamline work and reduce workload (right)

Leadership

Leadership perspectives were predominantly evaluated in study III, which applied the ATLAS instrument. Leadership aspects are, however, also part of the more general evaluation using MDT-MOT and MDT-MODe. In MDT-MOT, leadership represents one of the 14 aspects evaluated, and in MDT-MODe the chairs' contributions to the case discussions are evaluated. We found the following:

- Participants in national MDTMs rate leadership as well-functioning with 77% affirmative scores (study I).
- The chair had a predominant influence on the MDT discussions (studies I and II).
- The ATLAS instrument effectively captures various aspects of MDT leadership and chairing skills and is feasible to use for team development and leadership feedback (study III).
- Leadership skills scored high for time management, case prioritization, and treatment plans but lower for facilitation of case discussions, encouragement of team member contributions, and keeping the meeting focused (study III).
- Leadership skills correlated with MDTM quality based on MDT-MODe scores (study II).

MDT leadership influences teamwork and leads the MDT to provide treatment recommendations that are of high quality and of relevance to patients (Jalil et al., 2018, Mano et al., 2022). High-quality chairing and leadership skills are crucial to the decision-making process and to successful MDTM work, but they have received quite limited attention in cancer care (Soukup et al., 2018). Studies from teamwork in other health-care areas, such as operating rooms, emergency rooms, and intensive care units, have documented an impact on effective teamwork and patient safety (e.g., related to adverse events and critical incidents) (Manser, 2009). Based on MDT-MODe scores, we could conclude that leadership skills correlated with MDTM quality (study II, table 2). This suggests that a greater focus on such leadership skills as communication and coordination could improve the patient-centred and safety aspects of effective MDTs (Keats, 2019).

Leading an MDTM is a complex and multifaceted task. The team is skilled as well as heterogeneous. The Swedish national MDTs have developed a structure for rotating leadership in the MDTMs throughout the different expert centres (study I). Since the chair is responsible for meeting coordination and is not responsible for the care of all patients presented, the chair does not routinely present all cases in these meetings. Rotating leadership across different specialties and team members has been suggested to support an open discussion and broaden

involvement in the MDTM (Lamb et al., 2011C, Soukup et al., 2016A, Fehervari et al., 2021, Mano et al., 2022). Physicians from different specialities that develop their skills to chair MDTMs can improve the team performance by bringing new perspectives to the leadership (Lamb et al., 2011C). The schedule setting out who chairs the meetings could to a greater extent be planned on the basis of suitable skills and competence compared to planning other skill-driven tasks in health care to ensure efficient and high-quality meetings.

In the three regional MDTMs where we applied the ATLAS instrument, leadership varied somewhat. In the MDTMs for sarcoma and hepatobiliary cancer the responsible surgeon chaired the meeting, whereas an oncologist chaired the MDTM for brain tumours. The teams did not apply rotating leadership between specialties. It has been suggested that case presentations by the chair were less effective than presentations given by different team members, particularly in terms of interaction among team members and an open discussion climate. Research results support the chair as a coordinator who encourages team members' contributions to the discussion (Horlait et al., 2019). Such an arrangement where the chair facilitates and coordinates the meeting could also help the team to proceed with the agenda in a timely manner, ensure uniform decision-making, and ensure that all participants' viewpoints are taken into account when formulating treatment recommendations.

The chairing of MDTMs may be challenging due to dual tasks, as subject expert with senior experience and as team leader and coordinator. This can have a negative impact on performance if the chair is not aware of these dual roles (Jalil et al., 2018, Soukup et al., 2018). Lately, the use of video-based MDTMs with remote participants has increased. This has several advantages from equity of care and equal access perspectives, but it adds further complexity to the leadership role. The leader needs to be observant about inviting external team members into the discussion, and the technical solutions may sometimes disrupt the decision-making process (Shea et al., 2014, Janssen et al., 2018, Soukup et al.,2020B, Winters et al., 2021).

Some MDTs group cases within the meeting when different subspecialist experts attend selected parts of meeting when their input is needed (Hoinville et al., 2019). This is practised at the regional sarcoma MDTM in our studies, for example. Paediatric expertise is present at the beginning of the meeting, then the oto-pharyngeal experts speak, and so on. This can improve effectiveness and save clinicians time, but there is a risk of disrupting the meeting when staff is constantly coming and going, placing demands on the MDTM leader to keep the MDT focused. In our observation with the ATLAS instrument, the sarcoma MDT scored one point lower than the other MDTs on the observation item of keeping the meeting focused (study III, figure 2).

The ATLAS instrument for observational assessment aims to provide a multifaceted view of the different chairing and leadership skills that are relevant during MDTMs (Jalil et al., 2018). The instruments evaluated leadership aspects within 12 different domains which are defined to capture the complexity of the leadership task (figures 6 and 10). The results demonstrate highly variable scores between the different domains as well as the different teams (study III, figure 2). Compared to other instruments for MDT assessment, ATLAS provides more granular evaluation and specific feedback on leadership related to teamwork aspects and may thus provide valuable support to the teams in defining and prioritizing areas for development and improvement (Jalil et al., 2018).

Consistently high scores were documented for time management, case prioritization, summarizing case discussions, and ensuring the formulation of treatment plans. Weaker scores applied to communication, encouraging contributions from all team members, facilitating case discussions, keeping the meeting focused, leadership, and recruitment for clinical trials (study III, figure 2). The observations may reflect that many MDTs have performed structural improvements to ensure participation from key skills and availability of relevant materials to ensure efficient handling of a growing number of case discussions.

Modest scores were found related to the interdisciplinary aspect of chairing such as facilitating full team discussions and encouraging contributions from various team members. The variable and partly suboptimal scores demonstrated in the domains of communication, involvement of team members, meeting focus, and efficient leadership offer opportunities for improved teamwork and active involvement of non-medical professionals and nurses in the case discussions. MDTs could benefit from initiatives that focus on team culture, discussion climate, and feedback on communication and training. Leadership with a focus on team coordination and communication can empower professional interaction and support teams to attain more effective meeting structures. Mature and effective leadership and chairing MDTMs in a democratic team climate requires a complex set of personal and professional skills, which are not necessarily taught during medical education and specialization. Awareness of the complexity of the tasks and possibilities for observations and feedback and for targeted leadership training are relevant improvement points.

Health-care is by tradition hierarchical, and it is commonly observed that the most senior physician is scheduled to chair the MDTM. From estimates in the UK, 70-80% of MDTMs are led by a surgeon and 25% by an oncologist (Lamb et al., 2011C). This setting may counteract expression of deviating opinions or disagreement in the MDTM discussion. Future chairing of MDTMs could emphasize chairing as a skill-driven task to improve the focus and flow and widen the perspectives (Jalil et al., 2018). In aviation service, for example, the importance of non-technical skills has been highlighted and they are included in

training. They include cognitive, social, and personal resource skills, and they complement the technical skills and make an important contribution to efficient task performance and, not least, safety aspects (Flin and Patey, 2009, Ellis and Sevdalis, 2019).

The post-meeting administration and documentation process is often part of the chairing task and is a crucial part of the MDTM process from a quality and further communication standpoint (Ruhstaller et al., 2006, De Ieso et al., 2013, Ottevanger et al., 2013, Geerts et al., 2021, Tran et al., 2022). If there was disagreement in the MDT at the time of decision-making it is important to document that as well, in order to follow the discussion and to present the discussed alternatives to the patient to take a stand on to arrive at a firm decision (Ruhstaller et al., 2006, Alsuhaibani et al., 2018).

Our studies have identified strengths and weaknesses related to leadership skills and reveal a correlation between leadership skills and MDTM quality. The various leadership and chairing perspectives were illustrated with granular data, and such feedback may stimulate and engage the MDTs in their professional development and good clinical practice to ensure patient safety and high-quality care. Our experience was that assessment and feedback initiated important team discussions and reflections on organizational structures, team communication, the different team members' roles, and the importance of effective leadership.

Figure 10. Leadership skills measured by ATLAS (Jalil et al., 2018)

MDTM evaluation

- Information from MDT participants revealed positive views on team function and development of participants' competence (study I).
- More negative feedback was reported related to evaluation of national MDTMs (study I).

After completing the observations at the 33 regional MDTMs in studies II-IV, the study group offered the participating MDTs an opportunity to have the overall evaluation data presented at a team meeting for feedback and discussion, which the teams could use in their own further development work. These feedback sessions were not a part of these research studies but were highly appreciated by the regional MDTs, which made requests for follow-up.

It is important to continually reflect on and evaluate the MDT and MDTM work. Systematic evaluation provides quality and safety in resource-demanding aspects of modern cancer care. MDT surveys to collect the MDTM participants' views of the MDT and MDTM work in combination with audits can help MDTs identify their strengths and weaknesses. Development of formal structures that support the MDTs to monitor performance over time, continuously evaluate their work, and support opportunities to evaluate other teams for inspiration and consideration of alternative concepts and solutions could additionally promote quality development (Evans et al., 2019). Regularly assessing and improving MDTs and MDTMs with support of instruments designed to be used within cancer MDTs, including observational tools, self-assessments, and checklists, can enhance the quality and safety of this work (Soukup et al., 2018, Fradgley et al., 2021).

Inter-observer agreement

When conducting studies of clinical work with direct observations of quality and safety, internal validity is a key aspect of consistency of data between different observers. In studies I-IV we performed dual observations with application of the instruments to quantify the consistency between the observers in the study group (overview in table 4).

In study I, we performed double observations of all nine national MDTMs observed, which resulted in 18 observations with each of the instruments MDT-MOT and MDT-MODe. Herein, we found IOV of 0.71 for MDT-MOT and 0.86 for MDT-MODe, which is comparable to other studies (Lamb et al., 2013C, Shah et al., 2014, Jalil et al., 2014, Gandamihardja et al., 2019).

In study II, 104/349 case discussions were subject to double observations using MDT-MODe. IOR was assessed, and the results for all domains in the instrument are summarized in table 5. ICCs ranged from 0.00-0.80 and kappa values from

0.00-080, which is comparable to results from similar studies (Lamb et al., 2013C, Shah et al., 2014, Jalil et al., 2014, Gandamihardja et al., 2019).

In study III, 7/33 MDTMs were observed by two members of the study group who independently rated leadership aspects using the ATLAS instrument (study III, figure 1). IOA was acceptable to good; in the total sample set, the ICC was 0.72 (0.60-0.81). There was a discrepancy of more than one step on the Likert scale in 6% of the ratings. Domains with high inter-rater agreement were the chair's ability to summarize the treatment recommendations and screening for clinical trials. Domains with more discrepancy between the observers were time management of the MDTM and the chair creating a good atmosphere (study III, figure 1). This study of the ATLAS instrument is to our knowledge the first, after the validated development of the instrument in the UK, and there is no comparable result yet in the literature (Jalil et al., 2018).

In study IV, open notes were taken by two observers for 101/336 cases. Concordance was defined as both observers identifying the same information and classifying it into the same distinct category. We showed 93% agreement with consistent identification and reproducible classification of information categories, which is comparable to the result observed in a similar French study (Restivo et al., 2016).

Table 4 Overview of interobserver agreement and reliability

Study	**I**	**II**	**III**	**IV**
Number	9 MDT meetings with double observations	104/349 cases with double observations	7/33 MDTM with double observations	101/336 cases with double independent notes
Result inter-observer variabilities	0.71 for MDT-MOT, 0.86 for MDT-MODe	ICC range 0.00-0.80 Kappa values 0.00-080	Inter-observer agreement acceptable to good Total sample set ICC 0.72 (0.60-0.81) Discrepancy > one level on the Likert scale in 6% of the ratings	93% agreement: consistent identification and reproducible classification of information categories
Comment	Comparable with other international studies	Comparable with other international studies	Domains with high inter-rater agreement -ability to summarize recommendations -screening for clinical trials Domains with more discrepancy between the observers -time management -creating a good atmosphere	Concordance defined: both observers identifying certain information, classifying it into a distinct category

Table 5 ICC, kappa values and mean differences, results from study II

	ICC (95%CI)	Kappa value (95% CI)	Mean difference
Quality of information case presentation			
Patient history	0.00 (-)	0.07 (-0.02-0.16)	-0.82 (-0.02--0.62)
Radiology	0.17 (-0.02-0.35)	0.14 (-0.11-0.39)	-0.12 (-0.36-0.12)
Pathology	0.48 (0.32-0.61)	0.36 (0.24-0.47)	0.94 (0.70-1.19)
Psychosocial	0.40 (0.23-0.55)	0.39 (0.23-0.55)	-0.03 (-0.18-0.13)
Comorbidity	0.37 (0.19-0.52)	0.30 (0.17-0.43)	0.13 (-0.10-0.35)
Patient views	0.27 (0.08-0.44)	0.20 (0.04-0.37)	0.17 (0.06-0.28)
Quality of contributions case discussions			
Chair	0.16 (0.03-0.34)	0.14 (0.02-0.26)	-0.33 (-0.53--0.13)
Surgeon	0.80 (0.72–0.86)	0.64 (0.54-0.74)	-0.08 (-0.27-0.11)
Oncologist	0.61 (0.47-0.72)	0.52 (0.39-0.65)	-0.25 (-0.50-0)
Nurse	0.73 (0.63-0.81)	0.64 (0.52-0.76)	0.09 (-0.03-0.21)
Radiologist	0.27 (0.08-0.44)	0.28 (0.15-0.40)	0.79 (0.49-1.08)
Pathologist	0.52 (0.37-0.65)	0.47 (0.32-0.62)	0.49 (0.25-0.73)

Conclusions, clinical implications, and future perspectives

In conclusion, we demonstrate strengths and weaknesses in regional and national MDTMs, show disparities in contributions from MDT members to case presentations and case discussions, identify various MDTM leadership aspects, reveal a correlation between leadership skills and MDTM quality, point to needs to define key case presentation elements, and suggest that case selection structures may support prioritization of patients for MDTMs.

Case discussions

National MDTMs

In study I, national MDTMs for rare cancers were overall found to function well based on evaluation using MDT-MOT and MDT-MODe. Treatment recommendations were made in 91% of the cases, team interaction was well-functioning, and leadership was well defined and rotating. Participants provided high scores for development of individual competence and team competence, but rated meeting technology, principles for communicating treatment recommendations, and guidelines for evaluating the meetings lower. Observational assessment resulted in high scores for case histories, leadership, and teamwork and low scores for patient-centred care and involvement of care professionals. Case discussions cover medical perspectives well, whereas patient-centred aspects receive less attention.

National MDTMs represent a relatively new phenomenon aimed at providing equal access, high-quality evaluation, and support for research development in rare cancers. We show that such meetings are feasible, and our study provides a summary of factors to consider in the establishment of a national MDTM:

- Roles during national MDTs could be clarified to align expectations and ensure that relevant patient-related information is provided.
- Structures for safe and efficient sharing of clinical data should be considered, which include legal as well as technical considerations.

- Responsibilities for documentation and patient information should be defined and communicated in national MDTM Standard Operating Procedures (SOPs).
- Leadership of a virtual and geographically spread team requires special skills, and leadership support and development may be relevant.
- The extent to which national MDTMs provide equal access, ensure complete coverage, and improve patient outcomes would be relevant to investigate.

Regional MDTMs

Evaluations of regional MDTMs, some of which were physical and some virtual, based on observational assessment using MDT-MODe revealed that case information was predominantly from the chairs, surgeons, radiologists, and oncologists, with limited input from nursing staff.

Provision of patient-related information was observed in a minority of the cases, and patient preferences were rarely reported. Non-medical factors were rarely and randomly referred to, but valuations and irrelevant patient comments were sometimes made.

MDTs should discuss and consider how to achieve an optimal balance between biomedical facts and patient-related aspects for a relevant and holistic basis for case discussion (figure 11). Even though many MDTs regularly do quality improvement work related to referral guidelines and case discussion format, for example, there is a lack of guidelines on which data elements to provide for a comprehensive MDT case discussion. Definition of relevant information differs among diagnostic teams, and the data requested should be kept at a modest amount to ensure efficient processes.

Initiatives to further improve information structures at MDTMs are needed to ensure high-quality decision-making and treatment recommendations with a high likelihood of implementation. A more stringent definition of data elements and development of consensus reporting standards may contribute to efficient, relevant, and complete case presentations and treatment discussions.

These observations suggest the following:

- Roles and responsibilities should be clarified for all participating staff.
- Involved staff may need specific training in efficient teamwork and decision-making.

- The contributions of information during MDTMs should be discussed to define what is feasible and efficient.
- To ensure provision of complete and relevant case information, definition of data elements and development of information structures and consensus reporting standards would be relevant.
- Application and evaluation of digital patient assessment instruments and comprehensive case presentation formats could be relevant.
- Consideration should be given to the questions of when, how, and by whom patient perspectives are solicited to ensure holistic information is available.
- Structures to consider patient eligibility for clinical trials should be developed to ensure that all relevant patients are considered for potential treatment within a suitable clinical trial.

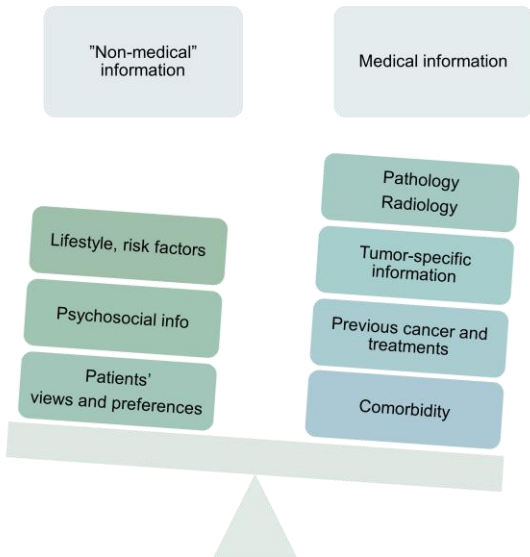


Figure 11. Aspects that may influence MDTM information balance

Patient selection

Complex patients benefit the most from an MDTM discussion. With limited resources and increasing MDTM workload, standardized selection aids such as the MeDiC instrument can be used to identify the more complex cases as an equal and qualified supplement to the clinical selection of the most suitable patients for each

MDTM. Application of the MeDiC instrument to evaluate case complexity in prostate cancer is feasible and can complement and support the clinical selection process to MDTMs. Further studies of selection instruments in different diagnostic settings and in more prospective applications would be highly relevant for refinement of the approach and an optimized definition of relevant cut-off levels of complexity to identify patients that would benefit most from the MDTM service.

Based on our observations we suggest that further work and research are needed related to:

- Definition of patient groups that would benefit most from full MDTM discussions.
- Structures to support objective selection of patients who would benefit most from the MDTM discussions.
- Identification of complex circumstances, use of algorithms for screening, and triage in selection of complex cases that would benefit most from MDTM discussions.
- Evaluation of effects from patient selection and streamlining.

Leadership

The ATLAS instrument effectively captures the multiple aspects of MDT leadership. Time management, effective case prioritization, and provision of clear treatment plans were all functioning well. Variable and partly weak results were seen for encouragement of team-member contributions, facilitation of case discussions, and ability to summarize case discussions.

Based on our results we suggest the following:

- MDT leaders should be offered relevant education and training for their role.
- The various and complex aspects of MDT leadership should be clarified and recognized among team leaders as well as MDTM participants.
- MDTs should actively consider which member is best suited for the coordinating role as a meeting chair and also consider rotating leadership.

MDTM evaluation

None of the MDTs and MDTMs studied herein had undergone regular evaluation of their services. Systematic team audits and reviews should be prioritized to further develop and optimize services. Such development needs support from senior management structures. Recurrent use of MDT assessment could be a purposeful strategy to continuously improve the decision-making process and teamwork, ultimately resulting in improved and patient-centred care. A variation of assessment strategies and instruments can be helpful to qualify the complex tasks of MDTMs and could support the design and personalized initiatives in skills development and improved teamwork.

- National MDTs should take initiatives to evaluate their services at regular intervals to provide feedback to team members and identify areas for development.
- Exchange of experience between MDTs in various hospitals and health-care regions may be feasible to gain momentum for changes and strengthen professional networks.
- Local and regional MDTs should regularly evaluate their MDTM services to identify improvement points and request organizational support for such quality development initiatives. Herein, cross-evaluation between teams from various diagnostic areas may be worth considering.
- Leadership feedback based on observational assessment using the ATLAS instrument, for instance, could contribute to development of leadership skills and identify individuals suited for the task of leading the MDTM.
- Structures and definitions for analysis of deviations from MDTM recommendations should be developed.

Implementation science is challenging and requires collaboration across multiple disciplines. Involvement of clinical and organizational expertise as well as experts in health economics, behavioural science, process development, etc. may be relevant and involvement of patient representatives should be secured in planning and evaluation of MDTM services.

Populärvetenskaplig sammanfattning

Bakgrund

Multidisciplinära terapikonferenser (MDK) är ett internationellt arbetssätt implementerat i cancervården i syfte att ge patienten en jämlik bedömning av hög kvalitet baserat på samlad expertis samt nationella vårdprogram och behandlingsriktlinjer. Varje vecka samlas specialister inom diagnosspecifika vårdteam för en gemensam diskussion om ett på förhand anmält antal patienter. Diskussionen utgår från ett förberett underlag av tex sjukhistoria, diagnostiskt bildmaterial, laboratorieprover, bedömning av patientens allmäntillstånd och övriga sjukdomar (samsjuklighet) och omständigheter. Teamet utgörs oftast av kirurg, onkolog, radiolog, patolog, kontaktsjuksköterska och MDK-koordinator inom ett visst diagnosområde såsom bröstcancer, lungcancer, tarmcancer etc. Vid behov kopplas även andra experters kompetenser in. MDKn kan vara lokal på ett sjukhus, regional, nationell eller t.om. internationell, då expertteam möts digitalt. Mötena är schemalagda och varar oftast mellan 1-2 timmar. Ett genomsnitt av 10 till 20 patienter diskuteras vid varje tillfälle. Efter genomgång sammanfattas en strukturerad värdering av diagnostiska och behandlingsrelaterade perspektiv från den multidisciplinära och multiprofessionella expertgruppen i en personligt anpassad behandlingsrekommendation för patienten att ta ställning till i samråd med behandlande läkare.

Den svenska cancervårdens organisation och strukturer har på många vis utvecklats det senaste decenniet genom en allt snabbare medicinsk utveckling, professionens olika initiativ, inspirerad av bland annat internationell utveckling samt i kombination med politiska och statliga satsningar. En statlig utredning om svensk cancervård resulterade 2009 i ”En nationell cancerstrategi för framtid” (SOU 2009.11) som lade grunden för sex sjukvårdsregionala cancercenter, RCC. I denna organisation har sedan utvecklingen av standardiserade vårdförlopp, SVF, för utredning och start av behandling av cancersjukdomar samt upprättade en struktur för etablering och kontinuerlig revidering av nationella vårdprogram med behandlingsriktlinjer för i princip alla cancersjukdomar utformats. Syftet har både internationellt och nationellt varit att driva utvecklingen mot en mer jämlik cancervård. I det standardiserade vårdförloppet av utredning och planering av cancerbehandling enligt nationella vårdprogram är MDK en viktig knutpunkt.

I cancerpatienters vårdförlopp ska MDKn bidra till patientsäkerhet, behandling enligt nationella riktlinjer och en individanpassad behandlingsrekommendation. Vid MDK hanteras omfattande och komplex information om cancerpatientens diagnostik och tillstånd, vilka är avgörande för multiprofessionella synpunkter för beslut om behandling. Ett högkvalitativt MDK-ledarskap liksom ett välutvecklat teamarbete med väldefinierade roller i diskussionen samt ett komplett och strukturerat tillgängligt informationsunderlag är centralt för en optimal beslutsprocess. MDK värderas högt av vårdprofessionen, men patientnyttan i överlevnad, jämlika behandlingserbjudanden, patientnöjdhet etc. har hittills varit svår att fastställa i internationella vetenskapliga studier. Antalet MDK ökar kontinuerligt i vården, allt fler MDK blir regionala eller nationella via videouppkoppling för multiprofessionell bedömning som når fler patienter med ökad professionell samverkan och kunskapsutbyte mellan sjukvårdsregioner. Samtidigt blir resursförbrukningen alltmer omfattande.

Tidigare forskningsstudier har visat att vårdprofessionernas roller vid MDK behöver definieras tydligare och att patientperspektivet vid MDK generellt är svagt. Systematisk utveckling och optimering av MDK i sjukvården saknas idag i stor utsträckning. Strukturer för effektivt och patientsäkert beslutsfattande behöver identifieras och implementeras för att säkra tillgången till MDK för de patienter som har mest nytta av denna. För att optimera MDK behöver urvalsmekanismer och andra stöd utvecklas för arbetet. Variation i arbetssätt, resursförbrukning, patientperspektiv och vårdteamens önskemål om utveckling lade grunden för forskningsstudierna i denna avhandling.

Mål

Det övergripande målet med avhandlingen är att bidra till utveckling av MDK för en effektiv beslutsprocess. Forskningsstudierna syftar till att utforska teamfunktion och beslutsprocess vid MDK i svensk cancervård med fokus på de olika teammedlemmarnas bidrag till information om patienten, olika teammedlemmarnas deltagande i falldiskussionen, ledarskapets betydelse vid MDK och möjlighet till urval av mer komplexa patienter till MDK.

Specifika mål:

- Testa observations mätningar och de nyligen utvecklade instrumenten MDT-MOT, MDT-MODe, ATLAS och MeDiC för att få fördjupad information om MDK i cancervården (studie I-III och V).
- Samla in information om MDK deltagarnas erfarenheter från virtuella nationella MDK:er (studie I).
- Mäta olika vårdprofessionernas bidrag till information och diskussion vid MDK (studierna I-II).

- Uppmärksamma färdigheter i den komplexa ledarrollen vid MDK som grund för feedback och utveckling av ledare och team (studie III).
- Korrelera resultaten från observationsbedömningar med patientkaraktäristika, teamets förutsättningar och egenskaper (I-III, V).
- Korrelera teamets funktion med MDK-ledarskapet (studie I-III).
- Kartläggning av tillgång och innehåll av medicinsk och icke-medicinsk information om patienten korrelerat till patient- och teamkaraktäristika (studie IV).
- Undersöka strukturerad bedömning av komplexitet i patientens omständigheter jämfört med kliniskt urval av patienter till MDK (studie V).

Metod

Samtliga studier utfördes inom nationella/regional MDK i svensk cancervård och är baserade på observationer med standardiserade, validerade bedömningsinstrument. Observationerna genomfördes vid nio nationella och 33 regionala MDK med insamling av observationsdata för 434 patient diskussioner, samt genomgång av specificerade journaldata från 364 patienter med nydiagnostiserade prostatacancer. Sjukvårdspersonalens åsikter om nationella MDK undersöktes med en enkätundersökning som besvarades av 125 MDK-deltagare.

Med hjälp av observationsinstrument, som ursprungligen utvecklats i cancervården i Storbritannien, har olika aspekter av informations- och diskussionsutbytet kartlagts. Innehållet och kvaliteten på information om patienten och olika professioners bidrag till diskussionen för över 400 patienter som diskuterats vid nationella och regional MDK har undersökts med instrumentet The Metric for Observation of Decision-Making (MODe). Med observationsinstrumentet A Tumor Leadership Assessment inStrument (ATLAS) har MDK-ordförandens ledarskapsfärdigheter i 12 definierade domäner undersökts vid regionala MDK. Verbala uttalande om patientens omständigheter har kartlagts med hjälp av fritextnotat från 336 patienter vid regionala MDK. I den avslutande studien granskades urvalsprocessen till MDK med hjälp av instrumentet MeDiC (Measure of case-Discussion Complexity) som mäter komplexiteten i varje patients omständigheter i 26 olika punkter. En utvärdering av instrumentet (MDT-MeDiC) för prostatcancerpatienter gjordes och jämfördes med den kliniska urvalsprocessen för att stödja urvalet av patienter som har störst nytta av diskussion vid MDK.

Resultat

Teammedlemmarnas bidrag till patientinformation bestod huvudsakligen av tidigare sjukhistoria, radiologisk och histopatologisk information, medan information om patientens mer personliga omständigheter och behov var sparsam (studie I och II). Diskussionen vid MDK fördes i huvudsak av ordförande, kirurger och onkologer, medan bidraget från kontaktsjuksköterskor var begränsat (studie I och II). Ledarskapsfärdigheter visade positiv inverkan på mötets kvalité (studie II). Höga ledarskaps-poäng erhölls för tidsanpassning, prioritering av patienter och tillhandahållande av behandlingsförslag. Lägre poäng uppmättes för att befrämja diskussionen, uppmuntran till teammedlemmarna att bidra samt att hålla MDKn fokuserad från distraktioner (studie III). Information om samsjuklighet uppgavs i cirka hälften av patienterna och information om patientens önskemål framkom i 4% (studie IV). Urvalsinstrumentet MeDiC var enkelt att använda och samstämmigt med det kliniska urvalet till MDK (studie V).

Diskussion

Ur patientperspektiv är MDK en av de viktigaste händelserna i patientprocessen då lämplig behandling diskuteras och föreslås. Analyser och undersökningar bedöms och diskuteras av experter från flera discipliner och baserat på samlad kunskap och erfarenhet ges en personligt anpassad behandlingsrekommendation. De genomförda studierna visar att patientperspektivet vid MDK ofta är svagt och information om relevanta personliga omständigheter kan saknas. Frågeställningarna kring förbättrad MDK avseende funktion, ledarskapsperspektiv, prioritering av komplexa patienter samt fokus på patientrelaterade faktorer är relevanta uppmärksamhetsområden i modern cancervård för jämlik bedömning och behandling. Ökad resursförbrukning och ökande patientvolymer, patientens medbestämmande och fler äldre cancerpatienter med samsjuklighet kräver fortsatt optimering för att de patienterna med störst nytta av en behandlingsrekommendation från MDK ska säkras tillgång.

Studierna är de första i Skandinavien som beskriver och rapporterar funktion, beslutsprocesser och ledarskap vid MDK. Metodologin har hämtat inspiration från Storbritannien och applicerade i flera av studierna etablerade och validerad observationsinstrument (ATLAS, MODe, MOT och MeDiC) som tidigare inte har använts i Skandinavien. Instrumenten fungerade väl även i svensk sjukvårdskontext och kan utgöra ett stöd för utveckling av effektivt teamarbete vid MDK. Dessa observationsstudier har i svenskt sjukvårdssystem bekräftat tidigare internationella fynd, tex att vårdprofessionernas olika roller behöver definieras tydligare för resursoptimering och att patientperspektivet generellt är svagt vid MDK. Information om samsjuklighet och patientens rådande omständigheter uppgavs för knappt hälften av patienterna och patientens önskemål i endast 4%. Strukturer för att effektivt rapportera den typ av information vid MDK behöver utvecklas, inte minst för äldre patienter, för att säkra att

behandlingsrekommendationen blir genomförbar. Ledarskapet vid MDK bedöms övergripande välfungerande, både i enkäten besvarad av MDK-deltagare och vid observationerna. Hur ledarskapet förs och i vilken ordning patienterna diskuteras visade sig ha betydelse för kvaliteten på presentation och diskussion av patienter vid MDK. Instrumentet MeDiC var effektivt för bedömning av komplexiteten i patientens omständigheter. Det fungerade väl som stöd för urval av patienter till MDK och överensstämde med det kliniska patienturvalet.

Konklusion

Sammanfattningsvis har vi visat på övergripande välfungerande nationella och regionala MDK i cancervården. Skillnader i MDK-medlemmarnas bidrag till presentation av patienter och diskussion har observerats. Vi pekar på behov av att definiera nyckeldata för en mer holistisk presentation av patienter vid MDK och strukturer för urval av patienter som kan stödja prioritering av de patienter som är mest betjänta av en diskussion på MDK. Vi har även visat på styrkor och svagheter i ledarskapsfärdigheter, att färdigheterna korrelerar med kvalitén på MDK samt på möjligheter till stöd för prioritering av patienter till MDK. Arbetet har lagt en grund för fortsatt utveckling av effektivt MDK-arbete, teamarbetet samt optimering av resurser i svensk cancervård.

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Multidisciplinary Team Meetings in Cancer Care

Jessica Wihl is a consultant in gynaecologic oncology at the Oncology department at Skåne University Hospital and medical adviser at the Regional Cancer Centre South. She is also an authorised Balint group leader and supervisor of groups discussing the patient-doctor relations. This thesis explores the function of multidisciplinary team meetings in Swedish cancer care, the team members contributions, different assessment instruments and identify markers predictive for the development of teamwork and of future MDTM structure.

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