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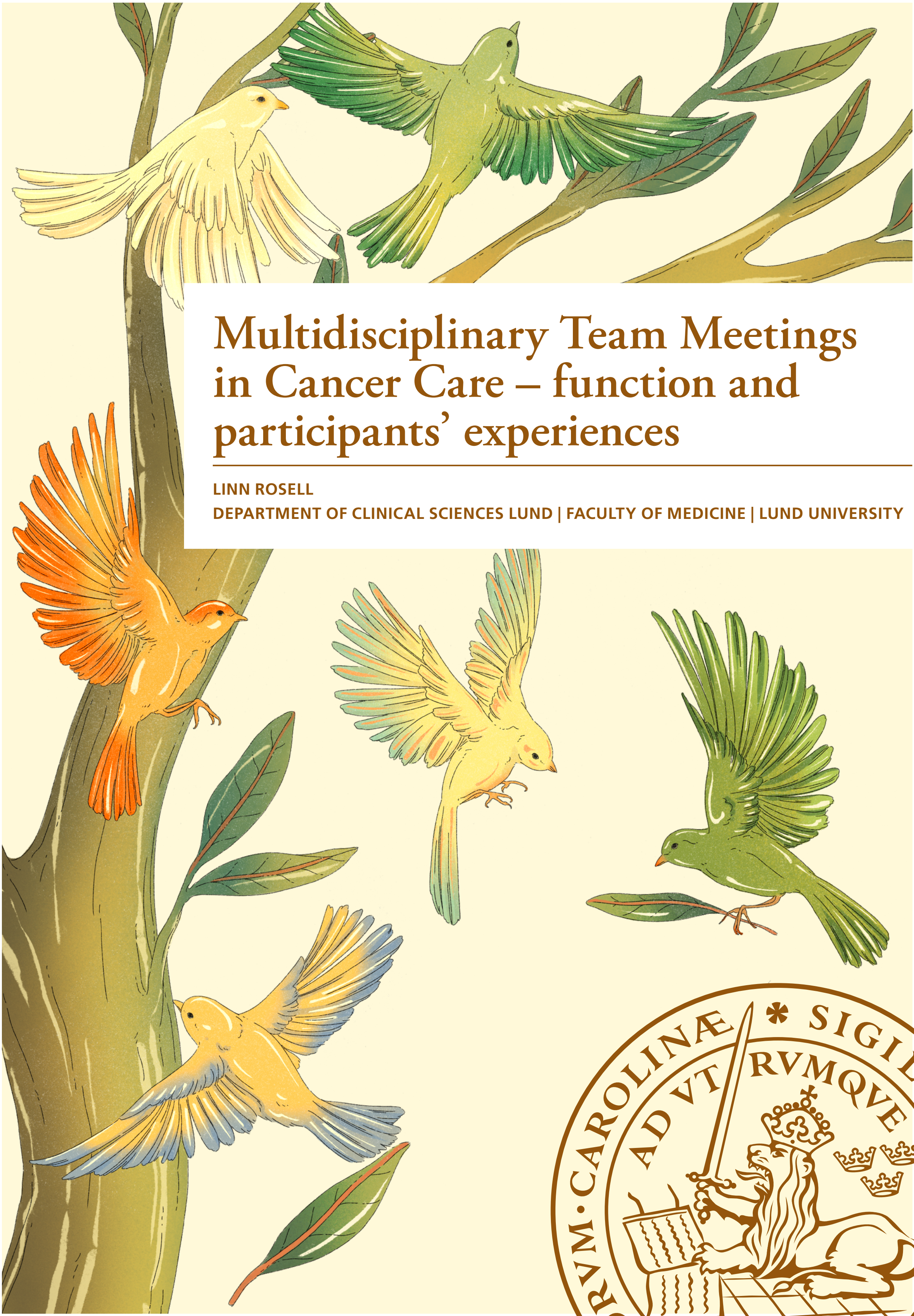

Multidisciplinary Team Meetings in Cancer Care – function and participants' experiences

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Linn Rosell

LUND
UNIVERSITY

DOCTORAL DISSERTATION

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Abstract

The multidisciplinary team meeting (MDTM) is a central point in the cancer care pathway. Multidisciplinary case discussion should provide a treatment recommendation based on evidence and/or best expert opinion, in alignment with national clinical cancer care guidelines and with consideration of a holistic patient perspective. The MDTM provides benefits, but is challenged in relation to, for example, resource constraints, access to relevant information, quality of teamwork and communication. This thesis focuses on MDTMs in Swedish cancer care and uses quantitative as well as qualitative methodologies to investigate MDTM participants' experiences, meeting function, information presented and MDTM participants' contributions to case discussions.

Study I aimed to obtain insights into MDTM participants' views on benefits of and barriers to multidisciplinary decision-making. The study was based on an electronic questionnaire distributed to participants in the 50 MDTMs in the South Sweden healthcare region. With a response rate of 67%, we identified benefits related to patient management, multidisciplinary decision-making and increased competence, and barriers related to lack of relevant information and limited information on patient perspectives.

Study II investigated MDTM participants' experiences and contributions to case information and case discussions in national MDTMs. We used two observational assessment instruments, MDT-MOT and MDT-MODe, and assessed 67 case discussions in three national MDTMs. In addition, MDTM participants in seven national MDTMs provided information on their experiences of the MDTMs based on an electronic questionnaire with a response rate of 52%. Observational assessment demonstrated high scores for case history, leadership and teamwork, and low scores for patient-centred care and involvement of care professionals. The questionnaire data revealed favourable views on role clarity and positive influence on competence development and challenges related to meeting technology, and evaluation of the MDTM.

Study III analysed MDTM participants' views on enabling factors and barriers for national MDTMs. Free-text data from the electronic questionnaire distributed to participants in seven national MDTMs (n = 125) were analysed using qualitative content analysis. Three categories and nine subcategories were identified. Participants described the national MDTM as a forum with potential for knowledge sharing and collaboration and described factors affecting decision-making, responsibilities and organization.

Study IV explored registered nurses' views on patient perspectives during MDTMs. Data were collected from 22 registered nurses during four focus group interviews and were analysed using conventional content analysis. Two categories and five subcategories were identified. The participants described different views and uncertainty about their role; they also voiced ambivalence and discussed prerequisites for inclusion of patient perspectives in MDTM decision-making.

In summary, our results demonstrate that MDTMs in Swedish cancer care overall are well functioning and that participants value the MDTMs for joint decision-making and competence development. At the same time, challenges relate to attention to patient perspectives, unbalanced contributions to the case discussions and ambiguous roles during MDTMs. The observations made provide a basis for targeted improvement work to further develop and optimize MDTM services in cancer care.

Key words
Tumour board; Interdisciplinary team; Patient perspectives; Patient-centered care

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Abstract

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List of studies

The following studies provide the base of this thesis and are referred in the text by their Roman numerals.

I. **Rosell L**, Alexandersson N, Hagberg O, Nilbert M. Benefits, barriers and opinions on multidisciplinary team meetings: a survey in Swedish cancer care. BMC Health Services Research. 2018;18:249.

II. **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.

III. **Rosell L**, Wihl J, Nilbert M, Malmström M. Health professionals' views on key enabling factors and barriers of national multidisciplinary team meetings in cancer care: A qualitative study. Journal of Multidisciplinary Healthcare. 2020;13:179-186.

IV. **Rosell L**, Melander W, Lindahl B, Nilbert M, Malmström M. Registered Nurses' views on consideration of patient perspectives during multidisciplinary team meetings in cancer care. BMC Nursing. 2022, accepted.

Abbreviations

CFIR	Consolidated Framework for Implementation Research
CN	Contact Nurse
CNS	Clinical Nurse Specialist
FG	Focus Group
HIPEC	Hyperthermic Intraperitoneal Chemotherapy
ICC	Intraclass Correlation Coefficient
MDT	Multidisciplinary Team
MDTM	Multidisciplinary Team Meeting
RCC	Regional Cancer Centre
RN	Registered Nurse
SCP	Standardized Care Pathways

Thesis at a glance

Table 1. Overview of studies included in the thesis

	Study I	**Study II**	**Study III**	**Study IV**
Aim	Insight into MDTM participants' views on benefits of and barriers to multidisciplinary decision-making	Assess case information and case discussions in national MDTMs for rare cancers and investigation of MDTM participants' views	Investigate MDTM participants' views on key enabling factors and barriers for national MDTMs for rare cancers	Explore registered nurses' views on patient perspectives during MDTMs
Method	Quantitative	Quantitative	Qualitative	Qualitative
Participants and data collection	Electronic questionnaire distributed to 362 participants in 50 regional MDTMs. 67% response rate	Observational assessment of 67 case discussions in three national MDTMs. Electronic questionnaire to 241 participants in seven national MDTMs. 52% response rate	Electronic questionnaire to 241 participants in seven national MDTMs	Four focus group interviews with 22 registered nurses
Data analysis	Descriptive statistics, chi-squared test, Bonferroni correction	Descriptive statistics, inter-observer variability	Conventional content analysis with an inductive approach	Content analysis with an inductive approach
Results	Benefits related to patient management, increased competence and multidisciplinary decision-making. Barriers included lack of relevant information and limited information on patient perspectives	Observational assessment gave high scores for case histories, leadership, decision-making and teamwork, but low scores for patient-centred care and involvement of care professionals. Participants scored roles and competence development high, but technology and evaluation of MDTM services low	Three categories and nine subcategories were identified. Enabling factors included collaboration, knowledge sharing, discussion of complex cases and competence development. Barriers included suboptimal attendance, resource constraints, uncertain assignment and limited patient related information	Two categories and five subcategories were identified. Ambivalence as to whether the MDTM should have a medical or holistic focus. Patient perspectives were described as valuable but with limited influence on treatment recommendation. Barriers for registered nurses' participation and contribution to MDTM were described
Conclusions	Multiple benefits from MDTMs were recognized and areas for improvement defined. Structured MDTM evaluations and increased focus on patient perspectives may be relevant development points	Biomedical perspectives were well covered in the case presentations and discussions, whereas patient perspectives receive less attention. Partly unbalanced contributions among MDTM participants	National MDTMs introduce benefits as well as challenges. Clarification and considerations of these may support implementation and further optimize MDTMs for rare cancers	Variable views on patient perspectives during MDTMs. The results suggest needs for structures to collect and present relevant information and to clarify registered nurses' role during MDTMs

Preface

The multidisciplinary team meeting (MDTM) is a focal point of the cancer care pathway. Within a short time frame the patient's case is discussed by experts from various disciplines and professions, followed by provision of an individualized treatment recommendation that should be based on best practice, evidence and national clinical cancer care guidelines. MDTMs have been broadly implemented in cancer care, and current national clinical cancer care guidelines in Sweden generally recommend that newly diagnosed cancer patients should receive an MDTM-based treatment recommendation. Increasing cancer incidence and new diagnostic and therapeutic options put pressure on the multidisciplinary teams (MDTs) with growing caseloads and reports of resource constraints.

In my work as a cancer care developer at the Regional Cancer Centre South, I have been introduced to the benefits and challenges of MDTMs in cancer care, for example, the MDTM as an integral part of the cancer care pathway, different formats and meeting principles, development of regional and national MDTMs and reports of waiting times to MDTM. In a project that mapped MDTMs in the South Sweden healthcare region we demonstrated that an MDTM discussed mean 12.6 cases during mean 4.2 minutes per case (1). Considerable resources are spent on MDTMs, which motivates optimized, high-quality services through regular evaluations to identify improvement points and develop services.

The patient is the protagonist in MDTMs but does generally not participate in the meetings. MDTM participants have the responsibility to present the patient case, discuss various treatment options and provide an individualized treatment recommendation with a high likelihood for implementation. Consideration of patient perspectives in the MDTM decision-making processes is at times limited, and the responsibility to present the patient's perspective is not always clearly defined.

In my PhD project I have focused on MDTM participants' experiences of barriers and facilitators for decision-making; on MDTM function and participants' experiences from the recently implemented national, virtual MDTMs for rare cancers; and on registered nurses' (RNs) views of inclusion of patient perspectives in MDTMs. Scientific studies regarding MDTMs were few at the initiation of this project, but the area has seen a rapid development during recent years. The contributions in this thesis, which stem from the Faculty of Medicine, Department of Clinical Sciences Lund, Lund University, and the Regional Cancer Centre South, are among the first in the field in a Swedish cancer care context.

Populärvetenskaplig sammanfattning

Cancervården är en komplex verksamhet som karaktäriseras av multidisciplinärt och multiprofessionellt teamarbete där multidisciplinära konferenser (MDK) har en central funktion. Vid en MDK samlas olika kompetenser och professioner för att fatta beslut om en individanpassad behandlingsrekommendation baserad på evidens, behandlingsriktlinjer och samlad kunskap. Sammansättningen av MDK-teamet varierar, men vanligtvis deltar onkolog, kirurg, radiolog, patolog, kontaktsjuksköterska (Figur 1) och ofta även en koordinator. I Sverige rekommenderar de flesta nationella vårdprogram att alla patienter med en nydiagnostiserad cancer ska diskuteras på en MDK vilket kan ske på en lokal, regional eller nationell nivå. En välfungerande och effektiv MDK är beroende av flera aspekter som till exempel tillgång till relevant information, infrastruktur, medverkan av specialister, tydliga roller och ansvarsområden, välfungerande teamarbete och ledarskap.

Flera studier indikerar att MDK bidrar till att säkra en för patienten jämlik bedömning av hög kvalitet och ökar följsamheten till vårdprogram och behandlingsriktlinjer. Effekten på patienttillfredsställelse, behandlingsval och klinisk effekt är dock svårvärderad med varierande resultat i olika studier. MDK är en resurskrävande verksamhet och i en tid av ökande antal patienter och allt fler behandlingsmöjligheter lyfts utmaningar kopplat till bristande resurser och begränsad tillgång till specialister. Denna utveckling ställer krav på en effektiv MDK men det saknas till stor del strukturerade utvärderingar och förbättringsinitiativ inom MDK verksamheten.

Doktorandprojektets **övergripande syfte** är att utvärdera MDKs funktionalitet samt undersöka MDK deltagarnas erfarenheter och syn på MDK med målet att identifiera faktorer som påverkar MDK verksamheten.

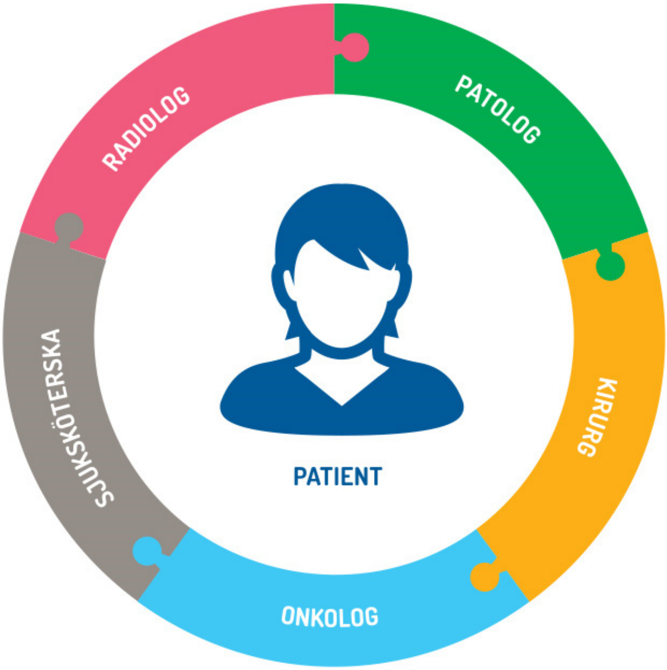
I **delstudie I** undersöktes deltagarnas syn på MDKs funktionalitet liksom faktorer som underlättar respektive förhindrar möjligheten att fatta beslut om behandlingsrekommendation. Deltagare i 50 MDK i södra sjukvårdsregionen inbjöds att besvara en elektronisk enkät med en svarsfrekvens på 67% (n = 244). Deltagarna såg över lag positivt på MDK och framhöll möjligheten till kompetensutveckling samt att MDK ger stöd i fortsatt hantering av patientens vård och behandling. Rapporterade fördelar inkluderade tillgång till samlad klinisk information, multidisciplinär bedömning och ökad följsamhet till behandlingsriktlinjer. Hinder för att fatta beslut om behandlingsrekommendationer innefattade behov av kompletterande undersökningar, otillräcklig information samt att ingen av de närvarande vid MDK hade träffat patienten.

Nationella MDK är en relativt ny företeelse inom svensk cancervård som införts till följd av centralisering av vård för ovanliga cancersjukdomar. I **delstudie II** undersöktes deltagarnas erfarenheter av nationella MDK med hjälp av en elektronisk enkät. Vidare genomfördes observationer av nationella MDK inom tre diagnosområden (peniscancer, analcancer och vulvacancer) med hjälp av standardiserade observationsinstrument; MDT-MOT (Meeting Observational Tool) och MDT-MODe (Metric for the Observation of Decision Making). MDK deltagarna rapporterade tydliga roller samt att MDK bidrog till kompetensutveckling. Det sammanvägda resultatet från observationerna visade att beslutsprocess och teamarbete var välfungerade, men indikerade samtidigt svagt fokus på patientens perspektiv. Vidare visade observationerna att ordförande och kirurg i hög utsträckning deltog i diskussionerna, medan sjuksköterska, fysioterapeut och koordinator var mindre involverade. Information om patientens sjukdomsbild och radiologisk information inkluderades i hög utsträckning medan information om patientens synpunkter och psykosocial information mer sällan delgavs.

Delstudie III syftade till att med kvalitativ metodik identifiera vilka områden MDK deltagarna identifierade som framgångsfaktorer respektive hinder vid nationella MDKer med hjälp av fritextsvar från den tidigare utsända enkäten i delstudie II. Svaren (n = 125) analyserades med hjälp av kvalitativ innehållsanalys och resulterade i tre kategorier och nio subkategorier. Framgångsfaktorer som lyftes var att nationell MDK erbjöd kunskap-, och erfarenhetsutbyte och kompetensutveckling samt stärkte nationellt samarbete. Utmaningar som lyftes relaterade till omfattande resursförbrukning, bristande medverkan från nyckelkompetenser, otydligt uppdrag samt bristande tillgång till information om patientens perspektiv.

Med bakgrund i våra egna resultat samt ett växande antal publikationer som visar att patientperspektivet ges begränsat utrymme vid MDK samt att sjuksköterskan ofta har en otydlig roll undersöktes i **delstudie IV** kontaktsjuksköterskornas syn på patientens perspektiv vid MDK. Fyra fokusgruppsintervjuer (N = 22) genomfördes och materialet analyserades med kvalitativ innehållsanalys vilket resulterade i två kategorier och fem subkategorier. Respondenterna lyfte två övergripande perspektiv; ambivalensen kring inklusion av patientens perspektiv vid MDK samt kontaktsjuksköterskan otydliga roll. Synen på om diskussionen skulle fokusera på enbart det medicinska perspektivet eller även inkludera det holistiska perspektivet skilde sig. Vidare diskuterade respondenterna möjlighet och utmaningar med att inkludera patientens perspektiv där struktur för att inventera och presentera informationen saknades.

Sammanfattningsvis visar avhandlingens resultat att MDK i svensk cancervård överlag är välfungerande samtidigt som brister och utvecklingsmöjligheter identifieras vilket är av vikt att beakta vid utveckling och implementering av nya MDKer. Våra studier visar att sjuksköterskan involveras i begränsad utsträckning samt att MDK diskussionen till stor del drivs av det biomedicinska perspektivet. För att kunna fatta ett välgrundat beslut om behandlingsrekommendation bör även patientens perspektiv beaktas. Detta kräver en struktur för hur information om patienten perspektiv ska erhållas och inkluderas i MDK sammanhang samt tydligande av roller och ansvarsområden inom respektive MDK-team. Avslutningsvis är det är av vikt att utveckla och införa strukturer för utvärdering och uppföljning av MDK för att löpande kunna optimera och effektivisera MDK verksamheten.



Figur 1. Kärnkompetenser vid en MDK (bild: RCC Syd)

Introduction

MDTMs have successively been implemented in cancer care and are considered to be an integral component of the cancer care process (2, 3) (Figure 2). The MDT meets to discuss patients' diagnoses and treatment options with the aim to provide an individualized and evidence-based treatment recommendation (3-6). Efficient MDTMs support coordination and continuity of care and strengthened collaboration and communication within the MDT (3, 6-9). Further, the MDTM offers possibilities for education and professional development (7, 10, 11). Multidisciplinary teamwork and decision-making are, however, complex, and organizational as well as personal factors influence efficiency and quality (2, 3, 12).

Though MDTMs are an integrated part of modern cancer care, our studies are among the first to study and report on these services in Swedish cancer care. In Sweden, there are no formal directives for MDTM performance or requirements for evaluation of MDTM services. Support for implementation, leadership and team development is limited. National clinical cancer care guidelines specify key MDTM participants, but do not define their roles and responsibilities. Data on recently implemented national, virtual MDTMs are scarce and efficacy, benefits and challenges of decision-making between geographically distributed MDTs are limited.

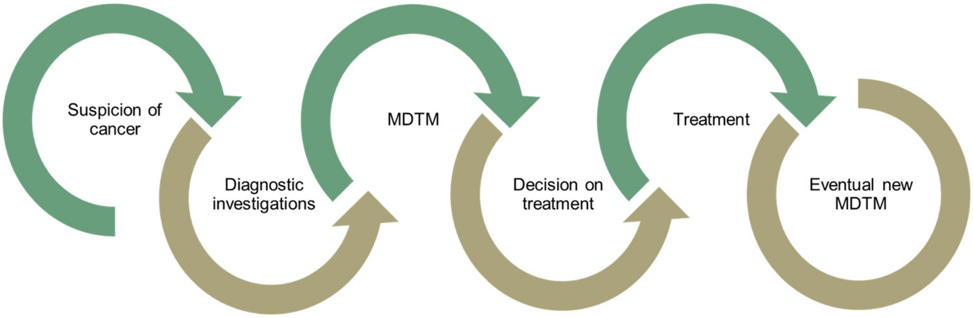


Figure 2. Overview of cancer care pathway with MDTM as a central component

Background

Cancer is a major cause of death worldwide, and the number of cancer cases is expected to increase by 47% from 2020 to 2040, mainly due to ageing populations (13). In Sweden, more than 60 000 persons are annually diagnosed with cancer and this number is estimated to increase to 100 000 in 2040 (14). Sweden has a decentralized healthcare system where the responsibility for primary care and specialized care resides with the 21 county councils, and home-based care is organized by the 290 municipalities. The government and its authorities are responsible for the overall healthcare policy and its governance (15). Cancer care is provided by the seven university hospitals, and for more common cancer types, also by county hospitals.

Motivated by suboptimal coordination and long waiting times, the Swedish government in 2009 took the initiative to develop *A National Cancer Strategy for the Future* (16). The strategy recommended initiatives within several areas, one of which was the establishment of six regional cancer centres (RCCs) with responsibilities ranging from cancer prevention and care processes to rehabilitation and support for clinical research. The RCCs have developed guiding documents related to cancer care processes and have responsibility for development and follow-up of, for example, waiting times. Several initiatives have directly and indirectly influenced MDTM work, which can be exemplified by:

- Establishment of 53 national clinical cancer care guidelines for different cancer types. These guidelines delineate key MDTM participants and define time points for MDTMs in the cancer care pathway (17).
- Implementation of 31 standardized care pathways (SCPs) that specify and streamline the diagnostic process. An SCP defines symptoms of suspected cancer and lists further investigations. Herein, the MDTM is a focal point for clinical decision-making and provision of treatment recommendations (18).
- Level structuring for rare cancers with the aim to ensure equal access to high-quality care and optimized possibilities for clinical research in rare tumour types. This initiative has led to the establishment of two to four national expert centres for several rare cancer types and procedures, for example, penile cancer,

vulvar cancer, anal cancer, advanced gastro-oesophageal and hepatobiliary cancer and, cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (HIPEC). Establishment of national, virtual MDTMs was linked to the initiative to ensure evaluation based on the collective national expertise, strengthened professional networks and MDTM-based treatment recommendations, irrespective of the patient's geographical location.

- Implementation of contact nurses (CNs) who support the patient through the cancer care pathway and often represent the primary point of contact for the patient. The CN is a registered nurse (RN) with a specific assignment that includes participation in the MDTM. The CN's assignment also includes, for example, provision of information, coordination of care, assessment of patient needs and ensuring possibilities for patient involvement (19).
- Strengthened patient involvement within cancer care by including patient representatives in development projects.
- Provision of openly available quality data from various clinical registries, including data on the fraction of patients within the respective diagnoses who receive MDTM-based treatment recommendations (20).

MDTM formats and meeting structures

High-quality cancer care requires collaboration between health care-professionals, and the MDTM is considered a cornerstone in the multidisciplinary approach to cancer care (2, 3, 5). During the MDTM health-care professionals from different and complementary disciplines present and discuss diagnostic materials and evaluations and consider patient-related information to provide an accurate diagnosis and/or individualized treatment recommendation based on evidence, guidelines and expert opinion (3-6, 21). MDTMs are often conducted weekly and sometimes fortnightly (10, 21-23). Patients can be discussed several times at MDTM (7) for example, at time of primary diagnosis (23), in case of recurrence, treatment failure or unexpected toxicity (3, 10).

In this thesis, the term MDTM is used, but these meetings are also referred to as, for example, tumour boards, multidisciplinary tumour conference, multidisciplinary case reviews and multidisciplinary oncology consultancy meetings (6, 24, 25). Though this thesis focuses on MDTMs in the context of cancer care, it should be recognized that

MDTMs also occur in non-oncological settings (9) for example, psychiatric care (26), otology (27) and cardiovascular care (28).

In Sweden, MDTMs are held on local, regional and national levels. The number of MDTMs has gradually expanded, with many MDTMs initiated in the last decades. Several MDTMs have developed out of local traditions, which implies that different principles for discussion format, leadership and MDT composition apply. The majority of MDTMs in cancer care are diagnosis-specific, but specialized MDTMs have been developed in response to clinical needs and subspecialization, for example, molecular tumour boards (22). Most hospitals with responsibilities for cancer diagnostics and treatment offer MDTMs for common cancer types such as breast cancer, colorectal cancer and urological cancer, whereas MDTMs for less common tumour types may be held on a regional or national basis. MDTs typically have defined principles for MDTM referral that specify required clinical information and clinical question. The MDTM coordinator often have the responsibility to review information and investigations to ensure completeness prior to the MDTM (29-31). MDTMs apply different principles for listing cases for discussion, for example, according to clinical question, participating experts and responsible physician, or in chronologic order.

An increasing number of MDTMs are virtual or hybrid meetings with both physical and virtual participation (6). Virtual MDTMs are suggested to be cost-effective, since this format reduces transition time, improves communication to satellite centres and supports joint decisions on treatment recommendations. The virtual MDTMs are also suggested to enhance meeting attendance and collaboration between geographically disparate health professionals (2, 11, 32-34). From the patient perspective virtual MDTMs may improve coordination and equity of care for patients in rural areas and facilitate faster access to expert review of their diagnosis and treatment options (34-36). Challenges reported relate to concerns about confidentiality of patient data, technical difficulties and expensive IT infrastructures (11, 34, 35). Well-functioning communication is also challenged by the virtual format with onsite as well as virtual MDTM participants (37).

National MDTMs is a recent development that in Sweden has largely been linked to centralization and establishment of expert centres for rare cancer types (38, 39). The implementation of national MDTMs was a defined and requested part of the centralization process with the aim to grant high-quality treatment recommendations irrespective of geographical location to grant sufficient expertise (30). Between 2015 and 2017, potentially curative treatments for penile cancer, anal cancer, vulvar cancer, advanced gastro-oesophageal and hepatobiliary cancer, and cytoreductive surgery with HIPEC were centralized to two to four national expert centres. In 2017, a national MDTM was also implemented for childhood cancer. The national MDTMs are physical and virtual meetings with physical gatherings for the respective teams, which collectively join the online meeting. The responsibility for organization and leadership rotates between the centres. Evaluation of national, virtual MDTMs is rare but previous research suggests improved patient management, especially related to complex cases, and MDTMs have been reported to reduce waiting times and support patient participation in clinical research (30, 40, 41).

MDTM participants

In Sweden, MDTM participants are defined in the national clinical cancer care guidelines. The composition of MDTs differs between cancer diagnoses and hospitals, but generally includes surgeon, oncologist, radiologist, pathologist, MDTM coordinator and specialist nurse (2, 6, 9, 21). The roles in the MDTM relate to the speciality and the discipline:

- Surgeons are involved in most MDTMs, since surgery is the main curative treatment in many cancer types (21). A multitude of surgical subspecialists may participate, for example, thoracic surgery, upper and lower gastrointestinal surgery, hepatic surgery, urology and gynaecology surgery.
- Oncologists specialized in the respective tumour areas are responsible for evaluation of suitability for medical oncology treatment and/or radiotherapy.
- Radiologists and pathologists usually participate to demonstrate imaging and pathology results.
- MDTM coordinators are typically medical secretaries who are responsible for meeting coordination (29-31).
- RNs are more recent additions to many MDTMs and may have different roles and motives for their MDTM participation, for example, coordination and administration, clinical trial eligibility and presentation of patient perspectives (30, 42, 43).

MDT composition also depends on the focus of the MDTM (2), for example, regular diagnosis-specific MDTMs, or molecular tumour boards that serve several diagnostic areas. Internal medicine specialists, for example, neurologists, pulmonologists, and dermatologists participate in MDTMs within their respective areas to provide expert opinion. Examples of health professionals participating selectively in MDTMs are specialists in geriatrics for elderly and vulnerable patients (44), experts in nuclear medicine and molecular pathology and palliative medicine, psychologists, occupational therapists (24), and physiotherapists (45).

Multidisciplinary teamwork and decision-making

MDTM decision-making is complex, and several factors influence meeting quality and effectiveness (3), for example, access to relevant information, participation of key MDT members, roles and responsibilities, clinical skills, communication and leadership (2, 32). Soukup et al. (46) suggests that the decision-making process is driven by four underlying factors: holistic and clinical input (including information on patient history, comorbidities, psychosocial aspects and patient views), pathological and radiological information and meeting management. All MDTM participants are expected to contribute with expertise and knowledge but unbalanced contributions from MDTM participants have been observed (3, 46, 47). Limited contributions have been documented from non-medical professionals, for example, RNs (2, 3). Limited input from RNs may impact the multidisciplinary approach to the case discussion and treatment recommendation, since the RNs may have the responsibility for presenting information related to patient preferences and psychosocial aspects (48). However, culture, hierarchal structures, undefined roles and variable expectations may explain these imbalances (2, 3, 48, 49). A democratic team culture with mutual respect between MDT members is suggested to enhance an open discussion climate and thereby facilitate decision-making (2).

The leader, that is, the MDTM chair, has a pivotal role in facilitating constructive case discussions and should ensure inclusiveness, effective communication and decision-making (2, 3, 43, 50). Characteristic of good chairing skills are efficient time and meeting management, good interprofessional relations, conflict management and supporting the decision-making process (2, 3). A recently published study assessing leadership and chairing aspects of MDTMs in Swedish cancer care demonstrated well-functioning leadership related to time management, case prioritization and provision of treatment plans, whereas encouraging contributions from all MDTM participants and supporting and summarizing the case discussion were found to be less efficient (50). Chairing has by tradition often been assigned to the participating surgeon (3, 31, 43, 51, 52), yet there are favourable experiences from rotating leadership and positive experiences of chairing by other disciplines, for example, oncologists and RNs (46, 52, 53). Soukup et al. (3) suggest non-contributing MDTM participants chair the meeting to avoid dual-task interference.

Impact from MDTMs on patient outcomes

Efficient MDTMs are broadly viewed as contributing to increased adherence to guidelines (54), improved quality of care and ensuring safe and equal patient management (3, 9, 22, 23, 32). The impact of the MDTMs on patient outcome is, however, uncertain (3, 9, 25) and difficult to assess due to heterogeneity of study design, data collection and analysis, and healthcare setting (31). Benefits related to changes in diagnosis and treatment recommendations have been suggested (5, 23). For example, El khoury et al. (55) reported that patients diagnosed with urological cancer discussed at an MDTM had an altered management decision in more than 41% of cases discussed. Similarly, a recently published systematic review reported a change in overall management plan (i.e. change in treatment and/or diagnostic accuracy) in up to 58% of all cases discussed in MDTMs for urological cancers, colorectal cancer, breast cancer and lung cancer. Changes in management plans are more often observed in complex cases (21). The impact from MDTMs on survival is, however, uncertain and studies on patient outcomes such as recurrence and metastasis have reached partly contradictory results with variations that are likely influenced by health-care settings and diagnostic areas (3, 23, 25). The gradual and increasing introduction of MDTMs in routine care in parallel with other clinical developments also challenges evaluations of the independent impact from MDTMs (23).

Resource constraints

Increased cancer incidence and development of multiple and complex treatment options have led to growing requests for MDTMs, which challenges currently available resources (3). Presence of all key MDT members in the MDTM is one of the most important facilitators for efficient decision-making (2, 11, 43, 56). Yet, MDTMs are time consuming (7) and identified reasons for non-attendance include lack of protected time and weak organizational support for MDTMs (3, 11, 12). From the health-care provider's perspective, the considerable human resources devoted to weekly MDTM is a major challenge in systems with shortage of staff and waiting times for cancer treatment. Current MDTM services are especially resource demanding for radiology and pathology due to the high number of cases that should be reviewed and prepared prior to the MDTM (1, 37).

An evaluation of MDTM resource use in Sweden was conducted in 2017, demonstrating that an MDTM lasts mean 0.88 h and the MDT discuss mean 12.6 patient cases with mean 4.2 min per case discussion. The total meeting time was found to be associated with number of cases discussed, cancer diagnosis, hospital setting and the use of video-conference systems. At the MDTMs, mean eight physicians and three RNs and other allied health-care professionals participated. The total cost per MDTM was calculated at mean 2675 EUR (range 1439–4070 EUR), which translates to 212 EUR (91–595 EUR) per case (1). Studies on time- and cost-related components of MDTMs are limited (21), though financial benefits through improvements in the organization and patient management have been suggested (57).

Increasing case-loads at MDTMs have also been reported to challenge decision-making (11). Cases listed later during the meeting risk getting less attention from the MDT, and to counteract 'decision-making fatigue' (12, 58, 59) a break mid-way has been demonstrated to improve outcome and raise attention (11, 58). To enhance efficiency and safeguard sufficient time for discussion of complex cases, various forms of streamlining may be considered (3, 11, 12, 37, 60-62). This implies that standard cases could be managed according to existing guidelines or listed for rapid review during MDTMs (11, 63). Complex cases have been demonstrated to have a greater benefit and a larger chance of altered treatment recommendations from MDTMs, while streamlining is challenged, since there is no generally accepted definition of case complexity (23, 59). Suggested factors that influence case complexity include rare cancer diagnosis, unsuccessful previous treatments, psychosocial aspects and comorbidities (37). However, from an individual perspective any person affected by cancer has unique and complex needs (43).

The Measure of case-Discussion Complexity (MeDiC) instrument has recently been developed as a standardized tool to define case complexity for prioritized discussions at MDTMs (59). Other possibilities include grouping cases by participating disciplines to allow professionals to attend only the part of the meeting where cases that depend on their input are discussed (60).

Patient perspectives

High-quality MDTM decision-making requires complete and comprehensive medical as well as patient-related information to ensure a holistic approach to the treatment recommendation (56). Yet, several studies demonstrate that the MDTM discussion and treatment recommendation are primarily based on biomedical information with less attention given to patient perspectives (3, 11, 37, 43, 48, 64). Multiple reasons may explain limited consideration of patient perspectives, for example, case discussions early in the clinical trajectory when the patient may not have been seen by any MDTM participant. Further, many MDTMs list a high number of cases with limited time per case discussion (64, 65). Some MDTM participants perceive that the MDTM should primarily focus on medical aspects (66), whereas subsequent meetings between the patient and the responsible physician should take patient perspectives into consideration.

Patient perspectives cover a broad range of aspects from, for example, information on patient views and wishes for treatment to psychosocial factors that may influence treatment decisions (64, 66). Adherence to these aspects is suggested to result in individualized treatment recommendations, a higher likelihood for successful implementation and a reduced risk of clinically inappropriate recommendations (3, 37, 66). The current model of MDTM does typically not provide information on whether the treatment recommendation given was implemented or not (67, 68). Studies that have assessed implementation of MDTM treatment recommendations demonstrate that 1%–16% of MDTM-based treatment recommendations were not implemented (32). For example, Blazeby et al. (67) studied the concordance between MDTM recommendation and treatment implementation in upper gastrointestinal cancer and concluded that 15% of the recommendations were not implemented. De Ieso et al. (7) found that 9% had altered management compared to the MDTM recommendations. Similarly, Hollunder et al. (69) demonstrated that 8% of MDTM recommendations differed from actual given treatment, and Vinod et al. (70) showed similar result with 8% of recommendations not implemented into clinical practice. Patient preferences and wishes, and physician's choice due to comorbidity or treatment complications represent the main causes of deviations from MDTM recommendations (7, 67, 69-72).

There is no standard for how to best involve patients and ensure considerations of patient perspectives in the MDTM decision-making process (3, 4) (Figure 3). There are MDTM settings that allow patient participation (73, 74). Yet, for practical reasons these are rare examples, and the MDTM predominantly constitutes a professional decision-making forum (11, 43, 75). Further, participation in an MDTM is perceived to be stressful for the patient (11, 12, 23, 54). It is also unclear which is most advantageous for the patient, that is, whether their perspective should impact on the decision-making or whether the MDT should discuss treatment options before weighting patient-related information. Patient perspectives could potentially change when the MDTM recommendation is presented, and patients may need time to reflect upon the recommendations provided (12).

Optimal timing and structures for considering patient perspectives in MDTM treatment recommendations should be discussed and defined by the respective MDTs. However, to be able to understand the meaning of patient perspectives in the context of MDTM, clarification of the concepts person- and patient-centred approach to care may be needed. Patients are persons, including their subjectivity and existence within a given environment, and their rights, meaning the patient is not defined by the disease alone. In a person-centred approach to care the patient is an active partner in the decision-making process and considered a co-creator of care. This approach demands that the healthcare professionals have relevant information on the person behind the patient (76). From this point of view a person-centred approach to MDTMs may not be possible, as the patient does not participate in the meeting. A patient-centred approach includes individualized and objective factors that determine which medical services best serve the patient (76). Soukup et al. (77) argue for a patient-centred paradigm shift to improve the effectiveness of MDTM, including consideration of psychosocial information, comorbidities, performance status, patient preferences and views on treatment alternatives.

Geerts et al. (66) suggest three strategies to improve patient-centredness in MDTMs: development of the MDTM organization (i.e. access to information on patient perspectives prior to MDTM, structured case presentation, team education and feedback); decision-making (i.e. assigning a person to advocate for the patient) and communication (i.e. strategies to collect information on patient perspectives). This is supported by Walraven et al. (11) who also suggest appointing an MDTM participant responsible for presenting patient perspectives. The RNs are, based on their skills in gathering and including information on patient perspectives, often suggested as the preferred MDTM participants to present patient perspectives and to advocate for the patients in their absence (12, 32, 42, 65, 66, 68). Yet, as previously mentioned, several studies report limited contributions from RNs in the MDTM setting (2, 3). Such a model would, however, require clarified responsibilities and increased contributions from the RNs during MDTMs (3).

Figure 3. MDTM decision-making process

MDTM evaluation and follow-up

Factors that define effective MDTMs relate to, for example, access to relevant information, sufficient resources, teamwork, communication and discussion climate. However, in clinical everyday work considerable variability of MDT performance has been documented (37). This emphasizes the need for team-based approaches to improve the quality and effectiveness of MDTMs, using appropriate evaluation methods (3) and validated instruments (12). Lamb et al. (61) emphasize that the MDTs need to take ownership of improving the health-care services and improving work processes in response to local needs. Yet, the challenge lies in how constrained resources can be combined with initiatives improving MDTM efficiency without restricting the benefits related to MDTMs (7).

Several quality assessment instruments have been developed to evaluate MDTMs, to provide insights into strengths and shortcomings and identifying areas for improvement of MDTM services. The MDT/MDTM evaluation instruments include checklists, instruments for observational assessment and team development schemes for external or internal assessment and evaluation (Table 2). These instruments can be used by MDTM participants, external evaluators or researchers to obtain an understanding of how MDTs perform to achieve a more granular view of different aspects and to define opportunities for development and improvement (37). Variables assessed include, for example, attendance, MDT performance, MDT members' contributions, leadership, meeting culture, availability of information, organization and administration of the MDTM (11, 25).

Table 2. Summary of quality assessment instruments used to assess and improve MDTMs

Instrument	Methodology	Description
ATLAS (A Tumour Leadership Assessment inStrument) (78)	Observational assessment	The instrument consists of 12 domains that assess leadership skills of the MDTM chair
CDSS (Clinical Decision Support System) (79)	Decision-support system	The decision support system helps the team in their self-correcting capacity for accurate diagnosis
MATE (Multidisciplinary meeting Assistant and Treatment sElector) (80)	Decision-support system	IT-based decision support system that gathers patient data, identifies patients suitable for clinical trials and suggests treatment recommendations
MCC Checklist (Multidisciplinary Cancer Conference) (81)	Checklist	Enhances quality of care of patients with breast cancer by raising attention to important aspects in the MDTM process
MDT-FIT (MDT Feedback for Improving Team Working) (82)	Team self-assessment and observation	Online tool that enables MDT assessment and feedback. The MDT identifies their own development needs and progress of improvement

Instrument	Methodology	Description
MDT-MODe (MDT Metric for the Observation of Decision Making) (83)	Observational assessment	Assesses MDT performance and decision-making processes based on presented information and MDTM participants' contributions to the case discussions
MDT-MOT (MDT Meeting Observational Tool) (84)	Observational assessment	Assesses the overall MDTM performance based on ten domains
MDT-OARS (MDT Observational Assessment Rating Scale) (85)	Observational assessment	Observational measures that assess quality in MDTM based on 15 aspects of effective MDT working
MDT-QuIC (MDT Quality Improvement Checklist) (86)	Checklist	Tool that supports MDTM decision-making and can be used as a checklist to structure case discussions
MeDIC (Measure of case-Discussion Complexity) (59)	Checklist	Tool that supports MDT to streamline case discussions based on case complexity
MODe-Lite (Metric for the Observation of Decision Making-Lite) (61)	Observational assessment	A shorter version of MDT-MODe that allows the MDT to conduct quality assessment on a daily basis
Multidisciplinary team maturity matrix (87)	Team self-assessment	An improvement programme that consists of a survey and maturity matrix that provide insight into MDT performance and a framework to strengthen team performance
TEAM (Team Evaluation and Assessment Measure) (88)	Team self-assessment	Questionnaire that assesses team performance with the aim to improve teamwork in MDTMs

Even if quality assessment instruments are of value, Brown et al. (25) argue that the instruments focus on the MDTM process rather than on the quality of the decision on treatment recommendation and effect on patient outcome. This is also emphasized by Devitt et al. (89), who point to the importance of methods that ensure and measure MDTMs' capacity to provide evidence-based and individualized treatment recommendations.

Rationale

Even though MDTMs are a recurrent work task for many health-care professionals in cancer care, research on MDTMs in Swedish cancer care is limited. Shortcomings such as technological difficulties, resource constraints, suboptimal communication, time pressure and lack of patient-related information may negatively influence teamwork and decision-making (2, 3). Better insights into benefits of as well as barriers to MDTM-based decision-making are thus needed to further improve and optimize MDTM services.

National, virtual MDTMs for rare cancer are a new concept, which implies limited information on function and decision-making. Expansion of MDT in virtual expert networks will likely further increase in health-care to serve rural areas and provide expert recommendations for rare diseases. Physical MDTMs have been suggested to enhance communication and facilitate discussions, whereas national, virtual MDTMs challenge communication, which may affect decision-making (11, 90). Structured evaluation and definition of strengths and weaknesses related to national, virtual MDTMs with participation from geographically dispersed expert teams can provide insights that are relevant for further improvement of national MDTMs.

Previous research suggests that the MDTM decision-making is skewed towards biomedical information and less attention is given to patient perspectives (3, 24, 37, 43, 77, 91-93). RNs have more recently been included in the MDTMs but show limited contributions to the case discussions. Insight into RNs' views on their roles during the MDTM, in particular related to patient perspectives, provides a basis for further discussions on how to ensure holistic case discussions that contribute to treatment recommendations with a high likelihood for clinical implementation.

Aims

The overall aim of this thesis was to evaluate MDTM function and to investigate MDTM participants' views on MDTMs as a basis for further development of these services. The specific aims of the four studies were to:

I. Assess MDTM participants' views on perceived benefits of MDTM-based treatment recommendations and barriers to reaching joint treatment recommendations with correlation to discipline, profession, hospital type and diagnostic area.

II. Evaluate national, virtual MDTMs for rare cancers regarding functionality, MDTM participants' contributions to case presentations and case discussions and participants' experiences.

III. Investigate MDTM participants' views on key enabling factors and barriers for national, virtual MDTMs for rare cancers.

IV. Explore registered nurses' views on the prerequisites for and barriers to including patient perspectives during MDTMs.

Materials and Methods

To provide a comprehensive insight into the research questions asked, a combination of different materials, data collection and analytical methods were used. An overview of study design, participants, data collection and data analysis is presented in Table 3.

Table 3. Overview of materials and methods in the different studies

	Study I	Study II	Study III	Study IV
Study design	Quantitative, observational study with an cross-sectional design	Quantitative, observational study with an cross-sectional and longitudinal design	Descriptive, qualitative study with an inductive, explorative design	Descriptive, qualitative study with an inductive, explorative design
Sampling	Exploratory, non-probability sampling	Exploratory, non-probability sampling	Convenience sampling	Purposive sampling
Participants	244/362 MDTM participants in the South Sweden health-care region	125/241 participants in seven national MDTMs	125/241 participants in seven national MDTMs	22 registered nurses
Data collection	Electronic questionnaire	Observations, electronic questionnaire	Electronic questionnaire	Focus group interviews
Data analysis	Descriptive statistics, chi-squared tests, Bonferroni correction	Descriptive statistics, inter-observer variability	Conventional content analysis	Qualitative content analysis

Context

The studies included in this thesis were performed in Swedish cancer care. Studies I and IV were performed in the South Sweden health-care region and related primarily to local and regional MDTMs, whereas studies II and III studied national, virtual MDTMs. In the South Sweden health-care region with a population of 1.9 million, there are about 50 cancer-related MDTMs (1), and the region participated, at the time the studies were conducted, in seven cancer-related national MDTMs for rare cancers (94). The national clinical cancer care guidelines and SCPs indicate time for MDTMs and recommend key participants. These guidelines are, however, at a high level, and the various MDTs have individually developed referral principles and defined meeting structures, regarding, for example, frequency, required and added participants, data sharing formats, use of video-based connections, responsibility for chairing the meeting and for communicating results to the patient.

Though most national clinical cancer care guidelines recommend MDTM-based case discussions for all newly diagnosed patients with cancer, this is not uniformly implemented, which has also been reported elsewhere (63). In the rare tumour areas studied, the vast majority of eligible patients are referred to the national MDTM. In studies I and IV a broad range of MDTMs are represented and herein referral rates vary from close to all patients to selected patient groups and varying goal achievement (20).

Patients did not participate in any of the MDTMs studied, which is standard procedure. The responsibility for case presentation varies between MDTMs and may rest with the responsible physician or with the chair who presents the case history and clinical problem, followed by MDTM participants contributing with their respective information and expertise (31, 48). Responsibility for case presentation in the regional MDTMs studied varied, whereas the responsible physician in the various expert centres generally presented the cases during the national MDTMs.

Most Swedish MDTMs include RNs with participation typically from the CN. CNs in cancer care are RNs with a specific assignment including, for example, responsibility for patient care and coordination and participation at MDTMs, though their specific role in the MDTM is not defined (19). Several higher education institutions in Sweden provide a CN specialization course. However, specialist courses are not compulsory to work as a CN. A CN can work in medical as well as surgical departments. In this thesis CNs are referred to as RNs. In studies I–III all MDTM participants, including RNs, were invited to respond to the questionnaires and were naturally included in the observational assessment in study II, whereas study IV specifically focused on the RNs' perspective.

MDTMs, participants and data collection

MDTMs

In a previous study aimed at evaluation of resource use, we identified 50 MDTMs in the South Sweden health-care region (1). In study I, participants in these MDTMs were invited to participate. The MDTMs included a broad range of cancer diagnoses: breast cancer, lung cancer, malignant melanoma, gynaecological cancer, urological cancer, gastrointestinal and hepatobiliary cancer, CNS tumours, head and neck cancer, endocrine tumours and sarcomas. Thirty-one MDTMs were held at the university hospital and 19 at county hospitals, with access to video-based connections and participation in 21 of the MDTMs.

In study II, observational assessment was conducted in three of the national MDTMs for anal cancer, penile cancer and vulvar cancer. These three MDTMs were selected based on having well-established structures and regular weekly meetings. Questionnaire data for studies II and III were based on data from MDTM participants in seven national MDTMs, which also included MDTMs for childhood cancer, HIPEC, advanced oesophageal and hepatobiliary cancer.

Study IV included RNs from different MDTMs, which included various types of hospitals (i.e. university and county hospitals), specialities (i.e., oncological and surgical departments) and cancer trajectories (i.e. gastrointestinal cancer, breast cancer, head and neck cancer, urological cancer, gynaecological cancer and lung cancer).

MDTM participants and data collection

In study I, 362 MDTM participants representing various professions, disciplines, and diagnostic areas were included. The MDTM participants were identified by the cancer care coordinators at each hospital and received an invitation to participate, including a link to the questionnaire by e-mail. The questionnaire was constructed by the research team based on clinical expertise and previous research. The questionnaire included demographic questions, 20 statements regarding structure and function of the MDTM, 13 statements on possible benefits from MDTM and 15 statements on potential barriers to reaching a joint MDTM recommendation. The respondents were asked to rate the statements on structure and function on a seven-point Likert scale (1 = strongly disagree and 7 = strongly agree) and to select three statements on the most important barriers and benefits. Data were collected in 2016 with complete responses obtained from 244 (67%) MDTM participants. The participants included 70% physicians and 28% RN and MDTM coordinators. Surgery was the most common discipline (47%) followed by medicine (29%), radiology (14%) and pathology (7%). Hospital types were university hospital (52%) and county hospitals (48%).

In study II, we used observational assessment tools and an electronic questionnaire to evaluate national MDTMs' function, with a focus on MDTM participants' experiences, case information presented and contributions to case discussions. The two observational tools MDT-MODe (Metric for the Observation of Decision-Making) and MDT-MOT (Meeting Observational Tool) were used for data collection. Each MDTM was observed at three different occasions (N = 67 case discussions) with participation from two members of the research group. MDT-MODe provides a case-based evaluation focused on information presented and MDTM participants' contribution to the case discussion (Table 4). Each variable was assessed by using a five-point Likert scale (1 = insufficient function and 5 = optimal function) (83).

Table 4. Overview of parameters evaluated in the observational assessment tool MDT-MODe (83)

Information presented	MDTM participants' contribution to case discussion
Case history	Chair
Radiological information	Surgeons
Pathological information	Physiotherapist
Psychosocial aspects	Oncologists
Comorbidity	RNs
Patient's view	Radiologists
	Pathologists
	MDTM coordinators

MDT-MOT assesses the MDTM's overall performance based on 10 key domains (Table 5). Each domain is evaluated similarly to MDT-MODe by using a five-point Likert scale (1 = insufficient function and 5 = optimal function) (84).

Table 5. Overview of parameters evaluated in the observational assessment tool MDT-MOT (84, 95)

Characteristics	Examples of team performance
Attendance	MDT members attend relevant cases
Leadership	Managing time and discussions, ensures evidence-based treatment recommendations
Teamwork	Agreed meeting standards including conflict management and inclusive discussion environment
Personal development and training	The MDT support teaching and training
Physical environment	Dedicated conference rooms and appropriate physical environment
Technological infrastructure	Sufficient equipment to present relevant information and appropriate video-meeting infrastructure
Organization and administration	Patient responsibility is clear, relevant information is available
Post-meeting coordination	Structures are implemented to ensure communication of treatment recommendations
Patient-centred care	Responsible MDTM participant presents patient-related information
Decision-making process	Agreed information is available, the MDT considers all relevant treatment options

Following an observational assessment, all 241 MDTM participants in the seven national MDTMs were invited to respond to an electronic questionnaire. The participants were asked to rate 14 statements concerning national MDTM structure and function on a seven-point Likert type scale (1 = disagree and 7 = fully agree). The scoring part of these data was included in study II.

The questionnaire also included three questions with the possibility to provide free-text answers. The qualitative analyses of these responses were included in study III with the aim to investigate MDTM participants' views of key enabling factors, barriers and development opportunities for national, virtual MDTMs. The questionnaire was constructed by the research team based clinical expertise and previous research and on the results from study I. Data were collected in 2017–2018 with responses from 125 (52%) MDTM participants. Physicians represented 87%, RNs 11% and medical secretaries 2% of the participants. Disciplines represented included surgery (56%) followed by medicine/oncology (26%), paediatric oncology (10%) radiology and pathology (6% respectively 2%).

In study IV, 22 RNs working in cancer care and representing various diagnostic areas were recruited to four focus group (FG) interviews. Inclusion criteria for the study were having knowledge and/or experience of MDTMs and being an RN working as a CN. Three FG interviews were held in a university hospital and one in a county hospital. All interviews were conducted in quiet and remote rooms at the respective hospitals. Informed written consent was collected from all participants before the interviews. The FG interviews were performed by two researchers (MM and LR) using a semi-structured interview guide (96), developed by the research team based on clinical experience and previous research. Field notes were taken throughout the interviews. The FG interviews were digitally recorded and transcribed verbatim. Data were collected during 2018.

Data analysis

In study I, the responses were analysed in relation to discipline, profession, hospital type and diagnostic area. The correlations assessed represent areas where sufficient data were available and where we hypothesized that differences in perceived benefits and barriers could apply. Responses on benefits and barriers were analysed using chi-squared tests with a significance level at $p = 0.05$. Responses on MDTM structure and function based on Likert type scale data were also analysed using chi-squared tests. Bonferroni correction was applied to adjust for multiple testing. Data were presented as diverging stacked bar charts (study I, Figure 1) and as horizontal bar charts (study I, Figures 2 and 3) and in table format (study I, Tables 1 and 2). The group MDTM coordinators and RNs were analysed together, since there were few participants in the former group.

In study II, the mean scores from the observational assessment tools, MDT-MODe and MDT-MOT were used in the analyses. Inter-observer variability was analysed by using correlation coefficient estimates. Overall data from MDT-MOT, MDT-MODe and MDTM participants' response profiles were presented as diverging stacked bar charts (study II, Figures 1–3). Questionnaire data from participants in national MDTMs for advanced oesophageal and hepatobiliary cancers were analysed together based on a high degree of overlapping MDTM participants.

In study III, MDTM participants' views based on 278 written free-text answers were analysed using conventional content analysis with an inductive approach inspired by Hsieh et al. (97). The methodology was motivated by limited research literature on national, virtual MDTMs (97). Three researchers (LR, MM and JW) independently read the whole text to get a sense of the totality. In the next step codes capturing key concepts were derived from the text, creating a coding scheme. Codes were then gathered into categories based on similarity, creating meaningful clusters. The analysis was a dynamic process moving back and forth between the general and the specific (97), resulting in three main categories and nine subcategories (study III, Table 2).

In study IV, the transcripts were analysed by using qualitative content analysis with an inductive approach inspired by Elo et al. (98). The methodology was motivated by limited research literature on RN perspectives and experiences of MDTMs in cancer care. The researchers (LR, WM and MM) separately read the verbatim transcripts to gain a comprehensive picture of the text. Open coding was performed to construct a coding sheet, and codes were clustered under subcategories. In the following abstraction process the subcategories were grouped under categories based on commonalities, and categories were sorted under main categories (98). Researchers BL and MN contributed with clinical knowledge and expertise, securing trustworthiness of the analysis, and with writing the manuscript. The field notes were used to support trustworthiness of the analysis. Likewise, in study III the definition of categories and subcategories was a dynamic process (98), resulting in two categories and five subcategories (study IV, Table 2).

Methodological considerations

This section includes reflections on the materials and methods used in the thesis and is divided into quantitative and qualitative approaches. All study designs have pros and cons, and the choice of study design may influence the findings as well as the conclusions from the study. In quantitative studies the concepts' validity and reliability should be considered in assessing the quality of research (99). While in qualitative studies trustworthiness is important to discuss, referring to a comprehensive sense of the study (100), including the concepts credibility, conformability, dependability and transferability (101).

Quantitative approach

Sampling and data collection

Sampling

In studies I and II, an exploratory, non-probability approach to sampling was employed, that is, sampling was not based on random selection. Non-probability sampling is useful when information on population parameters is limited and potential participants are selected based on, for example, their expertise and experience of the subject of interest (102). In study I, MDTs were identified by cancer care coordinators at all cancer-treating hospitals in the Southern Sweden health-care region, who also provided a list of MDTM participants. In studies I and II, the MDT chair provided contact information to MDTM participants. A limitation of this sampling method is potential selection bias related to missed MDTM participants, which the research team could not verify. However, a strength is that all MDTM participants in 50 local/regional and seven national MDTMs were eligible for the studies, and we had no reason to suspect eventual deviations from sampling.

Questionnaires

Questionnaires allow data collection from large, geographically distributed groups of respondents. A software programme (Survey Monkey) was used to create the questionnaires, which were distributed to MDTM participants by e-mail. These types of software programmes facilitate the research process by compiling and summarizing data in spreadsheets, minimizing data entry errors (103). Also, an electronic distribution is favourable based on the ease of answering and returning the questionnaire (102).

The questionnaires included both Likert type scales and fixed and free-text answers, where the latter will be discussed in the section regarding qualitative approach (study III). In study I, participants were asked to select up to three predetermined alternatives on MDTM benefits and barriers, respectively, to reach a joint treatment recommendation that limits the responses to predefined alternatives and does not allow the participants to ask consecutive questions. The use of predetermined alternatives may cause a potential risk of missing other aspects of importance. A seven-point Likert type scale was used in both questionnaires (studies I and II), which is a commonly used response format due to its simplicity and speed of administration (99). According to Streiner et al. (99), a basic principle when considering scale division is whether the number of steps is less than the respondents' capability to discriminate, which case there will be loss of information. The authors suggest five to nine steps as suitable, which includes a middle position. Another study suggests using five steps, with the motivation that the quality decreases as the number of steps increase (104). However, criticism has been raised against this type of scale based on the risk of acquiescence bias, meaning the respondent tends to agree rather than disagree with the statement in question (99). An alternative would have been to use fixed response alternatives to a greater extent, yet this would have resulted in extensive questionnaires, which was not desirable (102). In both questionnaires (studies I and II), the participants could always answer "do not know/not relevant" as an alternative response.

The questionnaires were constructed by the research team based on clinical experience and with inspiration from previously published research, which is usual when constructing new items (99). Reliability assesses whether the instrument measures what is intended in a reproducible manner. Validity refers to the instrument's accuracy in terms of whether it measures the desired qualities (99). Not using a standardized, psychometrically constructed instrument may be considered a weakness, impacting on the studies' quality in terms of reliability and validity. Yet, validity was to some extent strengthened by the questionnaires having undergone pilot testing to eliminate questions that were perceived as ambiguous or obscure (99) and to get an estimate of response time (102). Five to ten health-care professionals working in cancer care and with experience of MDTMs tested the questionnaires. Minor modifications to linguistic design were made afterwards to ensure that format and questions were relevant and clearly formulated (102, 103). Future development of psychometrically constructed instrument to evaluate MDTM services in Swedish cancer care would be beneficial to support recurrent and structured evaluations.

Observations

The chairperson of each MDTM was contacted by e-mail and permission was granted to attend and observe the respective MDTM. A summary of the research project was provided to the MDT prior to observation, but details on the study in focus were omitted to minimize potential influence on team performance. Members of the research team observed the MDTMs, but were seated at the back of the room, without interfering with or commenting on the case presentations or case discussions. The Hawthorn effect refers to the risk that researchers may influence behaviour when conducting observations. Yet, according to McCambridge et al. (105) there is no single Hawthorn effect; they report limited knowledge about the conditions under which the effect operates and the mechanisms and magnitudes of effects. Yet, the authors do claim that consequences of research participation exist, and instead suggest the term ‘research participation effects’. We regard the potential impact of our presence on MDT behaviour and performance as limited, and repeated observations led to less attention from the MDT to the presence of an observer.

Motivated by an aim to evaluate overall MDTM function as well as MDTM participants’ contributions to the case information and case discussion, MDT-MOT and MDT-MODe were selected for observational assessment. MDT-MOT was developed by Harris et al. (84) for use in routinely evaluating and identifying areas for MDTM improvement and supporting MDT development (106). The tool assesses the entire MDTM based on ten key domains and has demonstrated very good content validity and reliability (25). MDT-MODe was originally developed and validated by Lamb et al. (83) and further adapted by Jalil et al. (107), Shah et al. (108), Hahlweg et al. (92) and Lumenata et al. (109). The tool may be used by medical and non-medical observers to assess MDTM performance (83, 110, 111). MDT-MODe has demonstrated favourable content validity and reliability (25).

Our studies are the first to apply MDT-MOT and MDT-MODe in Swedish health-care, which means that comparison of the absolute scores to other studies in Swedish cancer care context was not possible. One possible limitation of the use of these instruments relates to the fact that these tools were not validated or translated into Swedish prior to our study being conducted, which may impact the reliability of the results. However, the instruments have been validated in the UK cancer context and shown to be valid and reliable, and the overall scores and results in our studies were shown to be comparable with results obtained from the UK. This, in combination with knowledge that the organization and execution of MDTMs in the UK are similar to those in the Swedish cancer context and that the tools assess the MDTMs on an overall level, may limit potential weakness.

Observer bias is inevitable when recording subjective factors. Observer bias is defined as systematic deviation from the truth during the observation, affecting the assessment. Preventive steps to minimize such impact on the results include training, identifying potential conflicts of interest among observers and having awareness of eventual preconceptions (112). Continuous discussions within the research team and pilot evaluations of the tools were conducted to decrease the impact of observer bias.

Data analysis

Questionnaires

The response rate of 52% in study II is suboptimal, though comparable to other voluntary questionnaires (113). Despite the limited response rate, we did receive a relatively high number of responses (n = 125), which should ensure multiple and various perspectives to the questions raised. Hence, non-response bias may impact on the representativeness of the result and should be considered (114). Streiner et al. (99) report that errors can occur arising from the items themselves, and from responses. Usually, bias in responding to questions relates to interpretation of the question, recall of the relevant attitude or behaviour, estimate of frequency, mapping of the answer onto the response alternatives and to the respondents editing their answers. The views of the responding MDTM participants may be biased toward participants who are more positive as well as more negative to the MDTM (99, 103), and the questionnaire will systematically be skewed towards findings from participants who are more likely to respond (102).

We had no information on participants who did not respond to the questionnaire and were not able to perform a non-responder analysis to study causes of non-response and underrepresented groups. Two reminders were sent by e-mail in studies I–III, which is suggested to boost response rate. The electronic data collection format could positively as well as negatively influence the response rate (114). On reflection, we could have considered sending reminders in physical format to obtain data from individuals with that preference, which may have had an impact on the response rate in study II-III (114). Yet, Denscombe (102) argues that electronic and postal surveys generate similar response rates.

Chi-squared tests were used in study I, which is motivated when the aim is to assess whether there is a link between two independent variables (115). The test requires data of sufficient sample size (116), which motivated merging of data from MDTM coordinators and RNs. The chi-squared test does not provide effect estimates, which could have been interesting to apply for a deeper understanding of the findings (117). Bonferroni correction reduces the p-value relative to the number of tests performed and was used to correct for multiple testing and to minimize the risk of type I error (118). Stacked bar charts were used in studies I and II to demonstrate data frequencies and relationships between variables (114).

Observational assessment

Data from observational assessments were analysed for inter-observer variability using correlation coefficient estimates. *Interclass correlation* estimates the relationship between different variables whereas *intraclass correlation* estimates the relationship among observations of the same variable (99). The value of the correlation coefficient can range between -1 and +1, with higher values suggesting better agreement between observers (119). We found inter-observer correlations of 0.71 for MDT-MOT and 0.86 for MDT-MODe which is considered a strength of this study. Our results are similar to the findings in studies in other diagnoses and healthcare settings. Jalil et al. (107) and Gandamihardja et al. (120) reported intraclass correlation coefficients (ICCs) just above 0.70, whereas ICCs were 0.9 in a study by Soukup et al. (121). The latter study included tool training. While members of the research team reviewed the tool, read relevant publications and performed pilot evaluations, formal tool training was not used in our study. Training in usage of observational instruments is suggested as a general principal for instruments assessing human factors in clinical contexts (122). Such training should include explanation of the domains and rating scales, reading of peer-reviewed publications and comparison of scoring against an expert evaluator (58) with the aim to minimize measurement error.

MDT-MODe assesses contributions to the case information and case discussion by seven core disciplines, namely, the chair, surgeon, oncologist, RN, radiologist, histopathologist and MDTM coordinator (46, 83, 111). However, the variable “phys” is included in the instrument without further description in some of the first publications (107, 110) and has later been interpreted as including contributions from various physicians (46). We used this variable to assess contributions from physiotherapists, who were overall scored low and rarely present at the MDTMs studied. Lack of a clear definition of the variable may indicate a potential bias, yet we consider that our interpretation of the variable has limited impact on the result, as the attending MDT consisted of the before-mentioned core disciplines. One alternative would have been to eliminate the variable from our observation/analysis.

The overall aims and general set-up of MDTMs are largely similar in different healthcare systems. Yet, whether the results of studies I and II are generalizable to other healthcare settings may be challenged on the basis of different healthcare systems, guidelines, referral principles, MDTs, leadership, meeting formats and caseloads. However, our main findings are strengthened by previous research demonstrating possible compliance and generalizability to other cancer care settings.

Qualitative approach

Studies III and IV are inductive, descriptive, qualitative studies with an explorative design. Qualitative research is characterized by, for example, the researcher as the main instrument, holistic account, emergent design, and adherence to the context. Qualitative research is advantageous when the aim is to gather rich and in-depth data, for example, exploring participants' opinions and experiences (123).

Sampling and data collection

As data in study III stem from the same questionnaire used in study II a convenience approach to sampling was used. Convenience sampling is usual related to ease of use, that is, participants are primarily selected based on accessibility (124). Selecting sample based on convenience is practical but is criticized as it challenges the rigour of scientific research, if used as the main basis for sampling (102). Studies II and III should be interpreted as a multi-step process where sampling was based on specific reasons linked to our research questions and requirements related to the investigation. Selection of a suitable data collection method is essential to ensure credibility of the analysis. Credibility refers to the focus of the research and how well data illuminates the research question (101). Questionnaires that include free-text answers are beneficial from the point of view that they provide access to large samples and allow the participants to reflect and provide wider and more diverse answers (102), which is valuable when the research question involves unexplored areas. Indeed, disadvantages relate to having no possibility to follow-up on responses and a potential lack of detail on the area of interest. Other challenges relate to the effort and time consumption for the respondent to provide answers, which may affect the willingness to respond to the questionnaire, and the time consumption for the researcher to analyse the written material (102).

In study IV, purposive sampling was conducted (124), which is suggested as a suitable method when the researchers are interested in informants who are well acquainted with the topic of interest (101). FGs are beneficial when the aim is to explore different perspectives, ideas or perceptions about, for example, a practice or underlying factors that impact on opinions or behaviours, which was the fact of our study. But there is also criticism towards the method, and it has been stated that there is an enhanced risk of participants tending to intellectualize or possibly responding untruthfully when interviewed in a group, or that dominant participants can influence the discussion. The criticism related to the quality of the material can be disproven by researcher neutrality and the systematic procedures used, including data collection, handling and analysis. A dominant participant can be managed by a skillful moderator (96), which includes traits such as having knowledge of the subject; a structured, empathetic and friendly approach; active listening skills; and ability to control the interview and interpret the discussion (125). We did not experience dominant participants in the FGs, but rather experienced equal discussions where participants exchanged experiences and thoughts. Since all participants were RNs, one could hypothesize that hierarchies should be less relevant in these groups.

Sample size is important for credibility and transferability. Yet, there is no acknowledged ideal sample size for qualitative studies (101, 124). The amount of data needed to answer the research question in a credible way depends on the quality of data and how complete and comprehensive the data are (124, 126). Four FGs, with 22 participants in total, were conducted, and additional FGs were not deemed necessary, as no new themes emerged from the fourth FG (96). We aimed for variable views and broad representation and therefor invited RNs from university hospital and county hospital settings and from various clinics and diagnostic areas, which is considered a strength enhancing the study's credibility (100). Still, we cannot exclude that additional FGs in different clinical settings could have brought other perspectives. The FG interviews were conducted during an eight-month period by two researchers, one with vast experience of FG in the cancer care context, which is considered a strength. The interview guide was developed by the research group based on clinical experience and previously published research. The interview guide included open-ended questions, and when necessary, probing questions were used to encourage participants to develop their statements and reflections (96).

Data analysis

Qualitative content analysis is a systematic method well suited to analysing large volumes of textual data, offering opportunities to analyse manifest as well as latent content (100). The content analysis is a flexible method but is challenged by the fact that there are different approaches, and the result is affected by the skills and analytical abilities of the researcher (98). Data from studies III and IV were analysed using conventional content analysis in study III (97) and qualitative content analysis in study IV (98). The methods are similar with minor differences in the description of analytical procedure (97).

The choice of an inductive approach was based on limited knowledge in the research area (98), that is, MDTM participant experiences of national MDTMs and RNs views on patient perspectives in the MDTM context. An inductive approach is a data-driven method characterized by the researcher searching for similarities and differences in the data (100). Benefits relate to the possibility of gaining rich understanding of the research area (97), and challenges relate to avoiding general descriptions (100). An inductive approach to data analyses is characterized by moving from the specific to the general, and conversely, the deductive approach moves from the general to the specific. A deductive approach, also called concept-driven, was perceived as unsuitable, as our aim was not theory or concept testing (98). Conformability relates to researcher bias, including management of foreground knowledge and subjectivity (101), which is a challenge when using an inductive approach (100). To minimize the impact of researcher preconceptions and variation in interpretation, transparent and continuous discussions between the authors were held throughout the research processes in studies III and IV. Potential bias was reduced by a multidisciplinary research team conducting the studies, contributing various knowledge, clinical expertise and experience within cancer care, thus ensuring a variety of perspectives, which strengthens conformability and credibility. Conformability was further strengthened by recurrent confirmation of the analysis with the transcripts and field notes and the use of representative quotations (101).

In study III, the Consolidated Framework for Implementation Research (CFIR framework) (127), was used to increase the understanding of our research findings (103, 128) and describe organizational and individual determinants that may influence implementation (128). Implementation research promotes and supports the introduction of research findings and evidence-based practice into clinical routine with the aim to enhance effectiveness and quality of health-care service (129). A growing number of frameworks, theories and models have been developed to gain insight into the mechanism of the implementation process and to support researchers and health-care professionals in conducting a systematic and successful implementation. An alternative would be to use a classic or implementation theory to explain aspects of implementation, but as our aim was to describe enabling factors and barriers for national, virtual MDTMs, the choice of a determinant framework (i.e. CFIR) was perceived as suitable (128). The CFIR is a robust and commonly used framework, based on previous determinant frameworks and relevant theories (127, 128, 130). A potential limitation is that the framework does not define causal relationships (131); yet, that was not our intention in conducting the study.

Dependability applies to data stability over time and in different settings. To enhance the studies' dependability, it is important to be transparent regarding sampling strategy and provide information on participants' main characteristics to enable assessment of transferability (101). Indeed, assessment of transferability of the results from studies III and IV is challenging, since the participants shared and reflected on their own experiences in the specific contexts in which they were active. Participants in studies III and IV represented different hospitals, MDTMs, professions, diagnostic areas and clinics, which allowed insights from different healthcare professionals' perspectives, strengthening credibility. In the end the transferability judgment rests on the reader (126, 132).

In conclusion, with the starting point from limited previous research on MDTMs in the context of Swedish cancer care, we have by using a variety of methods contributed with new insight into MDTMs in Swedish cancer care which can be used in clinical development work and as a basis for development of new research questions.

Ethical considerations

Ethical considerations are a fundamental part of the research process. Ethical considerations are based on the Helsinki declaration (133) and the four ethical principles, justice, beneficence, autonomy and non-maleficence (134). These principles and their implications for our studies have continuously been discussed during the thesis work process.

The principal of justice refers to fair and equal treatment of individuals (134). All identified MDTM participants in the 50 regional and seven national MDTMs were eligible for the studies and received an invitation to respond to the questionnaires (studies I–III). Observation of national MDTMs for vulvar cancer, penile cancer and anal cancer was based on well-established meeting structures, regular meetings and sufficient patient volumes (study II). In study IV we aimed for a variation in participants' views and experiences, whereby RNs from different hospitals, diagnostic areas and clinics were invited.

Principal of beneficence refers to the moral obligation to act with the best interests of the others in mind (134). One example where this principal was considered is in the construct of the questionnaire, which included a limited number of questions, out of respect for MDTM participants' time. Another example is the choice of location for

FGs, which was based on the desire to ease participation and reduce transition time for the participants. To decrease potential power imbalances between the interviewer and participants we avoided leading questions and instead encouraged participants to share their own experiences (123).

Respect for autonomy refers to the individuals' right to their own views, to make choices and to act on what they think is best (134). This means that individuals need to have information on what they are being asked to agree to, to be able exercise autonomy (99). Written information about the study was included in the invitation to respond to the questionnaire in studies I–III. Written and verbal information about the study was provided prior to observation (study II) and FG interviews (study IV). Participation in all four studies was voluntary, and participants were informed that they could withdraw from the study at any time. Informed consent was collected prior to the FG interviews (study IV), and respondents in studies I–III agreed to participate by responding to the questionnaire. Permission to observe the national MDTMs in study II was given by the MDT chair.

Principal of non-maleficence refers to the principle of doing no harm to others (134). The studies' results were presented at a group level. Confidentiality was ensured by all data being handled anonymously, by de-identifying research material that is, by removal of names and information that could be tracked to an individual person from transcribed interviews, responses to questionnaires and so forth.

Participation in the studies was perceived to have no negative impact on MDTM participants or their work situation. All studies were approved by the Regional Ethics Board, Lund, Sweden (Dnr 2016/195), and in an additional approval (Dnr 2017/109). Yet, observations, questions included in questionnaires and interviews may raise negative influences, feelings or thoughts (113). To counter potential negative concerns, contact information for the research team was provided to all participants eligible for the studies.

Results and Discussion

Overall, the regional as well as national MDTMs studied were, based on participants' responses, experiences and the results from observational assessment of the national MDTMs, found to be well-functioning, though challenges and areas for improvement were also identified. The results of the studies will, following an overall presentation of the data, be presented and discussed under the subheadings *Organizational perspectives, Multidisciplinary teamwork and decision-making* and *Patient perspectives*.

Summary of results

Study I

In study I, MDTM participants' views on MDTMs, including benefits of and barriers to MDTM-based decision-making were investigated. Responses from MDTM participants (n = 244) regarding MDTM structure and function demonstrated affirmative scores (5–7) for patient management and competence development for the individual as well as for junior colleagues (study I, Figure 1), whereas low scores (1–3) scores were provided for timely pathology reports and joint work to develop the MDTM (study I, Figure 1). The predominant benefits reported by MDTM participants included consolidated clinical information for appropriate treatment recommendations and multidisciplinary assessment (study I, Figure 2). Indeed, adherence to patient perspectives and screening patients suitable for clinical trials were reported in only 1%–3% of the responses (study I, Figure 2). Barriers to reaching a common treatment recommendation were related to needs for additional investigations and insufficient information on pathology followed by no MDTM participant had met the patient before the meeting, case complexity and insufficient radiological information (study I, Figure 3).

Studies II and III

In studies II and III, we used observational assessment and questionnaire data to investigate national, virtual MDTMs from the perspectives of functionality, MDTM participants' contribution and views on enabling factors and barriers. Responses from participants in seven national MDTMs (n = 125) showed affirmative scores for explicit roles at the MDTM (85%), development of MDT competence (81%) and development of individual competence (80%), whereas low scores related to clear guidelines for documentation (20%), well-functioning technology (22%) and structures for MDTM evaluation (30%) (study II, Figure 1). Observational assessment based on nine observation sessions and 67 case discussions using MDT-MOT and MDT-MODe provided similar pictures. MDT-MOT data showed high scores for the decision-making process, teamwork and culture, whereas patient-centred care scored low (study II, Figure 2). Observational assessment based on MDT-MODe demonstrated limited information on psychosocial aspects and patient view, whereas case history scored high followed by information on radiology pathology and comorbidity receiving moderate scores (study II, Figure 3). In the case discussions unbalanced contributions were noted with substantial contributions from surgeons and chairs, and low contributions from RNs, physiotherapists and MDTM coordinators (study II, Figure 3).

Study III was based on 278 free-text answers related to enabling factors, challenges and development opportunities linked to national, virtual MDTMs. Three categories were identified: (a) a national forum with potential for knowledge sharing and collaboration, (b) preconditions for decision-making and (c) organizational aspects and responsibilities. Hereunder a total of nine subcategories were defined. These were for (a) assembled competence, resource consumption and insufficient participation, and an arena for clinical research. Subcategories related to (b) were case discussions and compliance to treatment recommendations, meeting climate and limited information on patient perspectives and (c) national MDTM achieving its potential, management of referral and technical difficulties (study III, Table 2).

Study IV

In study IV, RNs' views on patient perspectives in MDTMs were explored. Two categories and five subcategories were identified (study IV, Table 2). The categories were (a) various views of and ambivalence about patient perspectives and (b) preconditions for considering patient perspectives in MDTM decision-making. The subcategories related to (a) were holistic perspective *versus* medical aspects, appraised value of patient perspectives and factors affecting patient contributions. Subcategories related to (b) were structures for enhanced attention to patient perspectives and prerequisites for RNs' contributions.

Organizational perspectives

Support in patient management

Overall, MDTM participants reported positive experiences from MDTMs. Participants described MDTMs as a quality assurance with the aim to ensure the best possible treatment recommendation for the individual patient (study IV). MDTMs were reported to provide support in patient management (study I), especially related to complex cases, to grant access to collective competence (study III), to ensure multidisciplinary evaluation (study I) and to increase adherence to clinical guidelines (studies I, III). In study III, collective competence and decision-making was also described as supporting equity in care and patient safety, which is concordant with previous research (135). Our observations are supported by previous studies reporting MDTMs as beneficial regarding coordination of care, adherence to clinical guidelines and developing clinical skills (3, 5, 22, 23). Fradgley et al. (90) described MDTM as a reassurance for the patient, including a second opinion function by expert review. A systematic review by Basta et al. (54) demonstrated changes in diagnosis in up to 27% of evaluated patients with GI malignancy and changes in treatment in up to 42% of all cases discussed at MDTMs. We did not, however, evaluate an effect on altered treatment recommendations due to lack of detailed data on clinical implementation of the recommendations made.

MDTM efficacy

Increased cancer incidence and development of various treatment options has led to growing requests for MDTMs, which challenges available resources (3). Respondents in study I provided moderate scores for the statement that MDTMs are resource-efficient. In study III, participants described national MDTM as resource demanding. Participants in study IV supported this view by describing the MDTM as time consuming and lack of designated time was suggested to lead to non-attendance. Similarly, previous studies report common challenges related to lack of resources, time constraints and insufficient attendance (87, 135). Low attendance is suggested to relate to insufficient planning, conflicts with other duties or lack of administrative support (2, 22). This risks reduced quality, since presence of all core MDT members is a key indicator for efficient decision-making (11, 43, 56). Therefore, protected time for participation is important to enhance attendance (2, 60). Support from the organization is crucial for participation, protected time and evaluation of MDTMs. Well-functioning and efficient MDTMs are a quality parameter but lack of key participants or information, inefficient meeting structures and delayed treatment recommendations risk treatment delays and suboptimal clinical management.

Streamlining case discussions

Besides protected time for participation, another suggested way to manage resource constraints and enhance MDTM efficiency is case selection and streamlining of case discussions (12, 60, 136). Overall, 61%–64% of the MDTM participants in study I were positive to targeted approaches to prioritizing and streamlining cases for MDTM discussions. Opinions on whether all patients with cancer should be subject to a MDTM discussion differed among MDTs and professionals. Some MDTM participants in study III and MDTs for urological and gynaecological cancer and lung cancer were supportive towards case selection. In contrast, members in MDTs, for example, breast cancer, gastrointestinal and hepatobiliary cancer and low-volume tumour types rather suggested discussing all patients (study I). This discrepancy may partly relate to different traditions and principles in the various MDTs (60). RNs and MDTM coordinators significantly more often than physicians supported MDTM case discussion for all patients (74% versus 49%, p=0.0015) (study I). Previous research suggests that MDTM-based treatment recommendations alter the initial management plan (i.e. treatment and/or diagnostic investigation) in up 58% of patient cases discussed (21), and MDTMs are suggested to be especially valuable for complex cases (90, 137). This is an argument in favour of streamlining and questions the approach to whether all patients should be discussed (3, 11, 21, 31, 60, 62, 106, 136). Case selection is also suggested to allow more effective discussions of complex cases (22, 137). However, streamlining and case selection is a complex task that needs to carefully balance possible effects on quality of care and patient safety (60).

The participants in national MDTMs supported the recommendations in national clinical cancer care guidelines that state that all patients with these rare diseases studied should be subject to an MDTM case discussion. However, participants reported inadequate adherence to referral guidelines, which was described to challenge the basic concept of equal access to highly skilled experts for patients with rare cancers. Reasons for non-referral were suggested to relate to ambiguous referral guidelines, prestige and case overload at the MDTM (study III). Atwell et al. (63) suggest that competing treatment options, unclear referral pathways, large patient volumes and shortage of health-care professionals may be potential reasons for non-referral to MDTMs. The description of low adherence to referral guidelines may also reflect the fact that the evaluation was carried out early in the implementation process of national MDTMs (study III). However, discussion of which patient groups can be managed outside MDTMs is suggested to be held at local level or within the cancer network (136). Adapting these recommendations to Swedish cancer care implies that the national workgroups responsible for national clinical cancer care guidelines should also include definitions of guidelines for potential streamlining and case selection for MDTMs.

Consideration of patients for clinical trials

The MDTM has been identified as an optimal time point to consider patients for inclusion in clinical trials (7, 9, 71). At the time of the MDTM, relevant clinical information is collected, and the MDT has collective awareness of open clinical trials. In study I, 74% of participants agreed to the MDTM being a suitable time point for such considerations, but only 3% identified this aspect as a key benefit (study I, Figures 1 and 2). This is partly concordant with study III describing dual views, including the perception of national MDTMs as a forum with potential to support clinical research, but participants also reported limited focus on discussing clinical trials (study III). This may reflect a lack of tradition of considering clinical trial inclusion during MDTMs in Swedish health-care. Participants in study III indeed suggested that time could be allocated at the MDTM to discuss clinical trials. Educational initiatives related to clinical trials for MDTs have been demonstrated to improve awareness and increase trials inclusion rates (138). Further, involvement of a clinical research assistant in the MDTM is suggested to be beneficial for patient enrolment (139). Askelin et al. (43) also report limited inclusion of patient preferences related to clinical trial participation during MDTMs. We did not in our studies have access to data on this aspect, but the limited attention to patient perspectives in general most likely also relates to patients' views on clinical trials.

Professional networks and competence development

MDTM participants reported divergent opinions on the MDTMs' impact on professional collaboration. Strengthened regional cooperation was one of the least selected benefits (study I, Figure 2). In a comparison between different disciplines, pathologists did more often than other physicians report benefits related to enhanced teamwork (43% *versus* 7%–11%, $p = 0.005$) (study I). In contrast, participants in national MDTMs reported that the MDTM was a preferred forum for knowledge sharing and collaborative networks, and a feasible platform for connecting geographically dispersed colleagues (study III).

Participants in regional and national MDTMs also reported that the MDTMs were beneficial for competence development not only from an individual and team-related perspective but also for junior colleagues (studies I–III). MDT members from the university hospital more often than MDT members from regional hospitals referred to increased team competence (34% *versus* 19%, $p = 0.015$) (study I). The support for competence development is encouraging and in line with previous observations of positive attribution related to increased knowledge-sharing, learning, collaboration and cooperation (87, 92, 135).

The educational value of participation in MDTM was referred to by physicians as well as RNs in study I and by participants in study IV. The MDTM is a relevant forum for education (8, 22) and training for junior staff (11, 31). This highlights the multidimensional value of MDTMs, that is, benefits related to patient management and teamwork and also perspectives related to competence development and education. The latter perspective is important to keep in mind when discussing alternative ways to enhance efficiency, as it easily can be overshadowed by different demands for austerity.

National and virtual MDTMs

National, virtual MDTMs aim to increase quality of care, grant access to sufficient expertise for evaluation of rare cancer types and support clinical research through larger patient series (30, 39). However, national MDTMs in Sweden were implemented without a formal strategy or guidelines for evaluation, which may reflect reported challenges related to suboptimal attendance, resource constraints, lack of designated time for MDT members, uncertainty of the MDTM assignment and of referral guidelines (study III). We used the CFIR to discuss how implementation may affect MDTM performance (127). Key enabling factors related to the domain outer setting (i.e. enhancing professional networks) and barriers were suggested to be related to the domain characteristics of individuals (i.e. suboptimal attendance) and intervention and inner setting (i.e. resource constraints and uncertain assignment) (study III). Likewise, Maharaj et al. (135) used the Theoretical Domains Framework, which is similar to CFIR (128), to explore factors that impact the implementation of MDTMs focusing on pancreatic cancer. Maharaj et al. (135) report benefits related to provision of quality care but also areas for further development such as agreed evidence-based protocols and referral pathways, resource allocation and culture that enhance widespread collaboration.

As healthcare systems work under complex and resource-constrained conditions, the use of evidence-based strategies is critical to ensure that, for example, research investments improve healthcare. Implementation science is suggested to have a pivotal role in supporting these investments (131); however, successful implementation demands a systematic approach with a clear rationale for design and reporting of development processes (140). Our results in study III suggest key enabling factors and several barriers that should be considered during implementation of new MDTMs. Establishment of an MDT and an MDTM requires a multitude of considerations, and in study II, Table I we list guiding principles for establishing a national, virtual MDTM, including aspects such as referral principles, infrastructure, supporting the role of chair and teamwork, and organizational and legal perspectives (e.g. methods to evaluate and follow-up MDTM performance and functionality).

Another challenge highlighted by participants in national, virtual MDTMs related to incompatible e-health systems. Although easy and safe sharing of relevant clinical information across health-care regions and between health-care providers should be granted, challenges related to technical solutions and legal barriers were reported (study III). Sweden's decentralized health-care system with 21 county councils may partly explain the observations, since the councils use several different e-health systems. Further, privacy regulations influence possibilities for sharing confidential information between participating hospitals and MDTs.

Lessons from virtual meetings suggest that these meeting formats are feasible and effective, though leadership needs to be attentive to keeping a blended meeting with on-site and external participants inclusive and focused (141-143). The COVID-19 pandemic forced previous face-to-face MDTMs to convert to virtual or hybrid meetings, and recent evaluations demonstrate that these meeting formats are sufficient, support work flexibility and increase attendance with a potential to expand professional networks (142, 144-146). One observation, though, is that interpersonal relationships, teamwork and training of younger colleagues may be negatively affected in the virtual meeting format (142, 144). Our studies were conducted prior to the COVID-19 pandemic, and results from studies I–III reported technical insufficiencies including dysfunctional video connections that negatively affected quality of case discussion (study I-III). In contrast, MDT-MOT data demonstrated high scores for equipment and technology (study II, Figure 2). It is possible that the transition to virtual meetings forced by the pandemic have solved many of the technical insufficiencies.

Multidisciplinary teamwork and decision-making

MDTM decision-making

Effective clinical decision-making and teamwork are influenced by, for example, discussion climate, communication and a skilled chairperson. MDT-MOT data demonstrated high scores for leadership (study II, Figure 2). Previous research has demonstrated variable leadership and chairing skills in Swedish cancer care where, for example, time and meeting management and case prioritization were reported as well functioning and, for example, communication and enhancing contributions from all MDTM participants were found to be less efficient leadership aspects (50). The chairperson has an important role, ensuring inter-professional relationships and relevant contributions from all MDTM participants (3, 50, 90). Strong leadership, meeting control and non-technical skills are suggested as key aspects to chairing MDTMs. Yet, these comprehensive sets of skills may require leadership training programmes (90), while, such programmes are scares in Swedish health-care and constitutes a possible area for development.

Further, decision-making is influenced by access to relevant information, inclusion of holistic perspectives, information on patient perspectives and attendance from key MDT members (37). The most common barriers to decision-making an provision of treatment recommendations were related to limited access to information, that is, need for supplementary investigations, insufficient pathology and that no participant had met the patient prior to the MDTM (study I, Figure 3). MDT-MOT data demonstrated high scores for decision-making process (study II, Figure 2). MDT-MODe data did however report low scores related to information on psychosocial aspects and patient view and moderate scores for information related to radiology, pathology and comorbidities (study II, Figure 3). The quality of the MDTM treatment recommendations is naturally linked to sufficient preparation (22) and the quality and accessibility of information (92). Lack of information related to radiology and pathology has previously been reported to negatively influence the decision-making process (7, 11, 31, 147). Failure to provide and present necessary information at the point of the MDTM may result in postponed case discussions or in tentative treatment recommendations (90), which in turn consume unnecessary resources and cause delays in patient care (37).

Balasubramaniam et al. (147) reported that a majority of radiologists working within breast cancer, colorectal cancer and lung cancer had one to two hours' MDTM preparation time in their job plan, but no time allocated for post-MDTM work. This is consistent with the inventory conducted in the Southern Sweden health-care region reporting mean time for preparation at 3.4 hours for radiologists and 2.4 hours for pathologists (1). The high workload for radiologists and pathologists is further affected by increasing cancer incidence resulting in a growing need for diagnostic investigations (147). Adding previously discussed challenges with MDTM efficacy and available resources, these challenges emphasize, besides need of protected time for MDTM-related work (11), structures securing access to relevant information prior to MDTM and potentially selective and targeted use of radiology and pathology demonstrations (60).

Multidisciplinary teamwork

Observational data demonstrate high scores related to teamwork, with case discussions that were predominantly driven by surgeon and chair followed by the oncologist, radiologist and pathologist; low involvement was observed from the MDTM coordinator, physiotherapist and RN (study II, Figures 2, 3). MDTM participants provided high scores for statements concerning distinct roles and involvement in case discussions. Herein, it should be noted that the majority (87%) of the respondents were physicians (study II, Figure 1). In contrast, participants in study IV who were RNs reported limited involvement in the MDTMs. Possibilities for RNs to participate and contribute in MDTMs were described to be hindered by three aspects: the appraised value of the information RNs carried: barriers for attendance (e.g. not being perceived as a mandatory MDTM participant) and obscure role at the MDTM. Limited contributions from RNs have previously been documented in several studies, some of which have also applied MDT-MODe (3, 49, 110, 120, 148). Accordingly, Horlait et al. (24) report unclear roles for non-physician cancer care professionals (i.e. RNs, social workers and psychologists) resulting in passive participation. The perception of underutilized contributions does not unexpectedly affect the will to contribute, and therefore, acknowledgment of all MDMT participants' expertise and development of nontechnical skills is suggested to enhance involvement and participation.

Our results demonstrate that MDTMs are not completely MDT-driven from the point of view that majority of case-reviews occurs between two to four disciplines only (study II, Figure 3 and study IV) which is supported by previous research (2, 51). Such asymmetries in contributions highlights two aspects, first it strengthens earlier studies arguing for the need of streamlining case discussions but it also put the light on the need for of a culture change that enhances interdisciplinary teamwork to address patients with complex needs (i.e. a patient-centred approach) (51). To achieve a patient-centred MDTM, the MDTs may need to develop interdisciplinarity rather than multidisciplinary and contribute, share, and integrate knowledge and information from several relevant sources and perspectives (2, 149).

To enable well-functioning teamwork and efficient decision-making, MDTM participants highlighted the importance of a permissive meeting climate (studies III and IV). Respondents in study III experienced varied quality of teamwork – from well-functioning meetings to disorganized meetings – and reported stress related to performance requirements. In study IV, participants described barriers to well-functioning teamwork, for example, related to hierarchical structures, work experience, authority and confidence. The influence of hierarchical structures has been reported by Lamb et al. (49) who argue that barriers to RNs' contributions to the MDTM are not produced by the physician, but rather originate at an organizational and cultural level. Similar results have been reported by Horlait et al. (24), who found that the RNs possibilities to contribute were influenced by team-related barriers (e.g. team composition, time constraints, team climate, confidence and work experience) and external barriers (e.g. culture and policy).

The challenges MDTs face in achieving their full potential depend on organizational as well as individual aspects (37). Therefore, the culture and structure of MDTMs may need to be reviewed to ensure high-quality MDTMs including sufficient involvement of all participants (93, 150, 151). Actions that have been suggested to improve MDTM efficiency and quality include clear guidelines for mandatory attendance of key participants and clarification of roles and responsibilities within the MDT (study II, Table 1and study III).

Patient perspectives

This thesis demonstrates a biomedically driven MDTM case discussion and treatment recommendation with limited focus on patient perspectives and herein adds to previous research (3, 24, 37, 43, 77, 91-93). Initially, when discussing patient perspectives in the context of MDTM, two clarifications may be needed. First, the term patient perspectives in the context of the MDTM lacks a clear definition (65). In study IV, descriptions of patient perspectives range from personal aspects (i.e. views and preferences) to information on life- and social situation to medical aspects (i.e. comorbidity and physical status). Previous research suggests similar aspects related to the term patient perspectives, that is, non-medical characteristics including demographic and psychosocial information and patient's view (3, 91). In this thesis patient perspectives refers to a holistic view of the patient as an individual person, including all relevant aspects that may impact on the MDTM discussion and treatment recommendation. Second, a patient-centred approach to MDTMs is often suggested in the literature, and Soukup et al. (77) describe patient-centredness in terms of adherence to patient view, psychosocial information and comorbidities. In this thesis we lean towards the following definition: patient-centred care relates to individualized and objective factors that determine which medical services best suit the patient as a recipient of medical services (76).

Patient-centred approach to MDTM decision-making

In study I, lack of information on patient perspectives was reported as a predominant barrier for decision-making (i.e. no MDTM participant had met the patient), and 78% of MDTM participants were supportive of including information on patient perspectives (study I, Figure 1 and 3). In contrast, MDTM participants in study II provided affirmative scores for considering patient perspectives, but MDT-MODe data demonstrated limited inclusion of information related to patient views and psychosocial aspects (study II, Figure 1 and 3). In study III the MDTM participants reported that limited availability and adherence to the patient perspectives sometimes resulted in recommendations difficult to enforce. This was supported by participants in study IV describing ambivalence about and different views on patient perspectives in MDTMs. Differences applied to which information should be included in the case discussion. Some participants argued for including patient perspectives to gain a holistic approach to the discussion and to ensure relevant treatment recommendations. Other participants argued for a medically focused discussion and held that consideration of patient perspectives had greater importance after the MDTM and in the care of the patient (study IV). Similarly, Baes et al. (137) reported that the majority of physicians considered the MDTM as a forum for decisions on clinical treatment recommendations in which psychosocial information should not interfere but should rather be discussed in, for example, patient rounds or ward meetings.

Patient-related information was perceived by the MDT members to provide added value in the decision-making process (studies I-IV). However, the overall result implies, limited inclusion and ambiguity in the definition of patient perspectives in the MDTM context, a lack of structure to collect the information and unclear responsibilities for presenting patient perspectives. Questions raised also indicate that the extent to which the information is allowed to impact on the MDTM case discussion and treatment recommendation is unclear (study IV). Limited focus on patient perspectives has been suggested to negatively impact on the implementation of MDTM recommendations (3, 12, 37, 54, 65, 66, 72, 92), indicating that the information has a crucial role in the decision of MDTM treatment recommendations. A patient-centred approach to MDTM is suggested to increase efficiency (77) and the possibility to make individualized and relevant treatment recommendation (3, 92). Such developments call for secured access to relevant patient-related information, structures for case presentation, clarified roles and responsibilities, team education and strategies for follow-up (66). Herein, the MDTM chair has an important role in fostering patient-centred care and stimulating teamwork (90) with attention to outcome and implementation of the recommendations provided.

Information on patient perspectives

Patient choice, preferences and comorbidity are reported as main reasons for diversion from MDTM recommendations (31, 54, 90), and are therefore perceived as relevant information in the MDTM. Comorbidity is suggested as one of several determinants related to what constitutes a complex case (37), and MDTs are less likely to reach a decision on treatment recommendation for patients with comorbidity (152). Bolle et al. (44) investigated MDTMs' decision-making processes for older patients (≥70 years) with cancer, reporting limited attention to patient preferences and age-related characteristics (e.g. vitality, frailty and comorbidity), demonstrating a lack of geriatric perspective. Given the challenges for medical decision-making in older patients due to often complex case profiles, these aspects are, according to the authors, relevant during the MDTM to generate a patient-centred approach. This is reflected in study I, where

17% of the MDTM participants considered limited information on comorbidities as a predominant barrier for not reaching a decision on treatment recommendations; however 87% of the participants were supportive of considering comorbidity (study I, Figures 1 and 3). In contrast, MDT-MODe data demonstrated moderate coverage of information related to comorbidity (study II, Figure 3). These findings may reflect that national MDTMs discuss rare and often complex cases to a greater extent consider comorbidity in providing a treatment recommendation.

Reported barriers to addressing patient perspectives included lack of structured collection of relevant information, undefined responsibilities to present this information and limited time per case discussion (study IV). Similarly, previous research reports that rapid diagnostic processes potentially impact on the possibility of collecting information before the MDTM (24, 37). Barriers may also relate to unclear responsibilities and non-attendance from key MDT members with first-hand information about the patient. Baes et al. (137) reports that information on psychosocial aspects were perceived as less important in the beginning of the patient cancer care process with increased importance in later phases.

To be able to identify which individual factors determine suitable medical services, patients' views need to be collected (76). The statement 'no decision about me without me' in the context of MDTMs (65) is referred to when discussing the importance of including patient perspectives. Appendix I summarizes studies investigating patient perceptions and experiences of the MDTM decision-making process. Seen from the patient's point of view, patients ask for an easy way to communicate their preferences in advance to the MDTM (65) and request that treatment recommendations are conveyed in an understandable way (68). Patients were, according to the participants in study IV, generally aware of their case being discussed at an MDTM. Participants reported that some patients asked for increased involvement in the MDTM decision-making process. However, several participants reported not asking the patient about their perspective (study IV).

There is limited knowledge on how patients are involved in the MDTM decision-making process, that is, how their perspectives are addressed (43). Taylor et al. (65) identified three main reasons for the limited possibilities for patients to impact on the MDTM decision-making process: diverse views on the importance of including patient-related information in the MDTM, patients' ability to assimilate information and patients' limited knowledge of MDTMs. Lamb et al. (153) also report that patient positions differ from wanting involvement to not being capable or asking for support from next of kin. This is concordant with study IV, where some participants also described patients struggling with limited health literacy, not wanting to be involved in the decision regarding treatment. A recently published study found that 70% of the patients' favoured physician-led decision-making, 22% promoted shared decision-making and 9% wanted to make decisions for themselves (89). Regardless of preferred level of involvement, Lamb et al. (153) report that patients emphasized that their case should only be discussed if some of the MDTM participants had met them in person, suggesting the clinical nurse specialist (CNS) as suited to present their views at the MDTM.

RN's role during the MDTM

A complete patient profile including biomedical aspects as well as information on patient perspectives, and input from all key MDT members, should be secured to provide a high-quality treatment recommendation (3). This links to a need to adopt a patient-centred approach to the MDTM to determine which medical services best suit the patient (76). However, a patient-centred approach cannot be obtained if there is no one present to advocate for the patient (whether medical or nonmedical), which calls for clarification of roles and responsibilities within the MDT (24). Walraven et al. (11) suggest that an MDTM participant should be appointed as responsible for presenting patient-related information. Basta et al. (54) argue that it is not important who presents patient-related information, but rather that the information is indeed available and discussed. This approach was discussed by some participants in study IV suggesting that the RN and the physician should share this responsibility. In study III, participants suggested attendance of the referring physician to enhance focus on patient perspectives.

However, the RNs are based on their skills in gathering information on patient perspectives and their tendencies to include the information in the MDTM decision-making to a greater extent than other MDTM participants (3, 53) often suggested as the preferred MDTM participants to advocate for the patients in their absence (12, 65, 66, 68). This corresponds with our results, where some participants in study IV described themselves in terms of patient advocates with responsibility to present the patient perspectives at the MDTM. The roles of and the views of the RN in the MDTMs have been investigated from various perspectives (Appendix II). Previous research report that RN's participation and contribution bring a potential for improved focus on patient perspectives during the MDTM (24, 93, 151, 154) supporting a patient-centred decision-making process (42, 53, 135, 150, 155).

Our results also demonstrate somewhat undefined roles of the RNs in the MDTM context (study II, Figure 3 and study IV). Some studies report that RNs may have negative experiences from MDTMs, but to provide optimal services it is important to have an open meeting culture that encourages participation from all MDTM participants (24, 150). Barriers to participation and contribution, that is, the perceived value of the information and unclear roles, were found to negatively influence the possibility to advocate for the patient (study IV). However, with participation come responsibilities, including the MDT's joint decision-making and treatment recommendations, which implies that responsibilities should be clarified to motivate accountability (151, 156). Participants in study IV suggested structured assessment to collect information on patient perspectives. This is aligned with previous research proposing, for example, checklists to improve consideration of patient-related aspects, facilitate RNs' contribution to the MDTM discussion (24, 77), and improve meeting efficiency and adherence to treatment recommendations (31, 66, 137).

Despite described unclear roles, participation in MDTMs was reported to generate important information that the RNs could forward to the patient after the MDTM (study IV). Meeting attendance motivated by information gathering has previously been identified (24), and the RN has been described as a communication link between the MDT and the patient (42, 49). McGlynn et al. (53) report that the RN has an important role after the MDTM, namely, to support the patient in the decision-making. This is concordant with the findings from study IV, where participants describe that the RN could explain the MDTM treatment recommendation from a nursing perspective and endorse the patients in making informed decisions. These perspectives broaden the view of the RN's role in the MDTM context from an often unseen MDTM participant to an information carrier throughout the cancer care process (Figure 4).

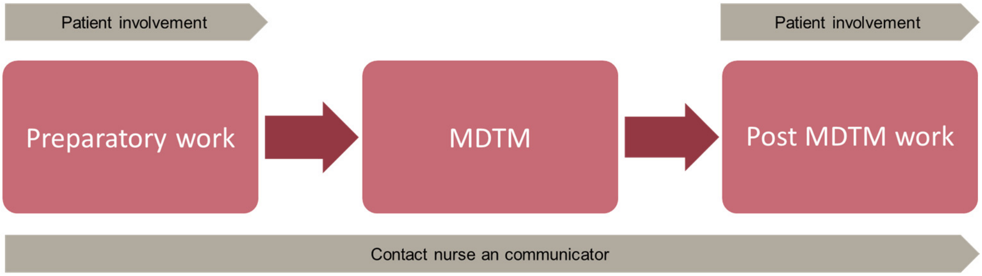


Figure 4. MDTM: a work process in three steps

MDTM evaluation and follow-up

MDTMs are considered resource demanding in relation to time and cost (21). Yet, advantages related to better diagnostics and patient management are suggested to exceed disadvantages (54). To better understand the impact of MDTMs, evaluation of the effectiveness of MDTMs for example related to impact on patient care and clinical outcome is relevant (21, 54).

MDTM participants in the regional as well as the national MDTMs gave critical feedback to MDTM evaluation, where only 30% of the participants in study I and 55% in study II reported work to develop and evaluate their MDTM services (study I, Figure 1 and study II, Figure 1). The implementation of national, virtual MDTMs was linked to centralization of treatment for rare cancers. However, beyond a virtual format and rotating leadership, there were no specified directives for performance or evaluation. Evaluation initiatives such as regular performance reviews, self-assessment, feedback and team training have proven valuable (110, 157), and Fehervari et al. (31) suggest external peer reviews to improve quality of care. A multitude of instruments have been developed to support such evaluations (Table 1) and based on our experiences from study II, application of MDT-MOT and MDT-MODe were feasible and efficient and provided structured insights and feedback to the MDTM services.

In summary, MDTMs are considered gold standard in cancer care, and multidisciplinary evaluation and decision-making will be increasingly relevant with expanding possibilities for diagnosis, treatment and follow-up. Increasing cancer incidence will challenge current MDTM structures with need for streamlining and case selection. Research is needed on the various aspects of the MDTM process to ensure efficient decision-making and provide robust treatment recommendations with a high likelihood of implementation. Such developments should be standardized and linked to patient safety evaluations to identify complex cases that need full MDTM case discussions.

The MDTM also represents an important opportunity for competence development from an individual as well as a team-based perspective. Patients may also have expectations on information and shared decision-making that the MDT needs to consider in achieving a patient-centred approach. To meet current and future needs, structured development programmes as well as evaluation principles will be an important quality issue for cancer-related MDTMs.

Conclusions

In conclusion, this thesis contributes new data and increased understanding of MDTMs functionality in Swedish cancer care with a special focus on MDTM participants' views. The observations made provide a basis for improvement work to further develop and optimize cancer-related MDTM services. Aggregated conclusions that could be drawn from the studies are the following:

- National MDTMs in Swedish cancer care are overall well-functioning and participants in regional MDTMs report an overall positive attitude. The meetings are by the participants reported to provide support in patient management, strengthen professional collaboration and enhance competence development.
- Regular evaluation and follow-up of MDTM services is key to defining areas and opportunities for future development. However, participants report limited focus on evaluation of MDTM services.
- Information on patient perspectives is perceived to add value to the MDTM. Lack of patient-related information, various views on and limited adherence to patient perspectives is recognized as barriers to efficient decision-making. Key information points and structures should be established to collect and present patient-related information.
- RNs report limited involvement in MDTMs, which suggests a need to define their roles during the meetings and align expectations on roles and responsibilities.

Future research

Organizational perspectives

In Sweden, formal MDTM evaluations have not been generally recommended or implemented. A multitude of methodologies and instruments are available and formal evaluation links to improvement initiatives and team development which will likely be relevant for successful development of future MDTM services.

Resources spent on MDTMs need to be balanced with other health-care tasks and developments, which calls for insights into resource use and strategies for more effective MDTMs. Several developments are also estimated to support the MDTM services, for example new technical developments that provide overviews of relevant information, remote radiology and pathology resources and implementation of decision-tree models for clinical decision-making.

Further, to be able to motivate the resources spent, MDTMs may need to address efficiency, patient safety and quality issues. For example, concordance between the MDTM treatment recommendation and the implemented treatment in the context of Swedish cancer care is largely unexplored and regular follow-up is needed to document and learn from diversions from MDT-based treatment recommendations.

MDTM case discussions for all patients or for selected patient groups also need to be further investigated and will likely differ between cancer types. Definition and strategies to ensure selection of patients with the highest need for and benefit from MDTMs would be relevant to develop and evaluate. Development of alternative structures or complementary fora for decision-making could be another option worthy of further exploration.

Multidisciplinary teamwork

The multifaceted and sometimes unclear role of RNs during MDTMs merits further research to make best possible use of the resource. Team development studies are rare, but could contribute to coordinated teams and increased meeting efficiency and ensure role clarity and align expectations for contributions.

MDTM leadership is complex, multifaceted and challenging, motivated by heterogeneous MDTs, the multitude of aspects to consider and the need to ensure an efficient meeting structure with an open discussion climate. Many MDTM leaders have been appointed to the position without specific considerations of leadership capacities or skills, but rather based on clinical seniority. Evaluation of leadership and research-based training sessions for MDTM chairpersons could be relevant to develop.

The MDTM is reported to support development of individual as well as team skills and competences. Competence development will be a key issue to attract and retain skilled staff, and it would be of interest to study what types of MDTM settings and individual responsibilities best support competence development. Investigation of how the MDTM can be utilized for training purposes would also be relevant to increase engagement and train practical multidisciplinary decision-making.

Patient perspectives

As health-care systems increasingly strive for a patient-centred approach, new dimensions of care have emerged that call for interdisciplinary rather than multidisciplinary teamwork. These perspectives prompt a more holistic care model but also introduce challenges related to communication, coordination and organization. Further research is needed into whether and how a patient-centred care model can be applied in the context of MDTMs. This could require development of structures that ensure provision of relevant information and clarification of MDTM participants' responsibilities.

Knowledge on how patients would like their perspectives to be represented in the MDTM context is limited. Patient perspectives may also have different meanings for the MDT and for the patients in question. Studies that compare the views of the MDT with the views of the patients would be relevant to gain new insights that could support alignment of expectation and potentially case discussion in a MDTM could be a factor that influence patient satisfaction and experiences from cancer care.

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Appendices

Appendix I: Summary of studies investigating patient perspective in MDTMs

Author	Research question	Diagnosis/country	Data collection	Conclusion
Baes et al. (137)	Elicit physicians' perceived barriers to inclusion of psychosocial aspects and/or patient preferences in MDTM decision-making	N/A/Belgium	Interviews	The Multidisciplinary Oncology Consultation, a specific type of MDTM, does not reach its objective of truly integrated multidisciplinarity and should strive for an interdisciplinary approach.
Bate et al. (68)	Describe patients' views on MDTMs and development opportunities	Ewing's sarcoma of the bone/UK	FG and questionnaire	Patients suggest that their views should be presented by an MDTM participant who has met them to grant that their views inform the decision-making process. Treatment recommendations should be provided in an understandable way. Tools to enhance communication may be useful.
Blazeby et al. (67)	Examine concordance between MDTM recommendations and implementation and reasons for changes in the treatment recommendation	Upper gastrointestinal cancer/UK	Medical records	Results demonstrate that evaluation of the concordance between MDTM recommendations and treatment implementation is of value for MDT decision-making. MDTMs for upper gastrointestinal cancer require increased information on comorbidities and patient preference to optimize implementation.
Bohmeier et al. (158)	Investigate health-care professionals' perceptions of shared decision-making in MDTMs with patient participation	Breast and gynaecological cancers/Germany	Interviews	From healthcare professionals' view, implementation of shared decision-making is hindered by current circumstances. Yet, patient participation provides an opportunity for patients to ask questions and contribute additional information.
Bolle et al. (44)	Investigate decision-making processes in MDTMs and the extent of involvement of geriatric expertise	Colon, or rectal cancer/Netherlands	Observations	Gaps were found in the MDTM decision-making process regarding older cancer patients (≥70 years). Aspects such as vulnerabilities and wishes were often neglected.
Chaillou et al. (159)	Investigate whether patient participation in MDTM causes anxiety/depression and patient satisfaction	Head and neck cancer/France	Questionnaire	Patients were positive towards attendance at MDTMs, which was perceived to not cause anxiety or depression. Participation enabled the patients to ask questions and receive information.
Devitt et al. (89)	Explore patients' attitudes toward MDTMs	Breast, gastrointestinal, haematological, urological, lung and other cancers/Australia	FG and questionnaire	Patients thought that the aim of MDTMs was to decide on an evidence-based and medical treatment recommendation made in consensus. Patients wanted to be informed about the meeting and its outcome.
Diekmann et al. (160)	Explore MDTM participants' perception of patient attendance in MDTMs	Breast and gynaecological cancers/Germany	Interviews	Mixed results from expected and perceived patient experiences suggest that patient attendance may not be only an advantage.
Diekmann et al. (74)	Investigate cancer patients' experiences of participating in MDTMs	Breast cancer/Germany	Questionnaire	The result suggests varied experiences regarding patients attending MDTMs, including both positive and negative experiences.
Geerts et al. (66)	Explore MDTM participants' perspectives on the need for and strategies to increase	Gastrointestinal, gynaecological, urological, head and	Interviews	A need to improve patient-centredness in MDTMs was identified and strategies for improvement were suggested

Author	Research question	Diagnosis/country	Data collection	Conclusion
	patient-centredness in decision-making processes	neck, and haematological cancers/Netherlands		emphasizing increased involvement of the patient in the decision-making process.
Hahlweg et al. (64)	Investigate the decision-making process at MDTMs and whether information on the patient perspective is included in the recommendations	Head and neck or gynaecological cancers/Germany	Observations	Information on patient perspective was absent and the decision-making process did not enhance shared decision-making. If MDTMs aim to increase patient-centredness, structures to include patient preferences are needed.
Hamilton et al. (161)	Examine the MDTM decision-making with focus on patient involvement	Head and neck cancer/UK	Interviews and observations	The result suggests that the decision-making process constitute a barrier to patient involvement. If patient involvement is the aim, the decision-making process needs comprehensive review.
Heuser et al. (73)	Investigate MDTM participants' expected or experienced feasibility concerning patient participation at MDTMs	Breast and gynaecological cancers/Germany	Interviews	The result suggests that participants' perceptions impact on patients' possibilities to participate in MDTMs.
Lamb et al. (153)	Explore patients' understanding of the purpose of an MDTM and their views on patient involvement in the decision-making process	Prostate, breast and upper gastrointestinal cancers and sarcoma/UK	FG	The results suggest that patients have a positive attitude towards MDTMs. Areas for improvements include information given to the patients concerning MDTMs and how their interest is presented. RNs have an important role to advocate for the patient in MDTMs.
Lane et al. (162)	Explore the nomenclature used to describe non-cancer-related perspectives in the MDTM discussion of older cancer patients	Upper gastrointestinal, head and neck, urological, and lung cancers/Australia	Observations	Non-objective and general descriptions were often used to address non-disease perspectives, which is suggested to have the potential to sway MDTM recommendation.
Nazim et al. (163)	Investigate how patient-related key factors impact on MDTM decision-making process	Prostate cancer/N/A	Review	Patient-related information such as age, religious persuasions, sexual health, education and cognitive deterioration were identified as key factors. Some of these key factors need to be considered to understanding patients' decisions on treatment, which might be contrary to the MDTM recommendation.
Restivo et al. (91)	Determine how patients' non-medical perspectives are included at MDTMs and how this information may impact on MDTM decision-making	Breast, upper gastrointestinal, and haematological cancers/France	Observations	The results demonstrate that patients' sociodemographic, psychological and relational perspectives were pointed out by oncologists in one third of the MDTM cases discussions and that including this information was associated with deferral of the final decision.
Stairmand et al. (152)	Systematic review that evaluates evidence on inclusion and impact of information concerning comorbidity in MDTM decision-making	N/A	Review	The result suggests that MDTMs should consider treatment of patients with comorbidity. Further research is needed on how to support inclusion of comorbidity in MDTM decision-making processes.
Taylor et al. (65)	Explore cancer patients' knowledge of and need for information to be involved in decision-making. Also, examine MDTM participants' views on patient involvement in decision-making	Upper gastrointestinal or gynaecological cancer/UK	Interviews	Methods for patient involvement in the MDTM process are needed to ensure individualized and evidence-based recommendations and to support patients making informed decisions regarding treatment.

Appendix II: Summary of studies investigating the RN's role in MDTMs

Author	Research question	Diagnosis/country	Data collection	Conclusion
Cook et al. (42)	How do MDTM participants experience and perceive the gynaecological oncology nurse specialist (ONS) role?	Gynaecological cancer/Australia and New Zealand	Questionnaire	The ONS has an important role as a central contact point for patients and their next of kin, offering support, information, assessment and patient advocacy. The ONS may enhance communication between the MDT and the patient.
Edwards et al. (156)	What support does the literature provide related to the clinical nurse specialist (CNS) role? Case study to demonstrate impact on patient trajectory	Lymphoma/UK	Case study	CNSs are a crucial part of the MDT. The CNS should ensure that they have clear responsibilities and are partly accountable for the MDTM decision-making.
Horlait et al. (24)	What are non-physician cancer care professionals' current and pursued roles in MDTMs?	N/A/Belgium	Interview/FG	Non-physician care professionals have a limited role during MDTMs case discussions.
Lamb et al. (155)	Is there evidence for variable roles of the CNS in the MDTM?	Urological cancer/UK	Review	A urology CNS impacts on every domain of MDT work and improves patient care.
McGlynn et al. (53)	Efficacy of this nurse-led service	Urological cancer/UK	Performance indicators	Urology oncology nurse-led MDT-based service is efficient and a well-functioning structure.
Punshon et al. (150)	How do specialist nurses in urology experience working in MDTs?	Urological cancer/UK	Questionnaire	Nurses had diverse, often negative, experience of the MDTM. It is important to ensure that all participants can contribute in a satisfactory manner.
Stewart et al. (151)	Is variation in working practices of lung cancer nurse specialists (LCNS) attributable to lung cancer services?	Lung cancer/UK	Questionnaire	Barriers to including LCNS expertise should be acknowledged and resolved. MDT culture requires review to benefit from LCNS's knowledge and to impact on patient experience.
Tod et al. (154)	What is the role of the LCNS and can the LCNS increase patient access to treatment?	Lung cancer/UK	Interview/observation	LCNS role may positively affect patient outcomes.
Wallace et al. (93)	Which approaches does the CNS use to contribute to the case discussion? How does this influence decision-making?	Gynaecological, haematological, and skin cancers/UK	Observation	The MDTMs is biased towards biomedical information. To achieve their full potential, MDTMs should involve all MDTM participants with different approaches suggested.

Study I

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RESEARCH ARTICLE

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Benefits, barriers and opinions on multidisciplinary team meetings: a survey in Swedish cancer care

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Abstract

Background: Case review and discussion at multidisciplinary team meetings (MDTMs) have evolved into standard practice in cancer care with the aim to provide evidence-based treatment recommendations. As a basis for work to optimize the MDTMs, we investigated participants' views on the meeting function, including perceived benefits and barriers.

Methods: In a cross-sectional study design, 244 health professionals from south Sweden rated MDTM meeting structure and function, benefits from these meetings and barriers to reach a treatment recommendation.

Results: The top-ranked advantages from MDTMs were support for patient management and competence development. Low ratings applied to monitoring patients for clinical trial inclusion and structured work to improve the MDTM. Nurses and cancer care coordinators did less often than physicians report involvement in the case discussions. Major benefits from MDTM were reported to be more accurate treatment recommendations, multidisciplinary evaluation and adherence to clinical guidelines. Major barriers to a joint treatment recommendation were reported to be need for supplementary investigations and insufficient pathology reports.

Conclusions: Health professionals' report multiple benefits from MDTMs, but also define areas for improvement, e.g. access to complete information and clarified roles for the different health professions. The emerging picture suggests that structures for regular MDTM evaluations and increased focus on patient-related perspectives should be developed and implemented.

Keywords: Tumor board, Cross-sectional study, Health care survey, Multidisciplinary team conference, Patient preferences

Background

Multidisciplinary team meetings (MDTMs) have widely been implemented in cancer care based on the principle that interdisciplinary case discussions lead to improved treatment recommendations based on updated and evidence-based knowledge or expert opinion. The MDTM structure is broadly considered to improve communication, coordination and decision making [1]. The MDTM is part of the weekly clinical duties for most physicians, nurses and coordinators in cancer care, links clinical information from various sources and represents a pivotal point of the patient care pathway. Benefits from MDTMs relate to improved care processes, adherence to clinical and up-to-date treatment recommendations, which have been documented in several cancer types [2–8]. Other potential benefits include shorter lead times, increased attention to patient-related perspectives, competence development, training opportunities for younger colleagues and the possibility to identify patients eligible for clinical trials [8]. Studies on the relation between MDTM, quality of care and survival have reached different conclusions, potentially explained by differences in study design, MDTM format, case selection and different diagnoses studied [2, 4, 6, 7, 9]. Core MDTM expertise varies between diagnoses, but typically includes surgeons, medical oncologists, radiation therapists, radiologists and pathologists. More recently, experts in nuclear medicine and molecular pathology, contact nurses, research nurses

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and cancer care coordinators have been added to the multidisciplinary team. Greater multidisciplinarity is, however, not necessarily associated with more effective decision-making and treatment implementation [9].

A number of issues will influence the benefit from a MDTM, e.g. participation from qualified and effective experts, case selection, access to relevant information, discussion format and structure, leadership, health professionals' interactions, technical equipment and administrative processes [9, 10]. Most MDTMs are held on a weekly basis, though a recent focus on shorter lead times and efficient diagnostic processes in Swedish cancer care has led to biweekly meetings in select diagnoses and hospitals. A growing number of MDTMs are video-based with regional or national participation. Though there is general agreement of the value of MDTM, the structure is also questioned since it is resource-demanding due to an increasing cancer incidence, participation from a growing number of experts, increased meeting frequency to grant timely treatment, evaluation based on refined diagnostic methods and more complex treatment algorithms. Information on the structure and function of individual MDTMs is scarce and a wide variety of meeting standards has been documented [4, 9, 11]. To provide a basis for structured and targeted improvements in cancer care, we investigated health professionals' views on MDTMs, including perceived benefits from MDTM-based recommendations and barriers to reach joint recommendations, with correlation to discipline, profession, hospital type and diagnostic area.

Methods

We performed a cross-sectional study on health professionals' views of MDTMs. Data was based on an electronic survey that was distributed to all identified participants in the 50 MDTMs in the south Sweden health care region. This region has a population of 1.8 million and provides specialized cancer care services provided by one University hospital and six county hospitals. These 50 MDTMs were initially identified in a study on the determinants of MDTM costs, which has recently been presented and documents a mean MDTM duration of 0.88 h, mean 12.6 cases discussed and a mean cost per case discussion of 212 (range 91–595) EUR [12]. The MDTM meetings were held on a weekly basis and included 19 meetings at local hospitals and 31 meetings at the University hospital. Of the 50 MDTMs, 19 were video-based regional and two were video-based national MDTMs with participation from health professionals from other hospitals. A list of MDTM participants was provided by the cancer care coordinators at each hospital. All participants in these 50 MDTMs were eligible for the study. A small number (< 10) individuals participated in more than one weekly MDTM and were assigned to the predominant diagnosis and meeting base on impact, i.e. from leading the meeting or from the number of case discussions. In total, 362 participants were identified to whom study invitations accompanied by a link to the electronic survey were distributed by e-mail.

We constructed an electronic survey (Surveymonkey.com) with three parts; a first part with five demographic questions and information on weekly MDTM participation times, a second part where the informants were asked to rate 20 statements on MDTM structure and function and a third part where the informants were asked to prioritize up to three possible benefits from MDTM and up to three potential barriers for shared MDTM recommendations (Additional file 1) . The questionnaire was constructed by the research group, was in Swedish and the contents related to benefits, barriers and choice of statements were largely collected from previous publications in the field. Data on validity and reliability are not available, but prior to data collection the questionnaire underwent pilot testing in five MDTM participants from various disciplines and professions. The demographic questions included data on age, sex, profession (physician vs nurse/coordinator), hospital type (county vs university hospital) and discipline (surgery, medicine, radiology, pathology). Surgery included general surgery, urology, thoracic surgery, neurosurgery, vascular surgery, orthopedic surgery and gynecology. Medicine included medical oncology and radiation oncology, pediatric oncology, hematology, pulmonology, endocrinology and neurology. Radiology included radiology, nuclear medicine and clinical physiology. Cancer care coordinators represent a new role in Swedish health care with responsibilities for booking and coordinating diagnostic and therapeutic procedures. Since the number of coordinators was low, this group was analyzed together with the nurses.

Health professionals' views on MDTMs were evaluated based on 20 statements that the respondents were asked to rate on a seven-point Likert scale from 1 (strongly disagree) to 7 (strongly agree) with a possibility to answer "do not know/not applicable". The statements referred to the participants' individual competence and their roles at the MDTM ($n = 3$), functional aspects of the conference, e.g. guidelines for referral and documentation, technology, availability of relevant information ($n = 11$) and overall impact from MDTM recommendations e.g. perceived benefits for patient management, education and training, clinical study inclusion and use of resources ($n = 6$). To collect information on perceived benefits and barriers, the respondents were asked to select the three out of 13 most important benefits of MDTMs and the three out of 15 most important barriers to reaching a joint treatment recommendation. Respondents who provided one to three responses were considered in the further analyses. The alternatives defined in the survey were selected from previous publications [9–11, 13–15]. All data are available from the corresponding author upon request.

The response profiles were analyzed in relation to professions, disciplines, hospital types and cancer-specific MDTMs. All statistical analyses were performed in R, version 3.2.2 [16]. Benefits of MDTMs and barriers to reaching a joint recommendation were analyzed using chi squared tests with significance set at $p = 0.05$. Data on opinions of MDTMs based on Likert scale data are presented in a diverging stacked bar chart and were analyzed using chi squared tests. Bonferroni correction was applied to correct for multiple testing.

Results

Complete responses that allowed for further analyses were obtained from 244 of 362 (67%) MDTM participants. Further analysis of non-responders was not possible due to lack of data on this subset. Of the respondents, 56% were women. The age distribution was 2% in the age group 20–29 years, 13% 30–39 years, 33% 40–49 years, 33% 50–59 years and 19% of the respondents were ≥ 60 years of age. Of the respondents, 70% were physicians and 28% were nurses and coordinators. Discipline was surgery in 47%, medicine in 29%, radiology in 14% and pathology in 7%. Hospital type was 52% university hospital and 48% county hospitals. The respondents represented teams from various cancer diagnoses: 27% gastrointestinal and hepatobiliary cancer, 21% breast cancer and malignant melanoma, 19% urological and gynecological cancer, 19% lung cancer and 12% other tumors, i.e. head and neck tumors, CNS tumors, sarcomas and endocrine tumors.

The respondents' views on MDTMs are summarized in Fig. 1. Overall, affirmative scores were given to the majority of the statements. Agreement (scores 5–7) was particularly strong for *provides support for further patient management* (94%), *develops competence of junior colleagues* (93%) and *develops individual competence* (92%). The two issues that received the lowest fraction of affirmative responses were *pathology reports are finalized in time* (48%) and *we (*i.e. *the MDT) work to develop the MDTM* (30%). The responses were consistent without major differences in relation to profession, discipline, hospital type or cancer-specific MDT. No significant differences applied for scores 1–3, whereas minor differences were identified for the affirmatory responses. Nurses and coordinators did more often than physicians agree to *MDTM being resource efficient* (88% vs 69%, $p = 0.008$) and *all cancer patients should be discussed* at MDTMs (74% vs 49%, $p = 0.0015$), but did less often report *being involved in the discussions* (57% vs 90%, $p = 0.0005$). The views also differed between cancer-specific MDTMs related to whether *all cancer patients should be discussed* in MDTMs, which was supported by a majority of members in teams working with breast cancer, GI cancer and other tumors (53–78%), but to a lesser extent in teams working with lung cancer and urological-gynecological cancer (31–38%) ($p = 0.0005$).

Analyses on the most important benefits of MDTM were based on answers submitted by 203 respondents. The two predominant benefits were *compiled clinical information and review results in more accurate treatment*

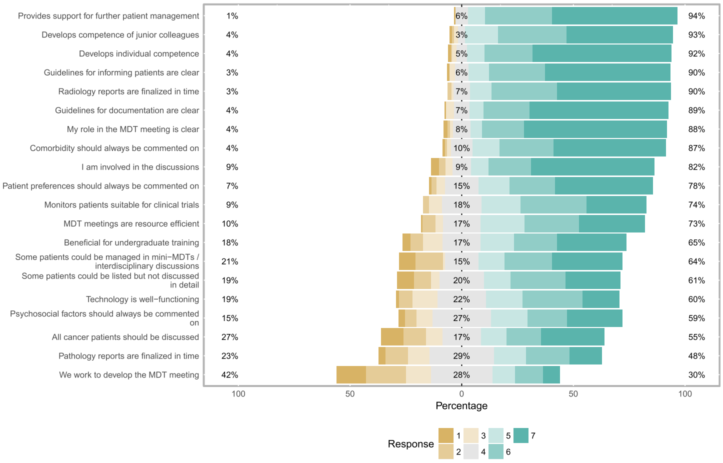

Fig. 1 Respondents' views on MDTMs. Diverging stacked bar chart demonstrating the frequency of different levels of agreement on 20 statements. Scores from 1 (strongly disagree) to 7 (strongly agree)

recommendations (81%) and *multidisciplinary evaluation* (67%), followed by *promotes adherence to clinical guidelines* (34%), *increases team competence* (26%) and *increases patient safety* (22%) (Fig. 2). The two reasons that were the least selected were *attention to patient preferences* (1%) and *identification of patients suitable for clinical trials* (3%). Perceived benefits of MDTM differed between various health care profession, discipline and hospital type, but was not influenced by the cancer field served (Table 1). Nurses and coordinators more often than physicians (28% vs 9%, $p < 0.001$, significant after Bonferroni correction) considered *shortened time from diagnosis to treatment* as a major benefit of MDTM. Pathologists did more often than physicians of other disciplines refer to *strengthens teamwork* (43% vs 7–11%, $p = 0.005$). Health professionals working in university hospitals did more often than those employed at county hospitals report *increases team competence* as a major benefit of MDTM (34% vs 19%, $p = 0.015$), whereas professionals in county hospitals more often selected *multidisciplinary evaluation* (75% vs 59%, $p = 0.026$).

Analyses of the most common barriers to reaching a joint recommendation were based on answers submitted by 216 respondents. The predominant barriers were *need for supplementary investigations* (87%) and *insufficient pathology* (65%), followed by *no professional present has seen the patient* (25%), *complex cases* (24%) and *insufficient radiology* (20%) (Fig. 3). *Patient preferences, insufficient leadership, insufficient teamwork, disagreement, insufficient preparations, interruption or distraction* and *lack of time* were rare causes, reported by 0–2% of the respondents. Reported barriers differed between professions, hospital types, disciplines and cancer-specific MDTMs (Table 2). Physicians did more often than nurses and coordinators (29% vs 13%, $p = 0.024$) refer to *no professional present has seen the patient. Complex cases* were reported by 37% of physicians in medicine compared to 29% of pathologists, 20% of surgeons and 14% of radiologists ($p = 0.049$). *Complex cases* were also more often referred to by professionals in the university hospital than in county hospitals (33% vs 17%, $p = 0.005$). Health care personnel at the university hospital did more often than personnel in county hospitals refer to *absence of key professionals* (17% vs 7%, p = 0.04). In contrast, health professionals in county hospitals more frequently chose *insufficient pathology* (73% vs 56%, $p = 0.015$) and *no professional present has seen the patient* (31% vs 18%, $p = 0.024$). Minor differences were observed between the cancer-specific MDTMs related to *no professional present has seen the patient*, which was rarely identified in the breast cancer teams ($p = 0.002$, significant after Bonferroni correction), and *disagreement* on the recommendations, which was more commonly reported from members in urological and gynecological MDTM teams ($p = 0.015$) (Table 2).

Discussion

Health professionals who participate in cancer-related MDTMs report an overall positive attitude, but also identify key issues for improvement, which fits with reports from other health care systems [2, 4]. MDTMs are typically chaired by physicians and more recent inclusion of nurses and coordinators in the meetings has been reported to improve team performance [17]. We identified differences between physicians and nurses/coordinators related to the estimated impact from MDTM on time to treatment, resource-efficiency and involvement in the case discussions. Nurses and coordinators did more often (28% vs 14%) refer to MDTMs contributing to shorter time to treatment, which may reflect that nurses and coordinators who participate in MDTM may immediately plan and book further procedures and treatments. Whereas the views on development of individual competence did not differ between physicians and nurses/coordinators, the latter group reported being less involved in the case discussions. An observing rather

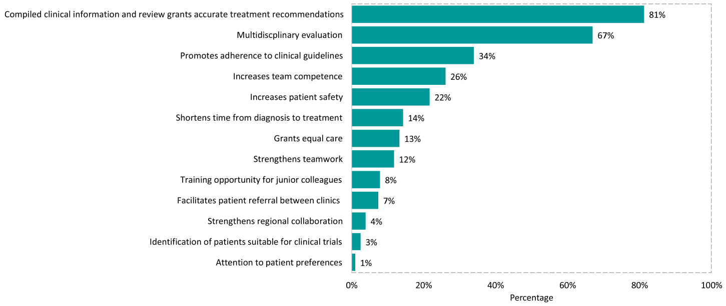

Fig. 2 Benefits of MDTMs. Respondents were asked to choose the reasons they considered most important, maximally three. Percentages refer to the total number of respondents ($n = 203$)

Table 1 Reported benefits of MDT meetings in relation to health profession, hospital type, discipline and cancer type being discussed

	Frequency of all responses	Nurses/ coordinators	Physicians	*P*-value	University hospital	County hospital	*P*-value	Pathology	Radiology	Medicine	Surgery	*P*-value	Breast cancer	Lung cancer	GI cancer	Uro/ Gyn cancer	Other tumors	*P*-value
Compiled clinical information and review grants accurate treatment recommendations	81%	75%	83%	0.221	78%	84%	0.381	100%	86%	78%	81%	0.278	76%	77%	88%	74%	96%	0.120
Multidisciplinary evaluation	67%	70%	66%	0.732	59%	75%	**0.026**	57%	68%	69%	67%	0.880	63%	63%	71%	64%	74%	0.830
Promotes adherence to clinical guidelines	34%	30%	35%	0.512	36%	32%	0.550	29%	46%	29%	33%	0.449	35%	29%	36%	31%	39%	0.897
Increases team competence	26%	26%	26%	1.000	34%	19%	**0.015**	14%	21%	27%	27%	0.702	22%	37%	21%	33%	22%	0.327
Increases patient safety	22%	19%	23%	0.699	24%	20%	0.628	29%	25%	13%	25%	0.274	24%	26%	19%	21%	17%	0.924
Strengthens teamwork	12%	11%	12%	1.000	13%	10%	0.535	43%	7%	9%	11%	**0.005**	13%	11%	14%	13%	4%	0.833
Training opportunity for junior colleagues	8%	2%	10%	0.073	5%	10%	0.194	0%	0%	15%	8%	0.075	4%	11%	7%	10%	9%	0.781
Shortens time from diagnosis to treatment	14%	28%	9%	**< 0.001***	18%	11%	0.240	14%	21%	9%	14%	0.504	13%	14%	14%	18%	13%	0.973
Grants equal care	13%	17%	12%	0.474	13%	13%	1.000	7%	7%	18%	14%	0.494	17%	20%	10%	13%	4%	0.401
Facilitates patient referral between clinics	7%	11%	6%	0.212	4%	10%	0.096	0%	4%	11%	8%	0.442	15%	3%	5%	8%	0%	0.095
Strengthens regional collaboration	4%	0%	5%	0.116	3%	5%	0.719	0%	0%	9%	3%	0.100	2%	6%	2%	3%	13%	0.138
Identification of patients suitable for clinical trials	3%	6%	1%	0.121	0%	5%	0.050	7%	0%	2%	3%	0.559	2%	0%	3%	5%	0%	0.649
Attention to patient preferences	1%	4%	0%	0.056	1%	1%	1.000	0%	0%	0%	2%	0.727	0%	0%	0%	3%	4%	0.217

P-values < 0.05 in bold writing

[*] *P*-values that remain significant after applying Bonferroni correction ($p < 0.004$)

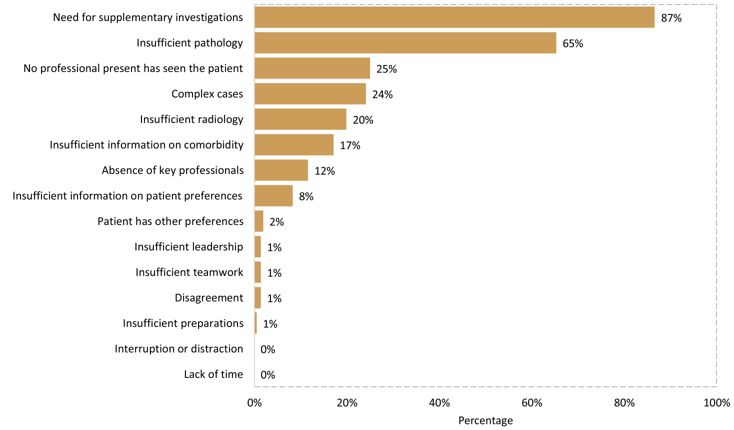

Fig. 3 Barriers to joint recommendations in MDTMs. Respondents were asked to choose the barriers they considered most common, maximally three. Percentages refer to the total number of respondents (*n* = 216)

than an interacting role of nurses in MDT meetings has been reported also by other investigators with reports that the medical perspectives dominate over care perspectives during MDTMs [18, 19]. An important aspect of improvement of MDTMs relate to an appropriate skill mix of a multidisciplinary team and development and implementation of MDTM structures and procedures [20]. These observations suggest that the roles of nurses and coordinators should be highlighted to improve MDTM function. Responsibilities that could be targeted to nurses include consideration of comorbidity, psychosocial aspects, rehabilitation and supportive care needs, patient preferences and relevant clinical trials [19]. Cancer care coordinators could take responsibility for all relevant documentation being available prior to the case discussions [18, 20].

Though many MDTM groups struggle with how to best include patient-related perspective in the decision process, a limited focus on these aspects have been documented in several studies [21]. Restivo et al. found that psychological, socio-demographic and relational aspects were discussed in 30% of the cases and patient' preferences were discussed in 10% of the cases at MDTMs in French health care [22]. Divergent treatment priorities between physicians and patients have been demonstrated in multiple studies and cancer types. If the MDTM aims to contribute to individualized treatment decisions and implementation of the MDTM's recommendations, patient values and preferences need to be considered. Our data demonstrate that in Swedish health care 78% of health professionals agree that patient preferences should be commented on during the MDTMs, but only 1% of the respondents identify patient perspectives as a major benefit from MDTMs (Figs. 1 and 2). The need to consider comorbidities was supported by 87% of the respondent and 17% considered comorbidity to be a major barrier for a joint MDTM recommendation (Figs. 1 and 3). Leadership and interactions between the MDTM participants are central in this process. MDTM leaders often express a clear view on the optimal treatment recommendation. Team members may counteract this by providing additional patient-related information, which may influence the further discussion, though perhaps based on fragmented and selected information [22]. Additionally, when the information is conveyed to the patient, it needs to be balanced, which requires that controversies and differences in opinion have been clarified. Current observations suggest that though the premises of multidisciplinary care involve addressing patients' needs, routines for how this should be granted at the MDTM need to be developed and will likely require substantial revision of the current meeting structure [9, 23–26].

The MDTM may be a suitable and relevant time point to consider patients for inclusion into clinical trials. In our data, 74% of the respondents supported that the MDTM could be used for this purpose, but only 3% identified this as a key benefit of MDTMs. Training for multidisciplinary teams in communication around clinical studies has been implemented and evaluated in the UK with promising results related to ease of communication and understanding of the impact for trial inclusion [27].

The two most important benefits from MDTMs were reported to be treatment recommendations based on compiled clinical information and multidisciplinary evaluation, followed by adherence to guidelines,

Table 2 Reported barriers to joint recommendations from MDT meetings in relation to health profession, discipline and hospital type

	Frequency of all responses	Nurses/ coordinators	Physicians	*P*-value	University hospital	County hospital	*P*-value	Pathology	Radiology	Medicine	Surgery	*P*-value	Breast cancer	Lung cancer	GI cancer	Uro/ Gyn cancer	Other tumors	*P*-value
Need for supplementary investigations	87%	94%	84%	0.069	87%	86%	0.841	93%	86%	88%	85%	0.812	85%	87%	90%	84%	85%	0.921
Insufficient pathology	65%	72%	63%	0.247	56%	73%	**0.015**	36%	62%	72%	66%	0.083	79%	72%	56%	58%	62%	0.102
No professional present has seen the patient	25%	13%	29%	**0.024**	18%	31%	**0.024**	14%	31%	25%	25%	0.699	6%	23%	29%	42%	27%	**0.002***
Complex cases	24%	22%	25%	0.854	33%	17%	**0.005***	29%	14%	37%	20%	**0.049**	23%	28%	19%	23%	35%	0.585
Insufficient radiology	20%	20%	20%	1	16%	23%	0.172	21%	21%	22%	18%	0.95	17%	10%	19%	30%	19%	0.232
Insufficient information on comorbidity	17%	11%	19%	0.21	15%	19%	0.485	14%	10%	13%	22%	0.354	19%	26%	20%	9%	8%	0.193
Absence of key professionals	12%	17%	10%	0.218	17%	7%	**0.040**	14%	17%	5%	14%	0.256	15%	10%	12%	9%	12%	0.94
Patient has other preferences	2%	4%	1%	0.576	4%	0%	0.055	0%	0%	2%	3%	0.864	2%	3%	0%	5%	0%	0.486
Insufficient information on patient preferences	8%	6%	9%	0.585	9%	8%	0.835	14%	10%	5%	9%	0.627	4%	8%	8%	12%	12%	0.742
Disagreement	1%	2%	1%	1	1%	2%	1	0%	0%	2%	2%	1	0%	0%	0%	7%	0%	**0.015**
Insufficient teamwork	1%	2%	1%	1	2%	1%	0.616	7%	0%	0%	2%	0.209	2%	0%	2%	2%	0%	1
Insufficient leadership	1%	2%	1%	1	1%	2%	1	0%	0%	3%	1%	0.576	0%	3%	0%	2%	4%	0.568
Insufficient preparations	1%	2%	0%	0.253	1%	0%	0.478	0%	0%	0%	1%	1	0%	0%	2%	0%	0%	1
Interruption or distraction	0.%	0%	0%		0%	0%		0%	0%	0%	0%		0%	0%	0%	0%	0%	
Lack of time	0.%	0%	0%		0%	0%		0%	0%	0%	0%		0%	0%	0%	0%	0%	

P-values < 0.05 in bold writing

**P*-values significant after applying Bonferroni correction ($P < 0.003$)

increased team competence and patient safety (Fig. 2). Reference to increased competence and strengthened team work fits well with data from an international survey that report that seeking advice on treatment recommendation and participation in multidisciplinary discussion were the main reasons for MDT attendance [28]. The MDTM may also improve communication, positively influence the work environment and is an important part of continuous medical education [28]. In our study, MDTMs were considered more valuable for training of younger colleagues/residents (93%) than for education of undergraduate students (65%) (Fig. 1). Health professionals at the university hospital did more often (34% vs 19%) than their colleagues in local hospitals refer to the MDTM contributing to an improved team competence. Pathologists did significantly more often (43% vs 7–11%) than other disciplines refer to teamwork as an important benefit of the MDTM, which most likely reflects differences in working cultures between pathologists, who independently diagnose cases, and other disciplines, where teamwork is part of the everyday clinical work.

Failure to reach a joint recommendation has been reported to occur in 6–52% of case discussions during MDTMs [16, 28]. Considering the increasing demand for meeting time, efforts to reduce this figure are important. The main barriers to reach a joint recommendation identified in our study were need for supplementary investigations and insufficient pathology, followed by no professional present who had seen the patient and complex cases (Fig. 3). Absence of key professionals was more frequently (17% vs 7%) reported from the university hospitals than the county hospitals, which may reflect a vulnerable access to highly specialized competences. The participants rated compiled clinical information as one of the most important benefits from MDTM, but at the same time identified insufficient clinical information as a main barrier for a joint recommendation, which is supported also by observations from other health care systems [16, 29]. Though poor leadership, insufficient teamwork, disagreement and time pressure were by the respondents identified as less important, other studies have documented that factors such as poor leadership, insufficient teamwork, disagreement and time pressure as barriers for efficient MDTM recommendations [17, 21]. MDTM case reviews have been shown to change the initial treatment plan in up to a third of the cases, with the highest likelihood in complex cases [22, 28, 30, 31]. In our study, complex cases were more often (33% vs 17%) identified as barriers for recommendations by MDTM members at the university hospital compared to county hospitals. This difference likely reflect case selection and underscores the need for highly specialized competences for high-quality case evaluations and the need for the MDTM team to define core competences and support these members in improvement initiatives related to efficient decision-making.

Guidelines for which patients should be discussed at MDTMs should regularly be reviewed since the benefit of multidisciplinary evaluation and the need for core expertise likely differs between cancer types, tumor subsets, disease stages and patient subgroups. Of the respondents, 61–64% were positive to targeted approaches, e.g. listing of standard cases without detailed discussion or mini-MDTMs with selected disciplines present. Alternative case discussion formats were in our study supported by teams in lung cancer and urological and gynecological cancer and support for prioritization has in previous studies been gained from e.g. urological and colorectal cancer [13, 30]. Though data on the use of mini-MDTM are scarce, this principle has been suggested to be time and resource saving compared to full MDTMs [28, 31].

Only 30% of the respondents reported work to develop the MDTMs, though use of e.g. independent observers or evaluation instruments have been shown to change case management and improve MDTM quality. Several instruments have been developed and have performed favorably related to validity and interrater reliability [11, 32–34]. Work to optimize MDTM recommendations need to consider the MDTM function as well as the implementation rate of the recommendations made with careful consideration of shortcomings and differences in views between the participants [9].

Strengths of the study include a population-based approach with participation from all MDTMs in our health care region, a 67% response rate and a large sample size, which allows for subgroup-specific analyses in relation to professions, disciplines, hospital type and cancer-specific MDTs. Weaknesses relate to our development of a questionnaire the results of which cannot readily be compared to other studies. The perceived benefits and barriers to MDTMs were largely restricted to issues previously identified in scientific studies. Use of select statements and predefined benefits and barriers risks overseeing less common perspectives, although the informants could provide free text comments. Furthermore, since standardized MDTM improvement programs have not been implemented in Sweden, the input from health professionals could not be studied in relation to whether the MDTM in question was well-functioning or not.

Conclusions

Health professionals in Swedish cancer care are overall positive to MDTMs, but also identify several shortcomings. Nurses and coordinators report being less active in the case discussions. MDTMs are rarely used to screen patients for inclusion into clinical trials. The focus on patients-related perspectives and preferences is weak.

Only one-third report structured work to evaluate and improve the MDTM function. Considering the increasing needs for MDTM and the considerable resources invested, these observations call for implementation of regular MDT evaluations and further research on how to best improve MDTM efficacy.

Practical implementation

Health professionals report strong benefits from MDTM related to support for further patient management and professional competence development and identify issues for improvement that include finalized pathology reports prior to the meeting and implementation of structured work to improve MDTM function. Nurses and cancer care coordinators did more often than physicians perceive that the meetings were resource efficient, but did less often than physicians report being involved in the case discussions. Predominant MDTM benefits were compiled clinical information and review, multidisciplinary evaluation and adherence to clinical guidelines. Major barriers to reach a joint treatment recommendation were the need for supplementary investigations and insufficient pathology. These issues would be valuable to consider in future MDTM improvement programs.

Additional file

Additional file 1: Questionnaire. Electronic survey distributed by e-mail to MDTM participants (*n* = 362). (PDF 315 kb)

Abbreviations

MDTM: Multidisciplinary team meeting

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Availability of data and materials

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

Authors' contributions

LR, NA, OH and MN have all made substantial contributions to conception and study design, data acquisition, analysis and data interpretation, have been involved in drafting and revising the manuscript, given final approval of the version to be published and have agreed to be accountable for all aspects of the work.

Ethics approval and consent to participate

Ethics approval was obtained from the Regional Ethical Review Board in Lund (reference number: 2016/195). All respondents were informed about the study purposes and gave consent to participate.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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Study II

Original Article

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Function, information, and contributions: An evaluation of national multidisciplinary team meetings for rare cancers

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Abstract

National virtual multidisciplinary team meetings have been established in Swedish cancer care in response to centralized treatment of rare cancers. Though national meetings grant access to a large multidisciplinary network, we hypothesized that video-based meetings may challenge participants' contributions to the case discussions. We investigated participants' views and used observational tools to assess contributions from various health professionals during the multidisciplinary team meetings. Data on participants' views were collected using an electronic survey distributed to participants in six national multidisciplinary team meetings for rare cancers. Data from observations were obtained from the multidisciplinary team meetings for penile cancer, anal cancer, and vulvar cancer using the standardized observational tools Meeting Observational Tool and Metric of Decision-Making that assess multidisciplinary team meeting functionality and participants' contributions to the case discussions. Participants overall rated the multidisciplinary team meetings favorably with high scores for development of individual competence and team competence. Lower scores applied to multidisciplinary team meeting technology, principles for communicating treatment recommendations, and guidelines for evaluating the meetings. Observational assessment resulted in high scores for case histories, leadership, and teamwork, whereas patient-centered care and involvement of care professionals received low scores. National virtual multidisciplinary team meetings are feasible and receive positive ratings by the participants. Case discussions cover medical perspectives well, whereas patient-centered aspects achieve less attention. Based on these findings, we discuss factors to consider to further improve treatment recommendations from national multidisciplinary team meetings.

Keywords

Tumor board, multidisciplinary team conference, patient perspectives, cross-sectional study, healthcare survey

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Introduction

Case discussions in multidisciplinary team meetings (MDTMs) represent a focal point of the patient trajectory. Based on all relevant information available, a multidisciplinary and multiprofessional team of experts consider treatment alternatives and provide treatment recommendations based on the best evidence available. MDTMs have been found to be particularly relevant and beneficial in complex cases, where multidisciplinary case discussions have been reported to alter the treatment recommendation in up to one-third of the cases.[1–3] Benefits linked to MDTMs include better coordination of care, development of clinical skills, and adherence to evidence-based treatment recommendations.[4–8] Rare cancers are, as a group, associated with multiple challenges including late and incorrect diagnosis, adverse outcomes, limited clinical expertise, weak evidence for best practice, and difficulties in collecting large series for research and in carrying out clinical trials.[9]

In Sweden, with a population of 10 million, surgery and select oncologic treatments for rare cancers, during recent years, been centralized to national specialist centers. This development was motivated by needs related to equal access to high-quality care, adherence to national treatment guidelines, infrastructures for research, and patient access to clinical trials. Between 2015 and 2017, treatment for penile cancer, anal cancer, vulvar cancer, gastroesophageal cancer, hepatobiliary cancer, and cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (HIPEC) underwent such centralization. As part of this process, national virtual MDTMs were developed to grant high-quality expert opinion and coordinated treatment recommendations across geographical areas, and case discussion herein were made mandatory. In 2017, a national MDTM was also initiated for childhood cancer with treatment responsibility from six regional pediatric oncology centers.

Efficient MDTM structures are influenced by a number of factors such as case selection, access to relevant information, technical equipment, participation from qualified experts, defined roles and responsibilities, leadership and teamwork, patient-centered care, and coordination of post-MDTM work.[10] Despite general agreement on the characteristics of an effective MDTM, teams show considerable variability related to, for example, organization, case selection, and decision-making processes.[11,12] This variability and different cultures and traditions can be expected to be particularly challenging when MDTM teams in different geographical locations are brought together as virtual teams in national networks, which is the case in the newly established MDTMs for rare cancers in Swedish healthcare. We hypothesized that video-based meetings may challenge participants' contributions to the case discussions. We, therefore, investigated participants' experiences from virtual national MDTMs and assessed how different health professionals contributed the discussions and to what degree various disease-related and patient-related aspects were covered in the case discussions.

Materials and methods

Study design

With a focus on national virtual MDTMs for rare cancers, this study investigates health professionals' views using an electronic questionnaire and through observational assessment evaluates MDTM function and participants' contributions to the case discussions.

Setting

In Sweden, treatment for several rare cancers was centralized during 2015–2017 to two to four treatment centers. The type of treatment centralized was defined for each cancer type, but, in general, involved curative surgical and/or oncological treatment. Patients with palliative needs should, as far as possible, be treated in their local or regional hospitals, but should still be discussed at the relevant national MDTM at the time of diagnosis and when otherwise relevant for treatment recommendations. Case discussions should, according to the national standards of cancer care, be performed at the time of primary diagnosis and at the time of potential recurrence. These standards also define participating health expertise, which for anal cancer include surgeon, oncologist, radiologist, nuclear therapist, coordinator, contact nurse, and, when relevant, pathologist. The MDTMs are connected through a national video-conferencing platform. Members of the national expert teams are default participants, and responsible clinicians in regional hospitals may participate for select cases for which they are responsible or have referred. The leadership rests with the responsible physicians, which for the MDTMs included surgeons or oncologists. The national MDTM is coordinated from one of the national treatment centers, with annual rotating leadership among the two to four centers responsible. Sweden does not yet have a national formally implemented system for follow-up or evaluation of MDTMs.

Participants

All national MDTM teams for rare cancers in Sweden were eligble for the study. These included MDTMs for penile cancer, anal cancer, vulvar cancer, childhood cancer, cytoreductive surgery, advanced esophageal cancer, and hepatobiliary cancer. The latter MDTMs were grouped in the analyses motivated by a high degree of overlapping participants.

Questionnaire

Participants in the national MDTMs received a link by email to an online, SurveyMonkey-based, questionnaire designed by the study group. Two reminders were sent. Data were collected between May 2017 and May 2018. The responders were asked to rate 14 aspects of the national MDTM they participated in on a 7-point Likert-type scale (7 corresponded to fully agree and 1 to disagree). The questionnaire was distributed to 241 participants in MDTMs for penile cancer ($n = 33$), anal cancer ($n = 30$), vulvar cancer ($n = 26$), childhood cancer ($n = 53$), cytoreductive surgery ($n = 12$), and advanced esophageal and hepatobiliary cancer ($n = 87$). In total, 125 (52%) health professionals responded and included 45% women with 38% of the responders being above the age of 50. Among the respondents, physicians accounted for 87%, nurses for 11%, and medical secretaries for 2%. The respondents' disciplines were surgery (56%), medicine/oncology (26%), pediatric oncology (10%), radiology (6%), and pathology (2%).

Observations

In the observational part of the study, members of the study group used observational evaluation tools. Motivated by well-established meeting structures, weekly MDTMs, and sufficient patient volumes, the MDTMs for penile cancer, anal cancer, and vulvar cancer were selected for this part of the study. The MDTM for penile cancer had participation from the two national centers, lasted a mean of 30 min, had a mean of 19 (15–22) participants, and discussed a mean of 11 (10–14) cases. The MDTM for anal cancer had four participating centers, lasted 40 min, had a mean of 21 (18–25) participants, and discussed a mean of 5 (4–6) cases. The MDTM for vulvar cancer had four participating centers, lasted 40 min, had a mean of 20 (15–25) participants, and discussed a mean of 6 (6) cases. Each MDTM was observed at three distinct occasions with participation from two study group members (M.N., B.O., J.W., and N.A. who are MDs) to a total of six observations for each MDTM. The observers independently rated the national MDTMs using the standardized observational tools: Meeting Observational Tool (MDT-MOT) and Metric of Decision-Making (MDT-MODe).[13,14] MDT-MOT assesses overall meeting performance to support team development based on evaluation of 10 key domains including attendance, leadership and chairing, teamwork and culture, personal development and training, physical environment, technology and equipment, organization and administration, post-meeting coordination, patient-centered care, and clinical decision-making processes. These domains are evaluated using a 5-point Likert-type scale in which 5 implies optimal function and 1 implies insufficient function.[13] MDT-MODe evaluates the MDTM based on individual assessment of each case discussion using a 5-point Likert-type scare in which 5 implies optimal function and 1 implies insufficient function.[14] MDT-MODe is divided into two categories: availability of information (case history, patients' view, psychosocial aspects, comorbidity, radiological, and pathological information) and paticipants' (including chair, surgeons, physiotherapist, oncologists, radiologists, pathologists, nurses, and MDTM coordinators) contributions to the case discussions.[15] Prior to scoring, the observers read relevant publications and received oral information about the tools. Data using the MDT-MOT were collected from nine MDTMs, and data using the MDT-MODe were based on 67 case discussions.

Ethics

All data were handled anonymously and are presented at group level. The study was ethically reviewed and granted permission by the regional ethics committee at Lund University (registration number: 2016/195).

Statistical analysis

Participants' response profiles based on Likert-type scale data and overall data from the instruments MDT-MOT and MDT-MODe are presented as diverging stacked bar charts. Data from MDT-MOT and MDT-MODe were analyzed for inter-observer variability using correlation coefficient estimates. For MDT-MOT, the total meeting score from each partipant was used. For MDT-MODe, inter-observer variability was estimated for each aspect based on all cases rated, followed by a total estimate of inter-observer variability for the tool as a whole. The mean score from the two observers for each aspect were evaluated and used in further analyses, which motivates use of 0.5 intervals in the stacked bar charts. Statistical analyses were performed in R version 3.2.2.

Results

Evaluation of participants' views

The response profiles from the 125 participants in the six national Swedish MDTMs for rare cancers are presented in Figure 1. Strongly affirmative scores (5–7) related to *my role at the MDTM is clear* (85%), *MDTM develops team competence* (81%), and *MDTM develops individual competence* (80%). The statements that received the lowest degree of agreement (scores 1–3) were *guidelines for documentation of treatment recommendations are clear* (20%), *technology is well-functioning* (22%), and *we evaluate working with the MDTM* (30%).

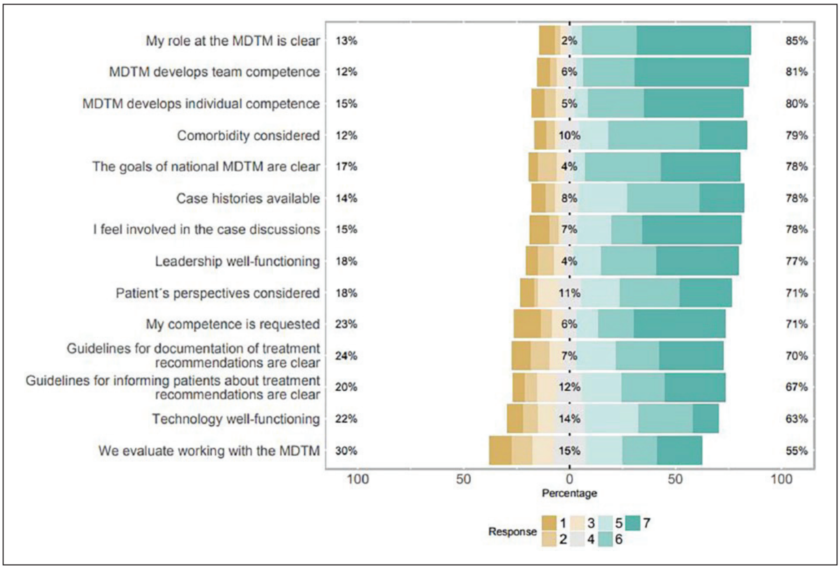

Figure 1. Participants' ($n = 125$) views on structure and function of six national virtual MDTMs in cancer care.
Stacked bar chart based on 14 aspects scored on a 7-point Likert-type scale.

Observational assessment

MDT-MOT is based on six observations from each diagnosis, whereas MDT-MODe is based on the total number of cases in the total number of case discussions observed, which was 68 for penile cancer, 30 for anal cancer, and 36 for vulvar cancer. The mean scores from MDT-MOT and MDT-MODe observations were used in the further analyses. Inter-observer correlations were 0.71 for MDT-MOT and of 0.86 for MDT-MODe. MDT-MOT evaluates the MDTM as a whole. High scores were obtained for clinical decision-making processes, teamworking and culture, technology and equipment, physical environment, and leadership and chairing. Low scores applied to patient-centered care, organization, administration, and post-meeting coordination (Figure 2, Supplementary Table 1).

MDT-MODe evaluates each case discussion and considers availability of information and paticipants' contributions to the case discussions. Case information and case discussions by the chair, surgeons, and oncologists scored high, whereas lower scores applied to radiologists, pathologists, nurses, physiotherapists, and MDTM coordinators (Figure 3, Supplementary Table 1). Low scores applied to information on psychosocial aspects and patients' views.

Comparison between participants' views and observational tools

Based on questionnaire data, MDTM participants reported high scores, for example, development of team competence (81%), development of individual competence (80%), clear MDTM goals (78%), involvement in case discussions (78%), and well-functioning leadership (77%), which was in agreement with the results from the observational tools that showed favorable scores for leadership and charing, teamwork and culture, and personal development and training (Figures 1–3). The observational tools, however, discriminated contributions from the different disciplines with high scores for participation from surgeons and oncologists and lower scores for radiologists and pathologists. Based on the MDT-MODe, contributions from nurses, physiotherapists and MDTM coordinators received low scores.

Both observational tools suggested weak consideration of patient-related aspects such as patients' preferences, comorbidity, and psychosocial aspects, which stand in contrast to the responses from the MDTM participants with 79% providing affirmative responses to consideration of comorbidity and 71% reporting to consider patients' perspectives. Better outcome based on observations than questionnaire data applied to functionality of technology and equipment that was rated high using observational tools, whereas affirmative scores (5–7) for technical functionality were given by 63% of the participants.

Discussion

Main findings

National virtual MDTMs for rare cancers have, during recent years, been implemented in Swedish cancer care.

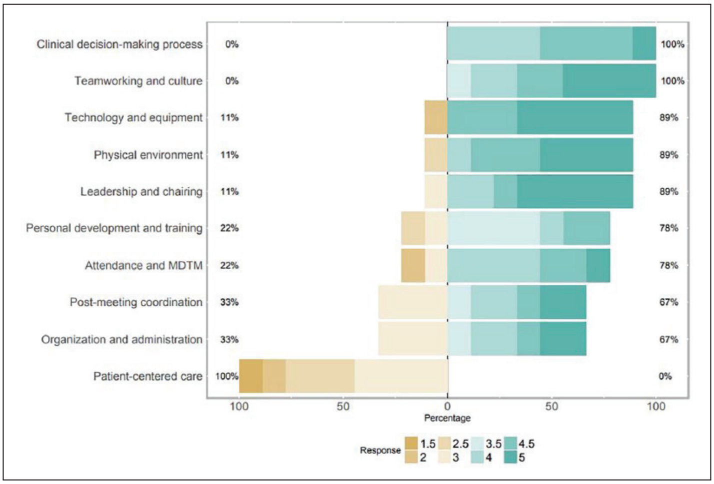

Figure 2. Observational assessment data based on MDT-MOT.
Stacked bar chart showing the results from the MDTMs for anal cancer, penile cancer, and vulvar cancer; the MDT-MOT tool assesses overall meeting performance to support team development based on 10 key domains using a 5-point scale.

Our data suggest that case information, leadership, and teamwork are overall well-functioning, whereas contributions from nurses, physictherapists and coordinators to the case discussions and considerations of patients' perspectives are limited (Figures 1–3). In Sweden, the medical teams responsible for establishing national MDTMs had access to updated national standards of care and a video-based communication platform, but otherwise implemented these virtual MDTMs independently and without formalized leadership training, improvement programs, or structured evaluation plans.

Several instruments have been developed to assess and improve MDTM function, but there are no generally agreed measures or principles for MDTM evaluations. Available instruments include checklists (Multidisciplinary Team Quality Improvement Checklist (MDT-QuIC)), observation tools (Multidisciplinary Team Observational Assessment Rating Scale (MDT-OARS), MDT-MODe, MDT-MOT, and a tumor leadership assessment instrument (ATLAS)), and self-assessment instruments (Team Evaluation and ASSESSment Measure (TEAM) and Multidisciplinary Team Feedback for Improving Teamworking (MDT-FIT)).[6,14,16,17] Our application of MDT-MOT and MDT-MODe was motivated by the wish to use two comparable instruments with somewhat different focus, that is, on overall function of the MDTM versus evaluation of the individual case discussions. The focus on the quality of information, the contributions to the case discussions, and the overall functionality of the meetings provide a basis for future team-led improvement programs. We demonstrate high inter-observer correlation and observations that are largely in agreement between the two observational assessment tools applied (Figures 2 and 3). MDT-MOT and MDT-MODe have been applied to MDTMs for different diagnoses.[18–21] Our double readings resulted in inter-observer variabilities of 0.71 for MDT-MOT and 0.86 for MDT-MODe, which fit well with the findings from Gandamihardja et al.,[19] who applied the MDT-MODe to MDTM for breast cancer with reliability coefficients of 0.73–0.93.

Studies on virtual MDTMs are rare, but experiences from regional MDTMs that connect specialists and community physicians in a geographical area demonstrate general satisfaction and suggest that virtual MDTMs are feasible and valuable.[4,22] Development of individual- and team competence were two of the top-rated benefits among participants in national MDTMs (Figure 1). This suggests a potential to strengthen national professional networks, increase collaboration across geographical regions, support further education, and stimulate knowledge sharing, which has been documented in regional MDTMs.[4,23,24] Access to relevant information and good teamwork with representation from all core disciplines have been identified as major determinants for reaching treatment recommendations at MDTMs.[15,19,20,25] We did not observe difficulties in reaching joint treatment recommendations, which may partly be explained by the large expert network available, well-functioning leadership, and relatively few cases per MDTM with a mean of 3–8 min per case discussion.

The national Swedish MDTMs are planned for rotating leadership on an annual basis. Most MDTMs are led by surgeons, but rotating leadership that involves various disciplines and professions, for example, oncologists and specialist nurses, may be relevant to consider since experiences from other MDTMs suggest that this principle may improve

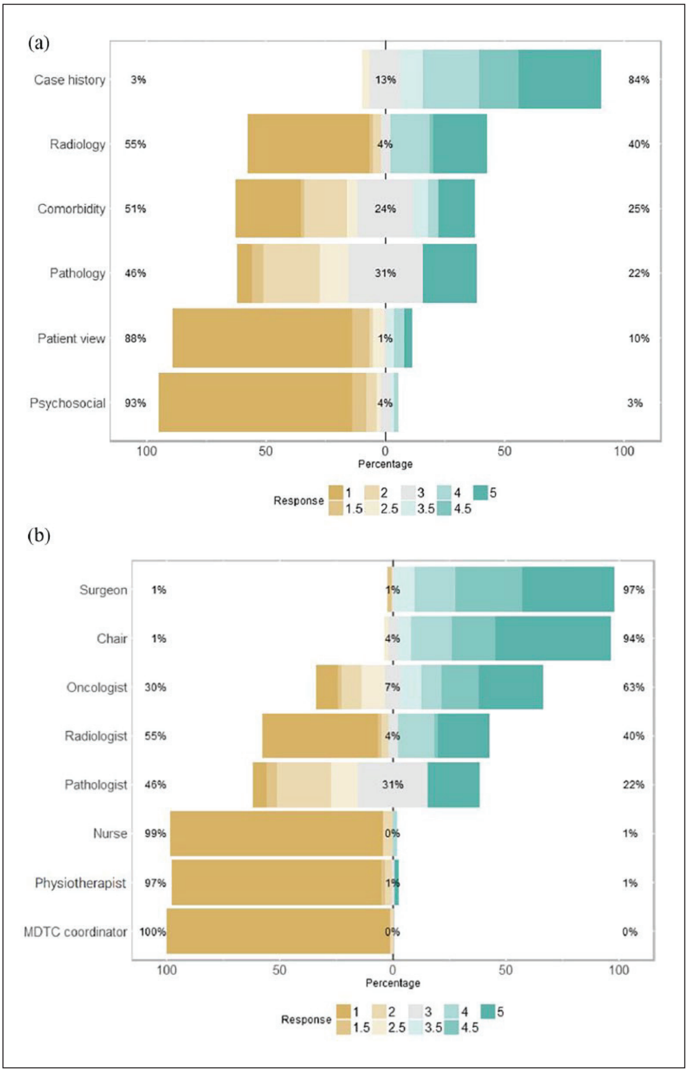

Figure 3. Observational assessment data based on MDT-MODe. Stacked-bar chart showing the results from the MDTMs for anal cancer, penile cancer, and vulvar cancer. Evaluation of (a) information and (b) contribution to the discussion. The MDT-MODe tool assesses quality of presented information and participants' contribution to the case discussion using a 5-point scale.

teamwork and reduce potential conflicts.[25,26] Formalized MDTM structures, definition of goals, and follow-up on implementation of treatment recommendations represent future focus areas.[4] Initiatives such as regular performance review, self-assessment and feedback, and e-based team training have proven effective and would likely be relevant and feasible also for national geographically disparate teams.[20]

Biomedical elements have, in several MDTM settings, been shown to be better covered than psychosocial aspects, information on comorbidity, and patients' views.[13,19,27–29] A patient-centered approach is considered to be an important basis for individualized treatment recommendations[14,23,24,30], and consideration of psychosocial aspects, comorbidities, and patients' autonomy are recognized as pillars for an effective MDTM.[28,31] Data based on participants' ratings

Table 1. Guidelines for establishing and running a national virtual multidisciplinary team meeting.

Focus area	Issues for consideration and planning
Principles for referral	Definition of time points in the disease trajectory for case discussions at national MDTM Establishment of guidelines for referral, for example, directly from local/regional hospital or from national expert center Definition of referral format, including structure and content of case history and ancillary data format Implementation of mechanism that allows identification of all eligible patients in participating clinics and hospitals Implementation of a MDTM coordinator role for collection and review of all available information prior to the case discussion
Infrastructure and technology	Regular meeting times and an agreed time frame Access to an interactive communication platform on which various types of documentation and information can be shared An interconnected IT system that provides an overview of the information available Access to technical support when relevant
Identifying and supporting chair and participants	Definition of required participants to grant qualified case discussions and recommendations Selection of chair Ensuring required expertise among participants Clarification of participants' roles with particular considerations of contributions from radiology, pathology, and care personnel Defining relevant participation from ancillary expert areas such as molecular diagnostics, rehabilitation, and palliative care Adjustment of work plans to allow case preparation, meeting participation, and relevant post-meeting work for participants
Running the meeting	Principles for identification of all participants Chairing that grants an efficient meeting structure and encourages active participation from all participants Principles and responsibilities for documentation of case discussions and recommendations Establishment of mechanism of how patients should be screened for eligibility of clinical trials Responsibilities for communicating treatment recommendation to patients Responsibilities for communicating treatment recommendation to other healthcare providers
Organizational and legal aspects	Applicable confidentiality agreements in place Legal consideration of compliance with regulations for data transfer Relevant funding and resources in place Mandate to provide treatment recommendations across healthcare providers Principles and methods to evaluate performance and improve MDTM functionality Principles for follow up of adherence to referral principles from participating hospitals and regions

MDTM: multidisciplinary team meeting; IT: information technology.

and data from our observations did, in this regard, differ with 71%–79% affirmative response among participants related to comorbidity and patients' perspectives, whereas observations rated consideration of patient-related perspectives low (Figures 1–3). Jalil et al.[18] used the MDT-MODe tool to evaluate MDTMs for various cancer types, including urological, gastrointestinal, and head and neck cancers and reported scores comparable to ours for comorbidity (mean 2.6 vs 2.1), psychosocial considerations (1.5 vs 1.4), and patient view (1.6 vs 1.3). National MDTMs gather expertise that may be geographically far from the patient, which further underscores the need to ensure development of structures to grant consideration of patient perspectives.[23,31] Furthermore, focus on patients' preferences, performance status and comorbidities has been shown to positively influence implementation of MDTM recommendations.[15,27] MDT-MODe suggested low contribution to the case discussions from nurses, physiotherapists, and MDTM coordinators with scores of 1.0–1.2 (Supplementary Table 1). This observation is supported by other studies, several of which have also applied MDT-MODe.[14,15,19,20,24,29] This shortcoming likely reflects the dominance of medical aspects over patient-related aspects in the case discussions. A weak focus on rehabilitation perspectives at MDTMs has been reported from the United Kingdom.[15,29,31–33] Based on the National Ewing Sarcoma MDTM in the United Kingdom, Bate et al.[32] have documented that patients feel that their views should inform the decision-making process and recommend initiatives such as treatment recommendations written in plain language and development of tools to improve patient involvement and enhance communication. Soukup et al.[25] demonstrated that a complete patient profile and contributions to the case review by all core disciplines drive the decision-making process at MDTMs. Our observations suggest that the national MDTM teams should discuss and consider how to grant an optimal balance between biomedical facts and patient-related aspects.[23–25] Development of standards for how patient perspectives are granted consideration would be relevant. Such a development will likely require consideration of the current meeting format and should involve care professionals who may represent patients' perspectives at the MDTM.

Since national MDTMs are resource demanding and require significant coordination, initiatives that grant safe and easy access to relevant information, skilled participants, well-functioning teamwork, good leadership, and efficient administrative routines are crucial.[1,2,6,15] The extended number of participants from various hospitals with different routines and traditions adds a level of complexity to national MDTMs. Though overall feasible, a number of issues should be considered prior to initiation of a national MDTM for best possible outcome. These include infrastructure and technology, referral principles, requirements for participants, running principles, responsibilities for communicating recommendations, and principles for governance and evaluation of national MDTMs. Based on our experiences and observations, and on current literature, we summarized issues to consider into guidelines for virtual national MDTMs in cancer care (Table 1).

Strengths and limitations

We aimed to obtain a comprehensive picture rather than to perform detailed evaluations of the independent MDTMs. The combination of team members' subjective views and objective evaluation based on observational tools represent strengths and allow for identification of areas of agreement as well as disagreement between the different measures. The concordant picture obtained for most factors and areas supports identification of relevant benefits and shortcomings. We regard a Hawthorne effect as less likely since the observers were present at one participating hospital, whereas the majority of the participants participated by video from other hospitals. Limitations include a response rate of 52% for the electronic questionnaire and observations limited to three MDTM sessions for each diagnosis. Though the observers documented good inter-observer agreement between the MDT-MODe and the MDT-MOT, the tools were new to the study group, and the evaluators may still be in the learning curve. Furthermore, the tools do not allow for scoring of individual specialists and do not account for cases where, for example, histopathological input was not considered relevant. The low scores for the contribution from nurses, physiotherapists, and MDTM coordinators may not fully reflect a suboptimal involvement, for example, limited involvement from nurses could reflect clinical trajectories where cases are discussed at the MDTM prior to being seen by the responsible nurse. Due to a limited number of answers from nurses and coordinators, subgroup analysis was not possible.

Conclusion

National virtual MDTMs for rare cancer type have successfully been established in Swedish cancer care. Evaluation based on participants' views and structured observational assessment identified well-functioning leadership and teamwork, but revealed weaknesses related to patient perspectives, involvement of care professionals, and MDTM evaluation principles. To make best use of the expert networks involved in national MDTMs and to provide appropriate and acceptable treatment recommendations for patients with rare cancer type, we suggest that team review and MDTM evaluation should be prioritized with a specific focus on how patient perspectives and contributions from care personnel may be strengthened.

Acknowledgements

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Author contributions

All authors have relevantly contributed to the manuscript and approved of the final version and its submission.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethical approval

The study was ethically reviewed and granted permission by the regional ethics committee at Lund University (registration number 2016/195).

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Supplemental material

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Supplementary table 1. Summary of results using MDT-MOT and MDT-MODe

		Penile cancer	Anal cancer	Vulvar cancer
MDT-MOT				
	Attendance at MDTM	4.2	4.2	3.3
	Leadership and chairing	4.8	5.0	3.7
	Teamworkning and culture	4.8	4.5	4.2
	Personal development and training	3.0	4.2	3.7
	Physical environment	4.7	4,8	3.8
	Technology and equipment	4.7	5.0	3.8
	Organization and administration	4.3	4.0	3.3
	Post-meeting coordination	4.8	3.5	3.3
	Patient-centered care	2.5	2.5	2.7
	Clinical decision-making processes	4.3	4.7	4.0
MDT-MODe				
Contribution to information	Case history	4.4	4.4	3.7
	Radiology	3.1	4.7	1.9
	Pathology	3.5	2.5	2.4
	Psychosocial aspects	1.0	2.0	1.1
	Comorbidity	2.8	3.2	1.7
	Patient's view	1.3	1.7	1.7
Contribution to case discussions	Chair	4.7	4.9	3.8
	Surgeon	4.5	4.5	4.3
	Oncologist	3.7	4.4	2.7
	Nurse	1.1	1.0	1.2
	Radiologist	2.7	4.2	1.0
	Pathologist	2.7	1.0	1.0
	Coordinator	1.0	1.0	1.1
	Physiotherapist	1.2	1.1	1.0

Study III

Journal of Multidisciplinary Healthcare

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ORIGINAL RESEARCH

Health Professionals' Views on Key Enabling Factors and Barriers of National Multidisciplinary Team Meetings in Cancer Care: A Qualitative Study

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Purpose: Multidisciplinary team meetings (MDTMs) are an integral component of cancer care. Increasingly, virtual MDTMs are used to grant high-quality treatment recommendations across health-care regions, which expands and develops the local MDTM team to a regional or national expert network. We investigated health professionals' experiences from national, virtual MDTMs for rare cancer with a focus on key enabling factors and barriers.

Methods: Health professionals who participate in seven national, virtual MDTMs in Swedish health-care responded to a questionnaire exploring key enabling factors, barriers and opportunities for MDTM development. Conventional content analysis was used to identify thematic categories based on free-text responses.

Results: Participants´ perspectives could be assigned into three categories ie, a national arena with potential for comprehensive knowledge and collaboration, prerequisites for decision-making and organization and responsibilities. These categories consisted of nine sub-categories that referred to, eg, collective competence, resources, clinical research, case discussion, meeting climate, patient-related information, MDTMs potential, referral and technical insufficiencies.

Conclusion: National, virtual MDTMs represent a new multidisciplinary collaborative arena that introduces benefits as well as challenges. Consideration of key enabling factors and barriers may ease implementation and further optimize MDTMs in cancer care.

Keywords: tumor board, rare cancer, healthcare team, treatment recommendation, decision-making, content analysis

Introduction

In cancer care, multidisciplinary team meetings (MDTMs) constitute a recurrent, weekly task for many health professionals and are recognized as a focal point of treatment recommendations. MDTMs contribute to coordinated care, improved quality of care and adherence to evidence-based guidelines.[1] At the same time, MDTMs are resource-demanding with a growing number of case discussions and increasingly complex diagnostic paths and treatment options, which raises consideration of resource-effectiveness, possibilities to prioritize case discussions and risk of decision-making fatigue.[2,3] These dual perspectives motivates evaluation of health professionals' experiences from MDTMs.

Centralized Treatment for Rare Cancers

Refined diagnostic procedures and novel treatment options, including development of personalized medicine programs, challenge health-care organizations to provide

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access to highly specialized skills across geographical regions. This is especially challenging for rare cancers, which are typically defined by an incidence of <6/100 000 persons per year and represent a heterogeneous group.[4,5] Management of rare cancers is challenged by limited evidence for best practice, expert skills are typically confined to a few key health professionals and clinical research programs are hampered by the low incidence.[6,7] As a group, rare cancers have reduced survival compared to other common cancers, are difficult to diagnose and require highly specialized knowledge and expertise for correct clinical management.[4] Sweden has a population of 10 million, which implies that each rare cancer type develops in less than 600 individuals annually. To provide best possible services, grant sufficient expert knowledge and stimulate clinical development and research, treatment of certain rare cancers has been centralized to two-four national expert centers. These centers have established a national, virtual MDTM where newly diagnosed cases as well as all recurrences should be discussed. National, virtual MDTMs aim to grant treatment recommendation based on evidence or best possible expert opinion and to ensure equity of care across geographical regions, develop national expert networks and stimulate clinical research.

Development of National, Virtual MDTMs

In Sweden MDTMs are held on local, regional and, more recently on, national level through video-based communication systems. To date, few studies have reported on implementation of national, virtual MDTMs, which makes the evidence-basis thin.[8,9] Virtual MDTMs have been shown to connect geographically spread experts with benefits that particularly relate to improved coordination of care for patients in rural and remote areas and to treatment recommendations for complex cases and rare diseases.[2,10–14] The MDTM network also provides possibilities for competence development for participating health professionals.[8] Difficulties related to virtual MDTMs include dysfunctional technology, concerns about confidentiality, coordination challenges between hospitals and limited patient-centeredness.[6,9,10]

With the aim to develop and optimize national, virtual MDTMs, we investigated health professionals' experiences of key enabling factors and barriers for national, virtual MDTMs for rare cancers.

Materials and Methods

The study was designed as a descriptive, qualitative study with an explorative design. By using free-text answers form health professionals, key enabling factors, barriers and opportunities for development for national, virtual MDTMs were explored. The study is part of a larger research project aiming to address feasibility, function and health professionals experiences from national, virtual MDTMs in Swedish cancer care. Reporting are conducted according to the Standards for Reporting Qualitative Research (SRQR) guidelines.

Context

In Sweden, treatment for seven types of rare cancers, has been centralized to national expert centers. This centralization was linked to establishment of national, virtual MDTMs to grant best possible treatment recommendation, develop national clinical networks, strengthen clinical research and improve patient care and outcome. Between 2015 and 2017, potentially curative treatments for penile cancer, anal cancer, vulvar cancer, gastroesophageal cancer, hepatobiliary cancer and cytoreductive surgery with hyperthermic intraperitoneal chemotherapy (HIPEC) were centralized. In 2017, a national, virtual MDTM was also initiated for childhood cancer with participation from the six regional pediatric oncology centers. Required participants in the various MDTMs are defined in the national standards of care and generally include surgeon, oncologist, pathologist, radiologist, contact nurse and MDTM coordinator. In Sweden, no formal MDTM training and/or evaluation is available.

Respondents and Data Collection

Health professionals who regularly participate in the seven national MDTMs for rare cancers described above were eligible for the study. The research team developed a questionnaire based on an earlier study on health professionals' experiences from local and regional MDTMs.[15] Information about the study and a link to an online questionnaire was distributed to all participants (N=241) by e-mail. Two reminders were sent. Data were collected between 2017 and 2018. In total, responses were obtained from 125/241 (52%) invited health professionals. The scoring part of these data have been reported elsewhere,[8] whereas the present study focuses on participants' experiences based on 278 written free-text answers to the questions, "what's your experience regarding profit/benefits of MDTMs? what is your experience regarding disadvantage/difficulties of MDTM? how would you wish to develop MDTMs?" Demographic data are presented in Table 1.

Table 1 Demographic Data

Gender		**Profession**		**Discipline**	
Women	45%	Physician	87%	Surgery	53%
Men	51%	Nurse	11%	Medicine/ oncology	26%
No information	4%	Medical secretaries	2%	Radiology	6%
		None of the above	0%	Pathology	2%
				None of the above	14%

Data Analysis

Free-text answers were analyzed with an inductive approach using conventional content analysis, which was motivated by limited availability of data from the study area.[16] The answers were analyzed by three researchers (LR, JW and MM) with expertise in cancer care, qualitative methodology and MDTMs to grant different analytical perspectives. Initially, the text was read and re-read by all authors to get a sense of the whole to capture the concepts of the text. Thereafter, the analytical process was dynamic moving forward and back between the whole and the parts of the text. Notes were made through out the process. Words and meaning units were categorized in an initial coding scheme based on their relationship to create meaningful clusters.[16] Similarities and differences in the initial coding were discussed until consensus was reached by all authors. The analysis resulted in three main categories (national arena with potential for comprehensive knowledge and collaboration, prerequisites for decision-making and organization and responsibilities). The categories were further split into nine subcategories (Table 2).

Ethical Approval

The participants' confidentiality was granted by reporting the findings on group level. The study was ethically reviewed and granted permission by the Regional Ethics Review Board in Lund, Sweden (registration number 2016/195).

Results

With a focus on key enabling factors and barriers for national, virtual MDTMs for rare cancers three main categories, ie, a national arena with potential for comprehensive knowledge and collaboration, prerequisites for decision-making and organization and responsibilities were defined (Table 2).

A National Arena with Potential for Comprehensive Knowledge and Collaboration

Collective Competence

National MDTMs were described as an important and well-functioning arena for knowledge-sharing and for discussing complex cases in highly specialized diagnostic and therapeutic areas. Case discussion at national MDTMs were reported to contribute to enhanced individual competence and strengthening team competence. This was described by one respondent,

> childhood cancer is a small specialty with great heterogeneity, that's why it is invaluable to share knowledge and competence with colleagues outside our own clinic. [physician, medicine/oncology]

Through nation-wide referrals, participating health professionals are exposed to a considerably higher number of cases, which was described to contribute to increased experience. The educational perspective was regarded as

Table 2 Categories and Subcategories

Category 3.1	**A National Arena with Potential for Comprehensive Knowledge and Collaboration**	**Category 3.2**	**Prerequisites for Decision-Making**	**Category 3.3**	**Organization and Responsibilities**
3.1.1	Collective competence	3.2.1	Case discussion and adherence to treatment recommendation	3.3.1	Achieving the MDTMs full potential
3.1.2	Resource-demanding and suboptimal participation	3.2.2	Meeting climate	3.3.2	Referral to national MDTM
3.1.3	National arena for clinical research	3.2.3	Limited patient related information	3.3.3	Technical insufficiencies

advantageous and may be especially valuable for small-volume clinics, which is reflected in the quote

> (national MDTMs) offers great educational opportunities because it is a small diagnose area, you can go through a whole professional life only seeing a handful. Here anyone interested can see all cases. [nurse, surgery]

The collective competences and experiences were described to contribute to a thorough discussion, to provide grounds for national consensus, contribute to adherence to standards of care and was regarded as a key enabling factor for decision-making. National MDTMs were also described to decrease the gap between experts in different geographical regions, which was perceived to be beneficial for collaborative professional networks.

Resource-Demanding and Suboptimal Participation

National MDTMs were perceived as important for high-quality treatment recommendations, but shortage of resources was described as a barrier to grant treatment within predefined lead times. The respondents reported suboptimal attendance, primarily related to lack of resources in radiology, pathology and oncology. Causes of suboptimal participation were reported to be irregular meeting dates and needs to coordinate participation with other health-care tasks. The MDTM was also perceived to be time-consuming and resource-demanding, particularly related to the preparatory work. Although active and well-prepared participants were described to grant effective case discussions, preparedness was reported to vary among the participants with negative influence on the quality of the case discussion. Some respondents also described lower commitment and participation in discussions of patients referred from other hospitals. To optimize participation the respondents suggested improvements including development of guidelines for mandatory attendance of key members with possibilities to invite specialists when relevant.

National Arena for Clinical Research

National MDTMs were described to have potential to increase clinical research collaborations and enable inclusion of patients in clinical trials. Several respondents, however, described a limited focus on clinical trials and it was suggested that designated time to discuss research protocols would enhance collaboration and stimulate research initiatives.

Prerequisites for Decision-Making

Case Discussion and Adherence to Treatment Recommendation

National MDTMs were reported to be relevant and feasible fora for discussions of complex cases. Respondents reported confidence in access to national, multidisciplinary expertise in the decision-making process. A major aim of case discussion at MDTMs is to provide treatment recommendations according to national guidelines. However, lack of transparency in terms of compatible e-health system and privacy regulations were described as complicating factors. One respondent described that,

> It is difficult to know what's been documented when each clinic makes their own documentation, if you chose to oppose the conference (recommendation) you can avoid document it in the journal. [medical secretary, medicine/oncology]

Therefore, it was suggested that the coordinating national centre should be responsible for documentation to enhance transparency and that the MDTM teams should designate time for evaluation and feedback.

Meeting Climate

The respondents' experiences of the case discussions varied greatly. Whereas some respondents described well-functioning meetings with structured discussions and an open meeting climate. Others described the meetings as sub-optimal with disorganized discussions, unresolved conflicts and stress related to needing to "perform" at a national arena. One respondent described,

> we have a well-functioning local MDTM but at the national MDTM you feel the pressure to review right and work effectively. Before the conference I sometimes call our surgeon to coordinate and make an agreement on what we are going to present. [physician, radiology]

To enable optimal case discussions, the importance of an open meeting climate was emphasized, and some respondents reported a need for clarification of roles and responsibilities.

Limited Patient Related Information

National MDTMs for rare cancers were perceived to contribute to equity in care, increased patient safety and were also reported to provide an unofficial second opinion functionality. Though treatment recommendations from a national MDTM were considered important for the patient, some respondents expressed concerns about limited availability and consideration of patient-related information such as comorbidities, performance status, care needs and patients' perspectives. Lack of relevant information was reported to lead to adjustments of and deviations from the recommendation given. One respondent described,

> it is common that you don't have any information about the patient before the conference, then you can't make a correct judgment and contribute to the discussion. It's sort of a hostage situation. [physician, surgery]

It was suggested that enhanced focus on patient-related information prior to the national MDTM would improve discussions quality. The respondents suggested that the referring physicians should participate to grant relevant recommendations and minimize needs for recurrent discussions.

Organization and Responsibilities

Achieving the MDTMs Full Potential

Several respondents reported that the national MDTMs did not reach the full potential. Shortage of relevant resources, uncertainty of the assignment and a feeling of competition between participating treatment centres negatively influenced collaboration and lead to misunderstandings. One respondent reported,

> To me the distribution of mandate is little unclear. We report a patient, present a short case history and then X (treatment center) decides what should be done. It´s not a discussion on equal terms, but maybe that's the whole point. [physician, surgery]

In parallel, it was reported that implementation takes time. Better regional knowledge of the national MDTMs and agreements on meeting procedures were suggestion to ease implementation and collaboration.

Referral to National MDTM

According to the agreement on national MDTMs and the standards of care for the diagnoses in question, all patients within the areas defined should be referred to a national MDTMs. Respondents, however, reported sub-optimal compliance to the referral guidelines and described this as a potential barrier for patients' access to equal health care. Reasons for not referring patients was motivated by obscure referral principles and prestige with hesitation having to ask a national MDTM for advice. Some respondents described case overload and argued for selection of complex cases. Transparent and accepted referral guidelines therefore likely represent a key success factor for national MDTMs.

Technical Insufficiencies

Participating hospitals used different technologies and e-health systems. Dysfunctional video-connections where participants could not see all participants or patient-related material were reported to lead to misunderstandings. Time-consuming, referral processes and complicated transfer of health-related information between centers, particularly within radiology, were also described as problematic. The respondents suggested better inter-operability of the e-health systems to increase effectiveness and encourage participation.

Discussion

During the latest years, MDTMs have developed in some diagnostic areas from local team meetings to regional or national multidisciplinary networks. This study adds knowledge about health professionals' experiences of key enabling factors and barriers for national, virtual MDTMs for rare cancers, which is essential for future improvements. Few studies today, have reported on implementation of national MDTMs[8,9] and it is well known that a strategy for implementation is essential for the outcome.[17] Damschroder et al (2009) established the theoretical framework, Consolidated Framework for Implementation Research (CFIR) consisting of five synergetic domains by which implementation is accomplished; the intervention, the inner and outer setting, individual characteristics and process. On a macro level, these domains can be used to explain and understand research findings and how implementation affect team's performance.[18] Therefore, we use the CFIR to discuss the main findings of this study focusing on key enabling factors such as strengthening professional networks (outer setting) as well as barriers such as suboptimal attendance (characteristics of individuals), resource constrains/lack of designated time (intervention) and uncertain assignments (intervention and inner setting).

In this study the respondents´ reported that national, virtual MDTMs provide support in decision-making, strengthen collaborations and professional networks, and develop individual and team-related competence, which is also supported by previous observations.[10,13] The benefits of professional networks are supported by the CFIR domain outer setting which emphasize the importance of organizations promoting networking and teambuilding since this positively influence implementation by individuals sharing information and visions.[18] Further, it has also been shown that competence -, and network development is particularly relevant for health professional in county hospitals or low volume centres,[8,19] which is supported by this study.

As other developments in cancer care, the implementation of national, virtual MDTMs has not been without challenges. The results of this study indicate that the main challenges for national, virtual MDTMs is suboptimal attendance, time and resource constraints as well as experiences of unclear assignments and low adherence to referral guidelines. The results therefore suggest that the organizational change reached through the initiation of a national, virtual MDTM needs to be linked to behavioral change in participating health professionals. This is in line with the CFIR domain characteristics of individuals, which emphasizes that an organizational change begins with a change in individual behavior and that the degree to which new behavior are positively or negatively valued affect the willing to change.[18] Therefore, promotional interventions can increase commitment and interactive participation.[19,20]

Several respondents reported resource constrains and lack of designated time to prepare for and participate in national, virtual MDTMs. These factors are interrelated, and lack of designated time has also in earlier studies been pointed out as a determinant for MDTM attendance.[1,12,19–22] The CFIRs domain intervention includes adaption ie, to which degree the intervention can be adjusted to meet local needs, but also emphasize the importance of a balance between fulfilling the implementation and flexibility related to local needs,[18] such as adaption to different working schedules. This emphasize the need of, at an early implementation state, clarify the value of participation in MDTM to motivate health professionals in investing the time and effort needed.[12]

MDTMs are resource-demanding, which motivates continuous work to ensure resource effectiveness. Initiatives to reduce caseload include mini-MDTMs for standard cases[19,20,23] and selection of complex cases who benefits the most from full MDTM.[2,24] Swedish guidelines for the seven rare cancers here studied call for referral of all newly diagnosed cases as well as all recurrences. The respondents claimed that all relevant cases are not referred, which may depend on several factors such as uncertainty of referral guidelines[23] and recent implementation of national, virtual MDTMs.[14] Hence, to improve MDTM effectiveness and meet the increasing demands on MDTM, structures for recurrent evaluations[19] and transparent referral guidelines are relevant to develop.

The respondents described that uncertain assignments and responsibilities and suboptimal collaboration between hospitals prevented the national, virtual MDTMs from reaching their full potential. The CFIRs intervention domain indicate that complexity increases with the number of targets (in this case several participating hospitals and individuals) and relates to how the intervention affects the work processes.[18] This suggests that it is important to clarify the national, virtual MDTM assignment[12] and to ensure efficient communication about the service at an early state of implementation. This is supported by the CFIRs inner setting domain, which stresses the importance of well-functioning informal and formal communication and clarification of goals.[18] In addition, leadership skills and use of rotating responsibility for chairing the meeting have been suggested to improve teamwork and to decrease conflict levels.[1,21]

In line with earlier studies, the respondents´ also reported suboptimal consideration of patient-related information, time constraints and non-attendance from core members[15,25] as a barrier for relevant treatment recommendations. Although a relevant MDTM recommendation should be evidence-based and patient-centered,[21] several studies show that the biomedical perspective dominate with less attention to other perspectives.[8,19,20,26–28] Improvements in this field include structures for standardized documentation and presentation of patient-related perspectives.[19]

Strengths and Limitations

Our study was conducted at an early state of implementation of national, virtual MDTMs and may therefore describe implementation challenges that have been resolved during the process. The study has limitations which needs to be considered when interpreting the results. These limitations include a response rate of 52%, no possibility for analysis of non-respondents, and that the free-text questions underlying the results of this study is not matched to the quantitative data in the core questionnaire. Further, the study is based on participants' individual experiences and the results transferability is therefore difficult to value. The 125 responses, however, described various key enabling factors and barriers and the findings are supported by relevant research, which supports applicability in similar contexts.[29] To ensure credibility the researchers moved forward and back between the original data and the analysis. Differences in interpretation between researchers was resolved through discussions until consensus was reached. The credibility is further strengthened by illustrating quotes in the text. Using a questionnaire, respondents representing different national, virtual MDTMs was reached which allows insights from several different perspectives.[29]

Conclusions

This study is to our knowledge, the first to explore health professionals' experiences of key enabling factors and barriers for national, virtual MDTMs for rare cancers. Consideration of the enabling factors and barriers herein identified may easy implementation and functionality of future MDTMs in cancer care.

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Author Contributions

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Multidisciplinary team meetings are an integral component in modern cancer care with the aim to provide the patient with an individualized treatment recommendation based on best practice, evidence and national clinical cancer care guidelines. Multidisciplinary teamwork and decision-making are complex, with organizational and personal factors influencing quality and efficiency. This thesis evaluates multidisciplinary team meetings with a focus on function, information, case discussions and participants' experiences.

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