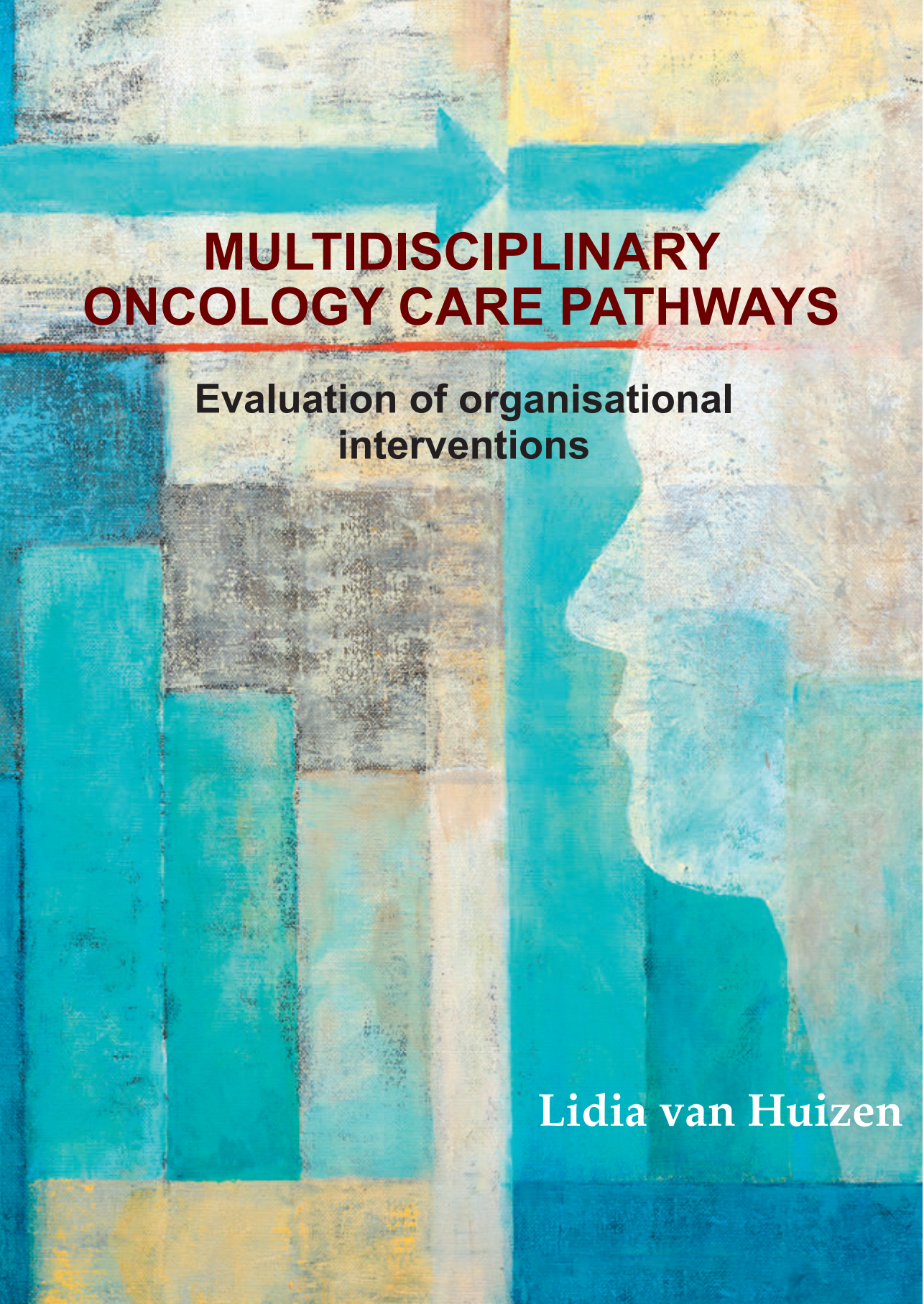
MULTIDISCIPLINARY
ONCOLOGY CARE PATHWAYS
Evaluation of organisational interventions
Lidia van Huizen

LIST OF ABBREVIATIONS

ENT	Ear, Nose and Throat
FtF	Face-to-face (physically)
MDT	Multidisciplinary team
MDTM	Multidisciplinary team meeting
MFDC	Multidisciplinary first-day consultation
GIO	Gastro-Intestinal Oncology
H&NO	Head-and-Neck Oncology
OMS	Oral and Maxillofacial Surgery
MO	Medical Oncology
RCT	Randomized Controlled Trial
RT	Radiotherapy
VC	Videoconferencing or video-conferenced

GLOSSARY OF TERMS

Care Pathway	A description of agreements between departments and specialisms that are involved in the intramural care of groups of patients suffering from a certain disease, from referral to follow-up.
Care path	A description of agreements on the organisation of care within a department or a specialism with protocols and procedures.
Care chain	A description of agreements on intramural and extramural care in a managed clinical network.
MDT	A multidisciplinary team managing a care pathway.
MDTM	A multidisciplinary team meeting in which patient cases are discussed regarding diagnostics and treatment plans.
Indicator	A statistical measure to describe for instance quality of care.
Structural indicators	A prerequisite needed for quality of care, for instance presence of specialists during MDTM.
Process indicators	A measure for timeliness or efficiency in quality of care, for instance throughput time to start treatment or the number of hospital visits.
Outcome indicators	A measure for the results of care, for instance quality of life or survival.

Multidisciplinary oncology care pathways

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Neem de plaats, de ruimte en de tijd
Neem mijn gaven, mijn talent, neem wat zich ontplooit
Dat ik word wie ik ben

Vrij naar Iona lied 44

CONTENTS


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CHAPTER 1

Introduction

1

1.1 History

Since the 1970s, multidisciplinary diagnostic procedures and treatment strategies have become the norm in oncology care. Having multiple diagnostic consultations could delay the start of treatment. Consequently, the coordination and organisation of oncology care became essential[1] and ad hoc multidisciplinary consultations, or more structural multidisciplinary teams (MDTs), arose to streamline the contributions of the various specialisms. In addition to exclusively oncological disciplines such as Medical Oncology and Radiotherapy, there are also oncological divisions within other disciplines including Gynaecology, Dermatology and Maxillofacial Surgery. Oncological disciplines would be embedded in a corresponding department such that staff and budgets were managed by these departments. As such, MDTs could only exist if these related departments cooperated. This led to joint outpatient clinics and oncology MDT meetings for the provision of local and regional oncological care. This process was aided by information and communication technology applications becoming available, such as videoconferencing (VC), to support regional cooperation and to reduce travel times for regional MDT meetings.

These developments stimulated the development of a new field in the organisation of health services often referred to as 'integrated care'[2]. Knowledge and expertise on diagnostic and therapeutic modalities of a range of disciplines or departments were organised as integrated services in the development of care pathways to treat specific, well-defined diseases. Given that departments and care pathways could have conflicting interests, such as over costs and scientific output, it could be difficult to organise integrated care. Indeed, how to organise and coordinate integrated care is still an issue that requires ongoing attention in many multidisciplinary collaborations in oncology networks[3,4]. The influence of organisational interventions[5] on care pathway performance and on perceived value is complex to evaluate and measure, largely because value should not be measured in terms of the volume of services delivered but on the outcomes achieved[6,7]. Further, also professionals' wellbeing and opinions should be taken into account[8]. The question then is how to evaluate and measure the outcomes of introducing a joint outpatient clinic or the reorganisation of MDT meetings in a cancer centre?

Clinical videoconferencing applications not only have benefits but also drawbacks that should be incorporated in any evaluation. However, how to organise the effective use of VC by collaborating MDTs within oncology networks collaborating across different locations has not been recently evaluated.[9,10] An up-to-date overview of the benefits and drawbacks would be helpful for policymakers and for teams in deciding whether to introduce VC to improve care coordination, lower costs and reduce travel time.

In this thesis, the effects of interventions addressing the reorganisation of oncological care pathways of the University Medical Center Groningen (UMCG) and the use of videoconferencing are evaluated. A mixed method design is used. In the quantitative component, process indicators such as throughput times and the number of hospital visits are used. Furthermore, stakeholders of the care pathways are interviewed to qualitatively analyse the benefits and drawbacks of the interventions.

1.2 Organisation of cancer care

An important organisational decision aimed at improving cancer care was the development of Comprehensive Cancer Centres[11] and care pathways[12,13] as will be outlined below.

1.2.1 Comprehensive Cancer Centres

The Dutch Health Inspectorate (DHI) decided to concentrate oncological care for 'low volume - high complexity' cancers in dedicated cancer centres. Later it transpired that the treatment of high-volume cancers was also becoming more complex and therefore also needed dedicated centres. This resulted in the development of Comprehensive Cancer Centres in which oncological activities were concentrated to improve the quality of care and patient safety. Another development was the establishment of officially registered oncological fellowships leading to cancer specialists within a range of disciplines. These developments all led to increased costs[14].

1.2.2 Care pathway management

Care pathways amount to disease-centred collaborations that use standardised operational procedures. In an oncological care pathway, expert diagnostic and therapeutic capacity are available to determine an optimal staging and treatment plan that is used for shared decision-making with the patient and a timely start to treatment. In this thesis, the definition developed by the European Pathway Association is used.

> *A care pathway is 'a complex intervention for the mutual decision making and organisation of predictable care for a well-defined group of patients during a well-defined period. A care pathway combines evidence-based key interventions, feedback on the actual care process, with a strategy for quality improvement. Defining characteristics of a care pathway include: (1) An explicit statement of the goals and key elements of care based on evidence, best practice, and patients' expectations and their characteristics, (2) the facilitation of the communication among the team members and with patients and families, (3) the coordination of the care process by coordinating the roles and sequencing the activities of the multidisciplinary care team, patients and their relatives, (4) the documentation, monitoring, and evaluation of variances and outcomes, and (5) the identification of the appropriate resources.'*[15]

In its efforts to improve the coordination of the treatment of oncological patients, the UMCG developed and introduced patient-centred, integrated care pathways for different patient groups. The last step in this process, before permanent implementation and after a period of use, is the evaluation of the cooperation between participating departments, treating disciplines and staff support[16].

In the UMCG, for the management of care pathways in general, the definition of the European Pathway Association was operationalised in a 'frame of reference' with clear standardised terminology to achieve reliability on information exchange on medical protocols and working methods. The terms care path, care pathway and care chain were introduced in the UMCG to clearly define responsibilities at different levels of the organisation (Figure 1).

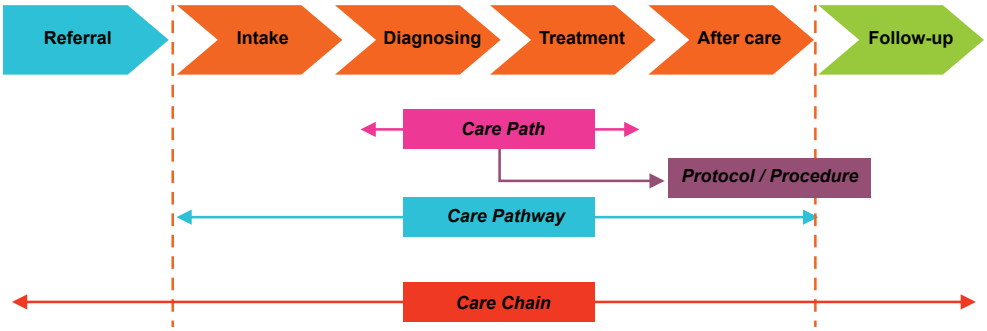

Figure 1. Operationalisation of care pathway terminology of the UMCG
Care path: a description of agreements on the organisation of care within a department or a specialism with protocols and procedures.
Care pathway: a description of agreements between all departments and specialisms that are involved in the complete intramural care of groups of patients suffering from a certain disease, from referral to follow-up.
Care chain: a description of agreements on intramural and extramural care in a managed clinical network.

Within a department, a 'care path' is used to describe the agreements made on the organisation of care, meaning the responsibility of the department to provide care on a sustainable basis. The term 'care pathway' is used to describe agreements between departments and specialisms that are involved in the overall intramural care for a specific disease within the hospital. The term 'chain of care' or care chain is used to describe the agreements on intramural and extramural care for a specific disease within a managed clinical or regional network, including referrals from general practitioners or other hospitals and aftercare in a nursing home, a hospice or through the general practitioner in the home situation[16]. Tumour boards that manage these oncological care pathways, and regional oncology or managed clinical networks, consist of a group of specialists that focus on 1) communication between specialists on managing evidence-based treatment for patients, 2) decision-making on treatment plans in MDT meetings and 3) multidisciplinary coordination of care and a timely start of treatment[3,17,18].

The unanswered question is whether organisational interventions based on these models for multidisciplinary care are an improvement. As such, there is a need to evaluate different care pathway interventions. For such an evaluation, we have selected four different care pathways as described below.

1.3 Care pathways addressed in this thesis

The care pathways reviewed in this thesis are the care pathway of the multidisciplinary Head-and-Neck Group and three care pathways from the tertiary centre for Gastro-Intestinal Oncology (GIO) of the of the University Medical Center Groningen.

In the Netherlands, the number of new cases per year (incidence) of head-and-neck cancer increased from 1,934 patients in 1989 to 3,017 patients in 2020. Despite this increase, head-and-neck cancer is still considered to be 'low volume - high complexity' oncological care. Consequently, the treatment has been concentrated in eight national centres since 1993. The head-and-neck cancer care pathway was chosen as a good example of 'low volume - high complexity' oncological care as it has already been functioning for more than 20 years, making it suitable for the evaluation of organisational interventions, because participants know and

trust each other. In comparison, the incidence of gastrointestinal cancer is much higher, with numbers rising from 12,877 patients in 1989 to 21,948 patients in 2020. Gastrointestinal cancer care is an example of high-volume oncological care that is carried out in general hospitals rather than only in comprehensive cancer centres. Nevertheless, due to new treatment possibilities, this care has become more complex, necessitating the development of tertiary centres. Tertiary centres act as centres of expertise that advise on treatment for patients being treated in a general hospital. Patients may also be referred to a tertiary centre for their complete treatment. A third possibility is a hybrid form of treatment, partly taking place in the general hospital and partly in the tertiary centre. Such regional cooperation in the care chain requires MDT meetings between the hospitals involved regarding treatment choice and subsequent care coordination. This regional cooperation, with three possible care pathways, makes GIO care a suitable example of 'high volume – low-to-high complexity' oncological care for evaluating organisational interventions.

Tumours that occur in the head or neck region and in the GI area tend to be fast growing. This means that if there a long interval between referral and the start of the primary treatment (surgery, radiotherapy and/or chemotherapy) that the tumour can proceed to a higher stage, reducing the likelihood of a cure[19]. Given that a patient's prognosis is determined by tumour stage, throughput time, defined as the gap from 'day of first visit to day of start of treatment', should be as short as possible[20-23].

1.3.1 Head-and-neck cancer in the Netherlands

The Dutch Head & Neck Society (DHNS), founded in 1984 as a scientific organisation, was one of the first organisations to promote concentrating care in dedicated multidisciplinary head-and-neck cancer centres. The main arguments were the 'low volume - high complexity' nature of the cancers and the variety of possible locations: nasal cavity, sinuses, lips, mouth, salivary glands, throat and larynx[24]. As a result, since 1993, head-and-neck cancer patients in the Netherlands are treated in one of eight head-and-neck cancer centres recognised by the DHNS, and six of these centres have preferred partners[25]. Criteria for qualifying as centre were: having the specialisms with expertise to treat the tumour, having the necessary diagnostic and therapeutic facilities and treating at least 200 new patients each year. Partners have to fulfil the same criteria, but should treat at least 80 new patients. The UMCG's head-and-neck cancer centre is one of these and its preferred partner, the Medical Center Leeuwarden, is located at a distance of about 60 kilometres.

Centres and their preferred partners are assessed by the DHNS every five years. This assessment consists of an evaluation of data provided by the centre and a site visit. The DHNS stipulates that 80% of patients should start treatment within 30 calendar days of first referral. Achieving this for all patients is considered unrealistic due to the complexity of some cases and co-morbidity issues. In 2006, throughput times at the UMCG head-and-neck cancer centre increased, and the percentage of patients treated within 30 days fell to below 80%.

In order to hasten the start of treatment, a multidisciplinary first-day consultation (MFDC) on the day of intake in the outpatient clinic was introduced. In this MFDC, an initial multidisciplinary diagnosis, tumour staging and diagnostic plan is made. In this research project, the effects of introducing the MFDC are evaluated on throughput times, number of hospital visits and compliance with the Dutch standard of starting treatment within 30 days.

The DHNS and the DHI both require, where there is cooperation between a head-and-neck cancer centre and a preferred partner, that all new patients at either location are discussed in a weekly MDT meeting[26]. This DHI requirement is seen as ensuring quality control for the preferred partner. Specialists from both locations, from the departments of oral and maxillofacial surgery, ear, nose and throat and radiotherapy, participate in these meetings using videoconferencing (VC). The effects of adopting VC are evaluated quantitatively in this research in terms of changes made in diagnostics and treatment plans. The value of VC is also evaluated qualitatively in terms of benefits and drawbacks by interviewing medical specialists.

1.3.2 The Gastro-Intestinal Oncology tertiary centre of the UMCG

In the UMCG, the GIO tumour board manages a tertiary centre board that organises oncology care together with partners across the northern region of the Netherlands. GIO covers cancer of the esophagus, stomach, intestines, colon, liver, gallbladder and pancreas.

The diagnosis and treatment of these patients is through one of three care pathways: 1) colorectal, 2) hepatobiliary or 3) esophagus-stomach[27,28]. These GIO care pathways differ from the head-and-neck care pathway in that there are platforms for consultation with the regional hospitals. Only complex cases and complex parts of a treatment are referred to the tertiary centre. The GIO board reorganised the MFDCs of the care pathways to include an assessment of the patient and a team meeting to decide on an initial diagnosis, tumour staging and diagnostic plan on that day. In this research project, this reorganisation is evaluated in terms of added value regarding throughput times, number of hospital visits and compliance with the Dutch standard to start treatment in a tertiary centre within 63 calendar days. In a qualitative part of this study, stakeholders of the care pathways are interviewed regarding the benefits and drawbacks of the reorganisation.

1.3.3 Evaluation of the value of the interventions on care pathways

Describing a care pathway will provide insights into the diagnostics, decisions made regarding the treatment plan, the start of the treatment and the coordination of this process. These insights can help in developing organisational interventions to further improve this process. As a follow-up, reorganisations to improve oncological care pathways should be evaluated in terms of efficiency and timeliness[29-33].

The ultimate criterion to assess an oncological care pathway should be survival rate. The drawback of adopting survival as a key outcome variable is that this requires a follow-up period of at least five years to be meaningful. Consequently, other outcome variables such as process indicators and professional well-being and opinions are used to evaluate care pathways in this thesis.

The author of this thesis is a senior consultant in quality and patient safety. Therefore, in the general discussion, aspects concerning the quality improvement domain are addressed.

This thesis provides answers to two research questions:

1. Have interventions in the organisation of one 'low-volume - high-complexity' care pathway and three 'high volume - low-to-high complexity' care pathways had added value?
2. What is the added value of videoconferencing in regional multidisciplinary oncology networks?

To answer these questions four studies have been carried out that are reported in the next four chapters.

CHAPTER 2 – Evaluating introduction of the MFDC in a head-and-neck care pathway
Head-and-neck cancer care is considered to be low volume – high complexity care. In this study, the value added by introducing an MFDC involving the key disciplines is analysed. The time needed for referral, the time taken for diagnostic procedures, the time to start the first treatment and the number of hospital visits are used as process indicators to evaluate the effect of the introduction of the MFDC. Data regarding these process indicators before and after the implementation of the MFDC are retrieved from the UMCG's medical records and analysed. In addition to this quantitative assessment, semi-structured interviews with members of the MFDC are performed to explore factors explaining the lengthy times that elapsed prior to starting treatment. A report of this study has been published in BMC Health Services Research (29 October 2018, DOI: http://dx.doi.org/10.1186/s12913-018-3637-1): *Multidisciplinary first-day consultation accelerates diagnostic procedures and throughput times of patients in a head-and-neck cancer care pathway, a mixed method study.*

CHAPTER 3 – Evaluating the reorganisation of MDT meetings in GIO care pathways
Gastro-intestinal oncology is considered to be high volume - low-to-high complexity care. Interventions in three care pathways (Hepatobiliary, Oesophagus-Stomach and Colorectal) of a tertiary centre for gastro-intestinal oncology are evaluated for added value. Process indicators such as throughput times, the number of MDT meetings per patient and the number of hospital visits are analysed. A minimum of 25 cases are studied in each care pathway before and after the reorganisation. In addition to this quantitative assessment, stakeholders of the three care pathways are interviewed to reveal perceived benefits and drawbacks of the reorganisation and current MDT meeting functioning. A report of this study has been published in International Journal of Integrated Care (25 February 2021, DOI: https://doi.org/10.5334/ijic.5526): *Reorganising the multidisciplinary team meetings in a tertiary centre for gastro-intestinal oncology adds value to the internal and regional care pathways. A mixed-method evaluation.*

CHAPTER 4 – Review use of VC for collaborating teams in oncology
Since the late-1990s, videoconferencing has been used as a medium to support collaboration between different oncological teams. In a scoping review, we delve into the benefits and drawbacks of VC. Studies are included in which VC is used to discuss treatment plans and for coordinating care in oncology networks between teams based in different locations. A report of this study has been published in BMJ Open (9 December 2021, DOI: http://dx.doi.org/10.1136/bmjopen-2021-050139): *Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review.*

CHAPTER 5 – Evaluating use of VC by head-and-neck centre and partner
Videoconferencing has been used for more than 20 years to support the cooperation between the Head-and-Neck Cancer Center of the University Medical Center Groningen and their Preferred Partner based in the Medical Center Leeuwarden, both in the northern region of the Netherlands. The added value of this VC is evaluated during an observation period of six months. Semi-structured interviews on the perceived benefits and drawbacks, and suggestions for improvement, are conducted with representative stakeholders of the key disciplines of both locations. A report of this study has been published in BMJ Open (8 November 2019, DOI: https://bmjopen.bmj.com/content/9/11/e028609): *Does multidisciplinary videoconferencing between a head-and-neck cancer centre and its partner hospital add value to their patient care and decision-making? A mixed-method evaluation*.

CHAPTER 6 - General discussion
This thesis shows that it is feasible to evaluate the added value of organisational interventions with tailored real-time indicators (i.e., performance data) for 'low volume - high complexity' care pathways and for 'high volume - low-to-high complexity' care pathways. Reflective interviews provided in-depth understanding of data, and increased professionals' own awareness of the benefits and drawbacks of the reorganisations and the opportunities provided for quality improvements.

VC is used in oncology for six distinct types of collaboration. Further, the Dutch policy of discussing all partnering organisation's patients in their combined VC-MDTM addressing head-and-neck oncology does not contribute to better care and should be reconsidered. The use of new information technology can help care pathway management by using real-time dashboards to focus on throughput times, the number of MDTMs and hospital visits, and reduce travel time by making use of videoconferencing to its full extent.

Future research could be directed at investigating the value of real-time dashboard information and consider waiting times and the status of diagnostic procedures in reaching a personalised treatment plan in an MDTM. On the level of the tumour board, further research should focus on identifying those indicators that enable effective care pathway management. These are likely to include indicators that (1) present real-time throughput time information on diagnostic procedures and treatment steps, (2) enable informed decision-making based on diagnostic and therapeutic capacity and (3) increase efficiency by reducing diagnostic procedures or treatments that do not add value.

REFERENCES

1. Gray R, Gordon B. Meeting patients' needs. improving the effectiveness of multidisciplinary teams meetings in cancer services. https://www.cancerresearchuk.org/sites/default/files/full_report_meeting_patients_needs_improving_the_effectiveness_of_multidisciplinary_team_meetings_.pdf. Updated 2017. Accessed 07/11, 2019.
2. Mur I, van Raak A. Integration of services and the european union: Does EU policy make sense? *Int J Integr Care*. 2003;3:e14.
3. Minkman MMN. The current state of integrated care: An overview. *Journal of Integrated Care Pathways*. 2012;6:346-358.
4. Minkman MMN. Longing for integrated care: The importance of effective governance. *Int J Integr Care*. 2017;17(4):10.
5. Abildgaard JS, Saksvik PO, Nielsen K. How to measure the intervention process? an assessment of qualitative and quantitative approaches to data collection in the process evaluation of organizational interventions. *Front Psychol*. 2016;7:1380.
6. Porter ME. What is value in health care? *N Engl J Med*. 2010;363(26):2477-2481.
7. Reitblat C, Bain PA, Porter ME, et al. Value-based healthcare in urology: A collaborative review. *Eur Urol*. 2021.
8. Havens DS, Gittell JH, Vasey J. Impact of relational coordination on nurse job satisfaction, work engagement and burnout: Achieving the quadruple aim. *J Nurs Adm*. 2018;48(3):132-140.
9. Fatehi F, Armfield NR, Dimitrijevic M, Gray LC. Clinical applications of videoconferencing: A scoping review of the literature for the period 2002-2012. *J Telemed Telecare*. 2014;20(7):377-383.
10. Janssen A, Brunner M, Keep M, et al. Interdisciplinary eHealth practice in cancer care: A review of the literature. *Int J Environ Res Public Health*. 2017;14(11):10.3390/ijerph14111289.
11. van Harten WH. Comprehensive cancer centres based on a network: The OECI point of view. *Ecancermedicalscience*. 2014;8:ed43.
12. Ouwens M, Hulscher M, Hermens R, et al. Implementation of integrated care for patients with cancer: A systematic review of interventions and effects. *Int J Qual Health Care*. 2009;21(2):137-144.
13. van Hoeve JC, Vernooij RWM, Fiander M, Nieboer P, Siesling S, Rotter T. Effects of oncological care pathways in primary and secondary care on patient, professional and health systems outcomes: A systematic review and meta-analysis. *Syst Rev*. 2020;9(1):246-020-01498-0.
14. Middenveldt I, Regts G. De ontwikkeling van oncologie netwerken in nederland. [the development of oncology networks in the netherlands.] aanbevelingen rond organisatie en financiering. [recommendations regarding organization and financing]. *https://www.oncologienetwerken.nl/sites/default/files/2018-09/Oncologienetwerken%20en%20financiering%20-%20rapport.pdf*. 2018:1-54 [in Dutch].
15. Vanhaecht K, De Witte K, Sermeus W. *The impact of clinical pathways on the organisation of care processes.* ; 2007.
16. van Gemert AG, Ahaus CTB, de Kleine AW, Franke HS, Kaagman CBM, Kuijlen CHE. Factors timulating chain development in emergency care (dutch: Bevorderende factoren voor ketenontwikkeling in de spoedzorg). *KiZ*. 2012;1:10-11-15.
17. Patkar V, Acosta D, Davidson T, Jones A, Fox J, Keshtgar M. Cancer multidisciplinary team meetings: Evidence, challenges, and the role of clinical decision support technology. *Int J Breast Cancer*. 2011;2011:831605.
18. Kodner DL, Spreeuwenberg C. Integrated care: Meaning, logic, applications, and implications--a discussion paper. *Int J Integr Care*. 2002;2:e12.
19. Ouwens M, Hermens R, Hulscher M, et al. Development of indicators for patient-centred cancer care. *Support Care Cancer*. 2010;18(1):121-130.
20. Huang J, Barbera L, Brouwers M, Browman G, Mackillop WJ. Does delay in starting treatment affect the outcomes of radiotherapy? A systematic review. *J Clin Oncol*. 2003;21(3):555-563.

21. Wyatt RM, Beddoe AH, Dale RG. The effects of delays in radiotherapy treatment on tumour control. *Phys Med Biol*. 2003;48(2):139-155.

22. Waaijer A, Terhaard CH, Dehnad H, et al. Waiting times for radiotherapy: Consequences of volume increase for the TCP in oropharyngeal carcinoma. *Radiother Oncol*. 2003;66(3):271-276.

23. van Harten MC, Hoebers FJ, Kross KW, van Werkhoven ED, van den Brekel MW, van Dijk BA. Determinants of treatment waiting times for head and neck cancer in the netherlands and their relation to survival. *Oral Oncol*. 2015;51(3):272-278.

24. Dutch Cooperative Head & Neck Group. Beleidsbrief nederlandse werkgroep hoofd-hals Tumoren 2013 [policy head and neck cancer care 2013]. http://www.nwhht.nl/organisatie/missie. Updated 2013.

25. Halmos GB, Bras L, Siesling S, van der Laan BFAM, Langendijk JA, van Dijk BAC. Age-specific incidence and treatment patterns of head and neck cancer in the netherlands-A cohort study. *Clin Otolaryngol*. 2018;43(1):317-324.

26. SONCOS normeringsrapport 7, pagina's 22-26 [standardization report 7, pages 22-26]. https://www.soncos.org/wp-content/uploads/2019/02/Soncos_norm-rapp2019-v7.pdf. Accessed 07/11, 2019.

27. Basta YL, Bolle S, Fockens P, Tytgat KMAJ. The value of multidisciplinary team meetings for patients with gastrointestinal malignancies: A systematic review. *Ann Surg Oncol*. 2017;24(9):2669-2678.

28. Basta YL, Tytgat KMAJ, Greuter HH, Klinkenbijl JHG, Fockens P, Strikwerda J. Organizing and implementing a multidisciplinary fast track oncology clinic. *Int J Qual Health Care*. 2017;29(7):966-971.

29. World Health Organisation. Definition on quality of care. https://www.who.int/teams/maternal-newborn-child-adolescent-health-and-ageing/quality-of-care. Accessed 04/02, 2021.

30. Beattie M, Shepherd A, Howieson B. Do the institute of medicine's (IOM's) dimensions of quality capture the current meaning of quality in health care? – an integrative review. *Journal of Research in Nursing*. 2013;18(4):288-304.

31. Allen D, Gillen E, Rixson L. Systematic review of the effectiveness of integrated care pathways: What works, for whom, in which circumstances? *Int J Evid Based Healthc*. 2009;7(2):61-74.

32. Delilovic S, Hasson H, Ahstrom M, von Knorring M. Implementing standardized cancer patient pathways (CPPs) - a qualitative study exploring the perspectives of health care professionals. *BMC Health Serv Res*. 2019;19(1):577-019-4413-6.

33. Robinson TE, Janssen A, Harnett P, et al. Embedding continuous quality improvement processes in multidisciplinary teams in cancer care: Exploring the boundaries between quality and implementation science. *Aust Health Rev*. 2017;41(3):291-296.


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CHAPTER 2

Multidisciplinary first-day consultation accelerates diagnostic procedures and throughput times of patients in a head-and-neck cancer care pathway. A mixed method study

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BMC Health Services Research, 2018, 18:820

ABSTRACT

Background

Head and neck cancers are fast growing tumours that are complex to diagnose and treat. Multidisciplinary input into organization and logistics is critical to start treatment without delay. A multidisciplinary first-day consultation (MFDC) was introduced to reduce throughput times for patients suffering from head and neck cancer in the care pathway. In this mixed method study we evaluated the effects of introducing the MFDC on throughput times, number of patient hospital visits and compliance to the Dutch standard to start treatment within 30 calendar-days.

Methods

Data regarding 'days needed for referral', 'days needed for diagnostic procedures', 'days to start first treatment', and 'number of hospital visits' (process indicators) were retrieved from the medical records and analysed before and after implementation of the MFDC (before implementation: 2007 (n=20), and after 2008 (n=20), 2010 (n=24) and 2013 (n=24)). We used semi-structured interviews with medical specialists to explore a sample of outliers.

Results

Comparing 2007 and 2008 data (before and after MFDC implementation), days needed for diagnostic procedures and to start first treatment reduced with 8 days, the number of hospital visits reduced with 1.5 visit on average. The percentage of new patients treated within the Dutch standard of 30 calendar-days after intake increased from 52% to 83%.

The reduction in days needed for diagnostic procedures was sustainable. Days needed to start treatment increased in 2013. Semi-structured interviews revealed that this delay could be attributed to new treatment modalities, patients needed more time to carefully consider their treatment options or professionals needed extra preparation time for organisation of more complex treatment due to early communication on diagnostic procedures to be performed.

Conclusions

A MFDC is efficient and benefits patients. We showed that the MFDC implementation in the care pathway had a positive effect on efficiency in the care pathway. As a consequence, the extra efforts of four specialist disciplines, a nurse practitioner, and a coordinating nurse seeing the patient together during intake, were justified. Start treatment times increased as a result of new treatment modalities that needed more time for preparation.

Keywords

First-day consultation, oncology, management care pathways, critical pathways (MeSH), process indicators, mixed method study, head and neck cancer

BACKGROUND

The tumours in the head or neck region (nasal cavity, sinuses, lips, mouth, salivary glands, throat, or larynx) are fast growing tumours. This means that a long interval between the moment of referral and the start of the primary treatment (surgery, radiotherapy and/or chemotherapy) can lead to upstaging of the tumour with less chance on cure [1]. Because of the complexity of the diagnostic procedures and therapeutic modalities, head and neck cancer care is centralized in special multidisciplinary head and neck cancer centres [2]. Although the patient's prognosis is determined by tumour stage, throughput time, defined as 'day from first visit to day of start of treatment' should be kept as short as possible [3, 4]. According to the Dutch Cooperative Head & Neck Group [5] treatment should start within 30 calendar-days after intake for 80% of new patients.

Until September 2007, the intake of head and neck patients at the University Medical Center Groningen (UMCG) was performed by the Department of Oral and Maxillofacial Surgery (OMS) and the Department of Ear, Nose & Throat (ENT), the front offices for the multidisciplinary head and neck centre. On the day of intake, the specialists or the nurse practitioner of the gate departments planned the diagnostic procedures, and two weeks after that, the diagnosis and treatment plan were discussed in the multidisciplinary meeting. In the meantime the involved supportive paramedical specialists, such as the dental team (special care dentist, oral hygienist), speech therapists, dieticians, and medical social workers, were consulted prior to the multidisciplinary meeting. This meeting was the first opportunity for a multidisciplinary discussion in the care pathway about treatment, based on written history, physical examination, laboratory data, and imaging. The patient was not present during the meeting.

In the Netherlands, the number of head and neck cancer cases increased between 1989 and 2016 [6] from 1934 to 2995 cases which is an increase of 55%. The highest increase is seen for patients over 75 years with 88% followed by the age group 60 – 74 years with 80 % (Table 1).

Table 1. Incidence rates Head & Neck Cancer in the Netherlands

Period	Number of cases per age category						Total	Dutch population
	0-14	15-29	30-44	45-59	60-74	75+		
1989	3	17	139	546	852	377	1,934	14,805,240
1990	1	17	144	606	900	409	2,077	14,892,574
2007	2	20	132	804	1,109	587	2,654	16,357,992
2008	5	26	133	849	1,291	575	2,879	16,405,399
2010	2	17	120	814	1,326	596	2,875	16,574,989
2013	0	25	91	776	1,421	644	2,957	16,779,575
2016	0	13	72	669	1,531	710	2,995	16,979,120

This increase and limited resources were reasons to improve the efficiency of diagnostics and treatment for patients and because the performance of the centre on throughput time was poor in 2007 (only 52% of patients started their treatment within the 30-day standard), the centre decided to implement a multidisciplinary first-day consultation (MFDC) to reduce the time to start treatment.

Whilst care pathways are organized with multidisciplinary patient meetings (MPM), but as evidence based guidelines are accepted to organize care, the added value of each MPM still should be proven [7]. Brunner et al. support this view in 2015 by explaining that the last 30 years multidisciplinary team meetings have become an essential component of tertiary-level decision-making in the treatment of malignancy [8]. It seems self-evident that the variety of specialist team members with their combined knowledge and expertise improve decision making and therefore a MPM is often described in guidelines as a structure indicator.

The research question is: what are the effects of the MFDC implementation on efficiency of the care pathway, measured as process indicators throughput times (referral, diagnostic procedures and start treatment) and number of hospital visits (Figure 1).

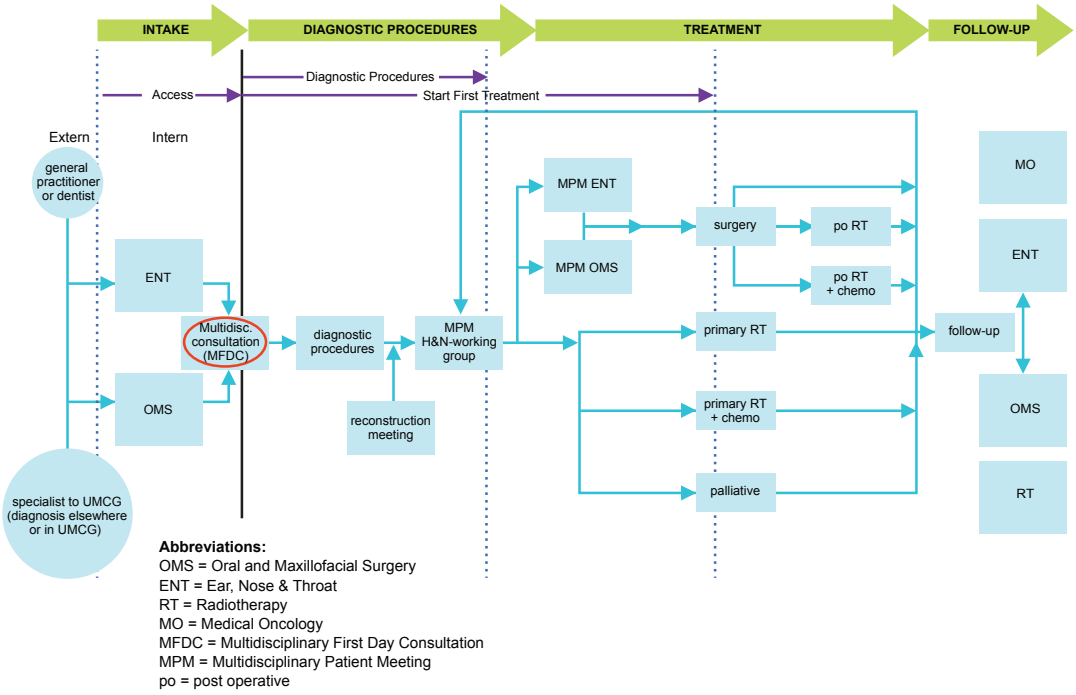

Figure 1. Care Pathway Head & Neck Oncology and throughput time definition
The care pathway consists of diverse personnel of four core departments (ENT, OMS, MO, and RT). The care pathway processes are called 'intake - diagnostic procedures – treatment – follow-up'. There are four treatment modules: surgery, chemo, chemo-radiation, and primary radiation. In the red circle the intervention: the MFDC.

METHODS

The MFDC was introduced in 2007 in the head and neck cancer care pathway using an '8-step method' [9, 10]. The method compares the current with the desired situation to formulate improvement measures and realise sustainable change.

While the intake in the morning by the department of OMS and the department of ENT remained the same, the MFDC in the afternoon of the same day served as an extra effort among the two front office departments OMS and ENT and the department Radiotherapy.

The four contributing specialities are ENT, Radiotherapy, OMS and the Special Dental Care. Special Dental Care is a sub-department within the Department OMS. The MFDC aims to provide a preliminary diagnostic plan, with multidisciplinary agreement, stating the diagnostic procedures to be performed, so intake for treatment modalities could start as soon as possible. The patient is informed on his or her diagnostic plan at the end of the day.

We applied a mixed method study [11, 12] combining statistical results and interviews. Firstly in search for process indicators for care pathway management we evaluated 'throughput times and number of hospital visits', secondly we performed semi-structured interviews of involved specialists of core departments to explore outliers in throughput times until data-saturation was reached.

Patients

The MFDC started in August 2007.

Four data sets were extracted, one data set of consecutive patients who were referred at least four months before the start of the MFDC (from April 2007 backwards), one data set of consecutive patients referred four months after the implementation of the MFDC (from January 2008 onwards) to compare immediate effects of MFDC. Two more datasets were extracted to analyse sustainability of the improvement over the five years after the implementation of the MFDC, one set of consecutive patients from January 2010 onwards and one set from January 2013 onwards.

Data of patients were included if they were 18 years of age and older, who had been curatively treated for a primary carcinoma of lips, oral cavity, oropharynx, nasopharynx, hypopharynx, or larynx (ICD(O) coding C00 through C14, C30 through C32) [13]. Data were excluded if patients were treated for an unknown primary tumour (C80), a second primary tumour in the head or neck region or if a recurrent or residual tumour was diagnosed.

Process indicators and study design

The Dutch Cooperative Head & Neck Group developed the standard of "80% of the patients with a head and neck tumour start their primary treatment within 30 calendar-days from day of intake", together with maximum throughput time for access to consultation and start treatment [2, 4]. For the evaluation of the effects of the implementation of the MFDC, the process indicators throughput times and number of hospital visits were used [1, 14-16]. We distinguished three different throughput times: the time to gain access to the first oncology consultation (access first consultation); the time to finish the diagnostic procedures, including the treatment plan (diagnostic procedures); and the time to start the first treatment (start first treatment). The throughput times "access first consultation", "diagnostic procedures" and "start first treatment" were measured from the day the patients had their first oncology consultation in either one of the front offices of the centre. In the pre and post intervention situation in the centre, the consultation or intake was done once a week, independent of the number of patients referred (Figure 1).

The first author registered the relevant data in a clinical registration form from electronic and written medical records. The last author checked the registrations of the medical records.

Statistical analysis

Our primary outcome measure was the change in the throughput time to start the first treatment as a result of the intervention of implementing the MFDC. Initially the sample size was set at about 20 patient records in each period (2007 and 2008) as a starting point to evaluate management of the care pathway over the years. Based on an analysis of these samples we would determine the definitive sample size. However in the analysis significant differences were found in throughput times hence data acquisition regarding 2007 and 2008 was not continued. Additionally to analyse sustainability of data, records of 24 patients from 2010 and 24 from 2013 were used. Statistical analysis was performed using SPSS 23.0 for Windows software.

Analysis of variance was applied to outcome variables throughput time (referral, diagnostic procedures, start first treatment) and number of hospital visits (total, from intake to diagnostic procedures complete, from diagnostic procedures complete to start treatment), 'age at start treatment'. Because samples were small and assumptions were not met, biased corrected bootstrapping (2000 samples) was applied [17]. The exact chi-square test was used to analyse differences in descriptive variables between the groups, regarding gender, tumour localization and tumour size, and compliance to the Dutch 30-day standard.

In all analyses, statistical significance was set at the 5% level.

Qualitative Analysis

Semi-structured interviews were used to explore reasons for non-compliance to the Dutch 30-day standard for starting the first treatment. Therefore the cutting point for 'outliers' chosen was defined as 'longer than 37 days to start treatment' (years 2008, 2010 and 2013); reflecting non-compliance to the Dutch 30-day standard and a (patient) delay of one week; for example if the first opportunity for outpatient clinic was skipped, either by the patient or for another reason.

We used the outlier cases to start the semi-structured interviews with one representative of each of the four departments that work together in the care pathway to give primary treatment ENT, OMS, Radiotherapy and Medical Oncology). Prior to the interview the specialists were given the medical records of the outlier(s) to enhance recalling the case. Each semi-structured interview with a specialist started after getting verbal informed consent of the interviewees by providing them with information about the outliers. The interviewer (first author) then guided the interview using a short topic list including 'cause of the delay' and 'perceived possibilities for change or improvement in logistics or of the care pathway'. The topics were introduced in a flexible way, and the interviews took the form of natural conversations.

The interviews were audio recorded and field notes were taken. Verbal transcripts of the interviews were made with the transcription program F4. The interviews lasted from 25-40 minutes. Quotations, related to throughput time or number of hospital visits, or improvement of the care pathway, were numbered in chronology of the interview. The first stage of the inductive analysis of interviews involved the last author and third author, in an open, initial coding procedure that resulted in a list of codes corresponding closely to the text fragments extracted from the four interviews. The codes were placed in a coding tree with major and minor themes in relation to management of the care pathway (Table 4) [18]. Any disagreements about the codes were discussed between the coders and the first author [19].

RESULTS

Quantitative analysis

In total 89 medical records were included in the study: 21 in the "pre MFDC group, year 2007" and 68 in the "post MFDC group, year 2008-2010-2013" (Table 2). Two-thirds of the groups are men, with a mean age of 66 years. The tumours were located in the oral cavity (tongue, gums or floor of mouth), the salivary glands, oropharynx, nasopharynx, hypopharynx, or larynx. The primary tumour classification ranged from T1 to T4 [20]. We found no significant differences between the pre MFDC group and the post MFDC group in patient and tumour characteristics.

Table 2. Patient and tumour characteristics

	Pre-MFDC		Post-MFDC						Sign.
	2007 (n = 21)		2008 (n = 20)		2010 (n = 24)		2013 (n = 24)		ANOVA
Age Mean (SD)	66	(11)	66	(13)	63	(13)	64	(9)	.640
									Chi^2
Gender	*n*	%	*n*	%	*n*	%	*n*	%	.680
Male	14	67	13	65	18	75	14	58	
Tumour localization									.303
Lip	0	0	0	0	0	0	2	100	
Oral cavity	8	38	11	55	17	71	9	38	
Tongue (C01, C02)	3		2		6		1		
Gums (C03)	1		3		2		0		
Floor of mouth (C04)	3		4		4		6		
Oral cavity, unspecified (C00, C05, C06, C14)	1		2		5		2		
Major salivary glands (C07, C08)	1	5	0	0	0	0	0	0	
Oropharynx (C09,C10)	2	10	2	10	1	4	4	17	
Nasopharynx (C11)	1	5	2	10	1	4	1	4	
Nasal Cavity (C30)	0		0	0	1	4	1	4	
Hypopharynx (C12, C13)	3	14	1	5	0	0	5	21	
Larynx (C32)	6	29	4	20	4	17	2	8	
Tumour size									.522
T1	9	43	8	40	10	42	4	17	
T2	5	24	4	20	5	21	6	26	
T3	3	14	2	10	3	13	2	8	
T4	4	19	6	30	5	21	12	50	
Tx	0	0	0	0	1	0	0	0	

In bold main patient characteristics of the dataset (age, gender, tumour localization and size).

Throughput times for the diagnostic procedures and start treatment decreased significantly, with an average of eight days, after the implementation of the MFDC (comparison between 2007 and 2008) through the extra effort of the four specialist disciplines while no increase in personnel capacity was possible in the care pathway. Time to gain access to the first oncology consultation did not change significantly (Figure 2 and Table 3).

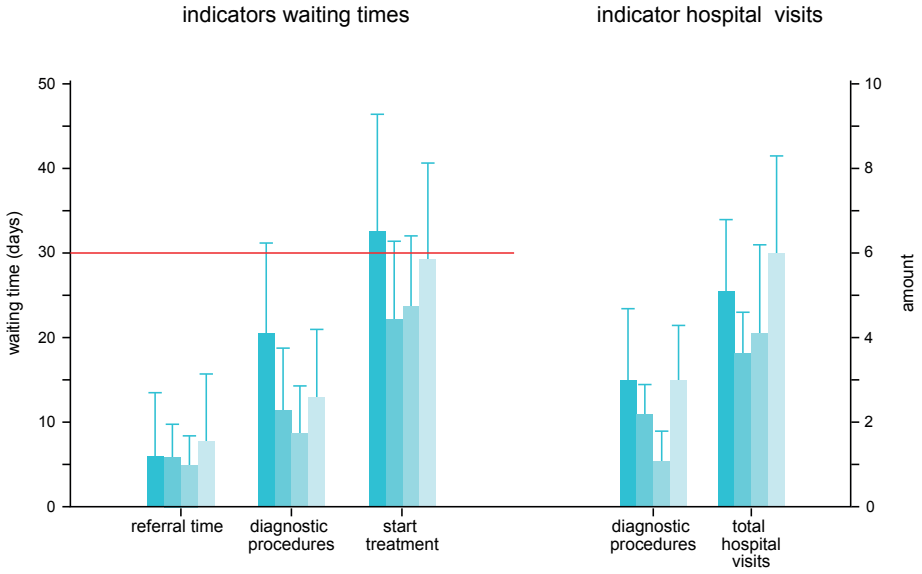

Figure 2. Throughput times and hospital visits pre- and post MFDC
Red line = the Dutch 30-day standard; darkest blue bar = pre MFDC situation, year 2007; dark blue bar = post MFDC situation, year 2008; lighter blue bar = post MFDC situation, year 2010; lightest blue bar = post MFDC situation, year 2013. Hospital visits is shown as hospitals visits from intake to completion of 'diagnostic procedures' and as 'total hospital visits'.

Table 3. Throughput times and hospital visits, pre- and post-MFDC

	Pre		Post		Significance	
	2007 (n = 21)	2008 (n= 20)	2010 (n= 24)	2013 (n= 24)	p ANOVA	pair wise comparison
Throughput time (days)						
	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)		
Access first consultation	6.0 (7.5*)	5.9 (3.9)	4.9 (3.5)	7.7 (8.0)	.592	-
Diagnostic procedures	20.6 (10.6)	11.4 (7.4)	8.7 (5.6)	13.0 (8.0)	<.000	2007-2008: .013; 2007-2010: .000; 2007-2013: .049
Start first treatment	32.6 (13.8)	22.2 (9.2*)	23.7 (8.4)	29.3 (11.3)	.009	2007-2008: .038
Number hospital visits						
Diagnostic procedures	3.0 (1.7)	2.2 (0.7*)	1.7 (0.7)	3.0 (1.3)	<.000	2007-2010: .014; 2008-2013: .049; 2010-2013: .001
Diagnosis to start Treatment	2.1 (1.5)	1.4 (0.9*)	2.4 (1.9)	3.1 (2.2)	.032	2008-2013: .012
Total	5.1 (1.7)	3.6 (1.0*)	4.1 (2.1)	6.0 (2.3)	<.000	2007-2008: .006; 2008-2013: .000; 2010-2013: .021
Start treatment within 30 days	52%	83%	71%	54%	.132	2007-2008: .040

Access first consultation; throughput time from 'date of the letter of referral' to 'intake in oncology front office', diagnostic procedures; throughput time from 'first consultation' to 'decision in multidisciplinary meeting of the head & neck cancer centre', start first treatment; 'throughput time form first consultation' to 'start first primary treatment'. Hospital visits are measured during the diagnostic procedures, and from diagnosis to start treatment, and in total. * = number of patients is 19, because one patient was treated elsewhere after receiving the diagnostic plan.

The number of hospital visits during the diagnostic phase reduced significantly with one visit (p < .032) after the implementation of the MFDC (Table 3). Furthermore we analysed hospital visits during the diagnostic phase and from diagnosis to start treatment; for 2013 we saw an increase for hospital visits during the diagnostic procedures and an increase in the total number of hospital visits (Table 3).

Before implementation of the multidisciplinary first-day consultation, treatment started for 52% of new patients within 30 calendar-days after the first consultation. After implementation of the multidisciplinary first-day consultation, this percentage increased significantly to 83% (p < .040). This percentage decreased again in 2010 and 2013. In 2013 waiting time to start treatment increased for all treating modalities, therefore outliers were analysed. In total, we defined 8 cases (12 %) as 'outlier'.

Qualitative analysis – specialist interviews

The specialists spontaneously gave their view on the agreements in the care pathway and described changes in guidelines, such as new treating modalities that may have increased throughput time.

Table 4. Codes in coding tree in relation to the care pathway management

Coding tree			Code	Code description	Frequency
Care pathway	Intake	Referral	1	Suspicion 'malignity' at intake not sufficient	9
		Patient related	2	Waiting on family home caregiver	3
			3	Co-morbid or complex patient	9
	Diagnostic procedures and logistics	Throughput time	6	More attention to cooperation between disciplines to combine patient appointments	6
			13	Control / logistics control lies with gate specialist or 'core specialist'	6
			8	Treatment of dental foci under anaesthesia	2
		Waiting time	17	Waiting time Radiology	3
			18	Waiting time Nuclear Medicine	2
	Treatment and planning	Preparation	4	For pre-surgery assessment the treatment must be known, that is possible when staging of tumour is ready	3
		Choice	14	Choice for treatment on basis of general health assessment	1
			12	Scientific Research increases number of hospital visits	2
		Planning	5	Planning reconstruction costs extra time	5
			7	Planning capacity operation centre versus 'examination under anaesthesia'- scopy	5
			11	Reconciliation of patient on chemo-radiotherapy	8
		Standardizing	16	Unclear starting moment waiting time chemo-radiotherapy, separate standard 'Nederlandse Vereniging voor Radiotherapie en Oncologie' (Dutch Association Radiotherapy and Oncology)	3
	Case management diagnostic procedures and treatment	Transfer	10	Transfer of 'core specialism'	1
		Information	9	No management information on throughput times in electronic patient dossier	3
			15	No standard patient tracking system	4
		Registration	19	Registration information not clear	1
Total quotations 37					76

This coding tree has major and minor themes that were derived from the primary research question (intervention in management of the care pathway) and minor themes derived during coding.

In some cases the different aspects of a quotation was scored separately (Table 4). The interviews gave in total 76 scores, 37 quotations that were coded with 19 codes. Quotations appear in the text in italic.

Analysing the interviews we learned that:

- introduction of new cure modalities chemotherapy and chemo-radiation took more preparation time and more hospital visits, coded as: 'Planning reconstruction costs extra time'.

'Duration and severity of surgery is not only the dissection of the tumour, but also the reconstruction that is discussed in the reconstruction meeting, like an obturator or a flap.'
'The treatment date is known [date], but clearly there were not enough slots in the 'major surgery planning' to treat this patient in time.'

- specialists were not aware that throughput times were lengthening, because information on throughput times is not easily available in the electronic patient dossier, coded as: 'No management information on throughput times in electronic patient dossier'.

'The gate specialist department agreed that they were supposed to keep track of throughput times, although this agreement was not traceable in writing;
'Register more accurately the throughput time when time to start treatment is longer than the 30-day standard.'
'BROC (database for oncology registration) is only meant for basic tumour registration, not for management information on quality indicators.' one of the specialist departments tried to reduce throughput times by creating time slots at the imaging departments, coded as: 'Waiting time Radiology or Nuclear Medicine (imaging)'.
'The slots are for radiotherapy patients at the Nuclear Medicine and Radiology department, for which hopefully in the future more slots become available in order to get PET-CT planned earlier. This is a logistic matter, which means that the amount of patients that need imaging to fit in the available slots is variable, sometimes only 2 and sometimes up to 10 patients. Back then we had less slots available.' Throughput times reduced again, but because slots at the imaging department were on consecutive days, rather than the same day, the number of hospital visits increased.

- co-morbid patients or patient delay took more time than expected (in 2013 62% of all patients started their treatment within the Dutch 30-day standard), coded as 'Co-morbid of complex patient'.

'Madam is admitted to a nursing home and has a long history – co-morbidity.'

- the interviewees saw opportunities for improvement of the care pathway, coded as: 'More attention to cooperation between disciplines to combine patient appointments'.

'Nowadays we do not wait for PEG-placement to start treatment. During admission for the first chemotherapy, a PEG-tube can be placed.'

Combining quantitative and qualitative results

Effects of the implementation of the MFDC diminished in 2013 mainly because of the use of newer treatment modalities such as primary radiotherapy and chemo-therapy (from 32.6 days in 2007 to 22.2 days in 2008, and 23.7 days in 2010 back to 29.3 days 2013 on average, table 3). In some cases patients needed extra time due to personal circumstances, in other cases preparation of a more complex treatment took more time and more hospital visits than in 2008 and 2010.

Each specialist gave his or her view on improving management of the care pathway when asked, they mentioned: *'planning that cannot be influenced, when slots are not available'*, *'access of management information'* and *'definitions of medical registrations'*.

DISCUSSION

We found that throughput times for diagnostic procedures and start treatment decreased considerably, with about eight days during the first years after MFDC implementation in 2007. The reduction in throughput times was a result of better logistics due to a multidisciplinary diagnostic plan, made during MFDC. There was no effect on referral times, because the MFDC is organized once a week. In 2008 the care pathway was in compliance with the Dutch national standard of 80% of new patients starting their treatment within 30 calendar-days after oncology intake. The patients visited the hospital approximately one time less, during the diagnostic phase. As a consequence of the introduction of the MFDC, the extra efforts of four specialist departments, a special care dentist, a nurse practitioner, and a coordinating nurse seeing the patient together during intake, were justified.

However when analysing sustainability through 2010 and 2013 we found that throughput times for diagnostic procedures were sustainable, but not for start treatment. Besides that the number of hospital visits for diagnostic procedures and hospital visits in total increased up in 2013 (Table 3). From the outlier-evaluation we learned that there were four major themes in the coding tree: intake, diagnostic procedures and logistics, treatment and planning, and case management for diagnostic procedures and treatment. Complex treatment and co-morbid patients at intake took more time. Logistics and planning during the diagnostic phase were more difficult with complex treatment, more diagnostic or imaging needed to be planned and treatment with cooperation of different specialist departments were difficult to plan on the same day. Dental foci treatment can only be performed when the total treatment plan is finished, but slows down the process of planning for start treatment. New features as 3D-planning for surgery give better results [21], but increase time to start treatment. For patients that need the most complex procedures planned, case management for that individual patient, tracking and tracing for all disciplines, would be helpful to keep the throughput time at a minimum. In most of these cases management information was not available and the involved specialists were not aware that the throughput times increased. This shows the added value of the MFDC in reducing the time needed for the diagnostic procedures for complex care.

In support of the above Ouwens et al. demonstrated in 2007 [22] and 2009 [23] that integrated care for head and neck cancer patients results in an improvement of perceived quality of care by improving patient centeredness in organizational issues like reducing waiting times and medical-technical quality of the diagnostic equipment. According to the guideline, patients need a treatment plan delivered by a multidisciplinary team of a cancer centre and an evaluation of the execution of that treatment plan registered in the patient dossier. To follow those guidelines for head and neck cancer it is of utmost importance for management of cancer centres to have throughput time and amount of hospital visit information available at all times [20].

Coordination of the logistics diagnostic procedures is important to shorten the time until the start of treatment. Time slots for diagnostic procedures can help improve efficiency of the care pathway and start treatment earlier [10, 24, 25].

We think that in our study we have shown that the MFDC for head and neck patients is an added value: implementation improved efficiency (reduced throughput times and hospital visits) and compliance to the Dutch 30-day standard. Therefore, when management of logistics of the care pathway can be trusted for 80% of patients, specialists can use the multidisciplinary patient meetings to have collegial discussions on complex cases and keep focus on patient centeredness.

We decided to include patients in a certain time period around the intervention to reduce bias. The moment it was decided that the MFDC would start on a certain date, changes may occur in procedures and patient selection. After the implementation of the MFDC it is likely that there is a learning curve. Therefore we chose an eight-months period, four months before and four months after the implementation of the MFDC, in which no data was gathered.

To evaluate the MFDC implementation we chose throughput times as process indicators because they are often regarded as logistic management measures and used as a "benchmark" for several purposes. Governmental bodies around the world try to compare their quality of oncological care with indicators such as necessary infrastructure and volume, and throughput time with other countries [20, 26-30]. However, direct relation between throughput times and outcome for head and neck cancer patients in our hospital is not proven. We chose to follow the Dutch standards that advice to use registrations on new patients with certain malignity only, that we called 'with curative intent'. Our indicators for process efficiency (throughput times) were chosen in a framework for measuring quality by assessing elements of structures or processes with proven connections with key outcomes of interest [31-34]. A good quality or process indicator signals changes in quality and is registered in a reliable manner [14, 30]. Implementation of structural planning of diagnostic procedures for head and neck cancer patients was found to have a positive effect on throughput times: time slots as a logistic structure reduced the diagnostic phase for head and neck cancer patients [25]. The structural planning of slots for diagnostic procedures are appreciated by patient associations and are reflected in their description of process indicators [35]. Several studies have shown that clinical characteristics of patients and prognostic factors explain a relatively large part of the variation in outcomes, such as survival and quality of life, while quality-of-care indicators explain a much smaller part [36-38]. Monitoring the process of care in a clinical pathway in direct relation to assessment of quality of care is of major importance to benchmark complex care such as head and neck cancer, but is difficult to assess [2, 39-41].

We wanted to show with a small sample and a simple method to evaluate, the effect of an intervention in the care pathway on efficiency. The added value of the extra multidisciplinary patient meeting is proven. We think that the combination of process indicators throughput time and number of hospital visits can be used in a dashboard to help care pathway management to monitor and sustain the agreements made.

The results of this study show that a "simple" intervention, such as the implementation of the MFDC, can improve throughput times directly, which in turn can help improve the perceived quality of care. Especially with complex, life-threatening diseases such as head and neck cancer, shortening of the pathways diagnostic procedure is important so that treatment can start as early as possible to give patients a better chance of survival [3, 23, 42, 43].

In case of low-volume, highly complex care such as head and neck cancer, patients are treated in a centre with large adherence area, about 11,400 km^2 with a total of 2.3 million inhabitants for our centre. Because of travel distances, reducing hospital visits with one visit is

a valuable contributor to patient comfort and cost reduction. A decrease of time of uncertainty about diagnosis, treatment and prognosis also reduces patient anxiety and increase patient satisfaction [35].

The reduction in throughput time was achieved mainly in the diagnostic phase of the care pathway. Although this study did not aim to improve a specific phase before start treatment, the time between the end of the diagnostic phase with the treatment plan and the start of the treatment has become relatively long. We recommend examining production agreements or slots for planning with medical support departments to further reduce the time to start of the treatment, thus reducing the risk of upstaging even more.

The reduction in throughput times was a result of better logistics due to a multidisciplinary diagnostic plan, made during MFDC. Management of the care pathway can use these indicators to stay focused on sustainable, seamless processes of care in a multidisciplinary setting [40, 44]. We would like the information needed for care pathway management to become available through our electronic patient dossier and in a dashboard, so that lengthening of throughput times could detected before they become unacceptably high. In case of change in the described process indicator combination from agreed levels, the management should look for variation or deviation on the agreements on the care pathway (with best intentions made) that could influence future patient outcomes.

CONCLUSIONS

We showed that the MFDC implementation in the care pathway had a positive effect on efficiency in the care pathway. As a consequence, the extra efforts of four specialist departments, a special care dentist, a nurse practitioner, and a coordinating nurse seeing the patient together during intake, were justified. Start treatment times increased as a result of new treatment modalities that needed more time for preparation.

LIST OF ABBREVIATIONS

BROC	Basic Registration Oncology outCome (database)
ENT	Ear, Nose & Throat
F4	Transcription program
ICD(O)	International Classification of Diseases (of Oncology)
MeSH	Medical Subject Headings
MFDC	Multidisciplinary first-day consultation
MO	Medical Oncology
MPM	Multidisciplinary Patient Meeting
NWHHT	Nederlandse Werkgroep Hoofd-Hals Tumoren or Dutch Cooperative Head & Neck Group
OMS	Oral and Maxillofacial Surgery
PEG	Percutaneous Endoscopic Gastronomy
PET-CT	Positron Emission Tomography – Computer Tomography
RT	Radiotherapy
SPSS	Statistical Package for Social Sciences
UMCG	University Medical Center Groningen

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Availability of data: Datasets will be available from the corresponding author on reasonable request.

Authors' Contributions

LvH was involved in the study design and concept; carried out the study; performed the data analysis, statistical analysis, interpretation of the data, and drafted the manuscript. PD and JR, the supervisors, were involved in the study design and concept, analysis and interpretation of the data, and revision of the manuscript. BvdL, KA and JR were involved in the coding of the interview quotations, together with LvH. BvdL, HR and HB were involved in the acquisition of the data and the revision of the manuscript. All authors read and approved the final manuscript.

Authors' information

The University Medical Center Groningen is developing patient centred care pathways for diverse patient groups including laws and regulations for quality and patient safety. LvH, JR are working in cooperation with KA of the Centre of Expertise Healthwise to research care pathway implementation in the Comprehensive Cancer Center Groningen and to develop quality and safety indicators, i.e. process indicators that predict performance of care pathways and sustainable patient outcome.

Ethics approval and consent to participate

This retrospective chart review was approved by and performed according to standards of the Ethics Committee of the UMCG (2012, ref. M12.113441), the Netherlands. Informed consent was not required according to the Ethics Committee.

Consent for publication: All authors give consent for publication.
Competing interests: No authors have competing interests.

REFERENCES

1. Ouwens M, Hermens R, Hulscher M, Vonk-Okhuijsen S, Tjan-Heijnen V, Termeer R, Marres H, Wollersheim H, Grol R. Development of indicators for patient-centred cancer care. Support Care Cancer. 2010;18(1):121-130.
2. Dutch Cooperative Head & Neck Group. Policy head and neck cancer care 2013 (in Dutch). 2013. http://www.nwhht.nl/organisatie/missie.
3. Wyatt RM, Beddoe AH, Dale RG. The effects of delays in radiotherapy treatment on tumour control. Phys Med Biol. 2003;48(2):139-155.
4. Lingsma HF, Dippel DW, Hoeks SE, Steyerberg EW, Franke CL, van Oostenbrugge RJ, de Jong G, Simoons ML, Scholte Op Reimer WJ, Netherlands Stroke Survey investigators. Variation between hospitals in patient outcome after stroke is only partly explained by differences in quality of care: results from the Netherlands Stroke Survey. J Neurol Neurosurg Psychiatry. 2008;79(8):888-894.
5. Dutch Cooperative Head & Neck Group. Evaluation report on bottle necks in head and neck cancer care (in Dutch). . 2004.
6. Dutch Cancer Registration. Cijfers over kanker / Figures on cancer. In: Nederlandse Kankerregistratie. 2016. http://www.cijfersoverkanker.nl. Accessed May, 6 2017.
7. Kruijff S. Het MDO toe aan een flinke renovatie. / The Multidisciplinary Meeting ready for a substantial renovation. In: https://www.medischcontact.nl/. 2017. https://www.medischcontact.nl/opinie/blogs-columns/blog/het-mdo-toe-aan-een-flinke-renovatie.htm. Accessed January, 30 2017.
8. Brunner M, Gore SM, Read RL, Alexander A, Mehta A, Elliot M, Milross C, Boyer M, Clark JR. Head and neck multidisciplinary team meetings: Effect on patient management. Head Neck. 2015;37(7):1046-1050.
9. Lodewijckx C, Decramer M, Sermeus W, Panella M, Deneckere S, Vanhaecht K. Eight-step method to build the clinical content of an evidence-based care pathway: the case for COPD exacerbation. Trials. 2012;13:229-6215-13-229.
10. van Gemert AG, Ahaus CTB, de Kleine AW, Franke HS, Kaagman CBM, Kuijlen CHE. Factors stimulating chain development in emergency care (Dutch: Bevorderende factoren voor ketenontwikkeling in de spoedzorg). KiZ. 2012;1:10-11-15.
11. Plochg T, Juttman RE, Klazinga NS, Mackenbach JP. Handbook health research (Handboek gezondheidszorgonderzoek): 1st ed. Houten: Bohn Stafleu van Loghum; 2007.
12. Charmaz K. Contructing Grounded Theory. A Practical Guide through Qualitative Analysis. London: Sage Publications; 2006.
13. Vlaams Kankerregistratienetwerk. International Classification of Diseases for Oncology, third edition, updates (in Dutch): whofic@who.int; ICDO3@iarc.fr ed. Vlaams Kankerregistratienetwerk; 2011.
14. Wollersheim H, Hermens R, Hulscher M, Braspenning J, Ouwens M, Schouten J, Marres H, Dijkstra R, Grol R. Clinical indicators: development and applications. Neth J Med. 2007;65(1):15-22.
15. Jaspers GW, Witjes MJ, Groen HJ, Groen H, Rodiger LA, Roodenburg JL. Strategies for patients with newly diagnosed oral squamous cell carcinoma and a positive chest CT. A cohort study on the effects on treatment planning and incidence. Eur J Surg Oncol. 2011;37(3):272-277.
16. Sobin LH, Gospodarowicz MK, Wittekind CE. TNM Classification of Malignant Tumors, 7th ed. . 2009(ISBN 978-1-4443-3241-4):310 pages.
17. Wright DB, London K, Field AP. Using Bootstrap Estimation and the plu-in principle for Clinical Psychology Data. JEP. 2011;2(2):252--270.
18. Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. Int J Qual Health Care. 2007;19(6):349-357.
19. Gioia DA, Gorley KG, Hamilton AL. Seeking Quality Rigor in Inductive Research: Notes on the Gioia Methodology. Organizational Research Methods. 2012;16(I):15-16-31.
20. Dutch National Cancer Control Programme. Progress Report on Cancer Control in the Netherlands, 2005-

2010 (Dutch NCCP, Nationaal programma kankerbestrijding). . 2010.

21. Schepers RH, Kraeima J, Vissink A, Lahoda LU, Roodenburg JL, Reintsema H, Raghoebar GM, Witjes MJ. Accuracy of secondary maxillofacial reconstruction with prefabricated fibula grafts using 3D planning and guided reconstruction. J Craniomaxillofac Surg. 2016;44(4):392-399.
22. Ouwens MM, Marres HA, Hermens RR, Hulscher MM, van den Hoogen FJ, Grol RP, Wollersheim HC. Quality of integrated care for patients with head and neck cancer: Development and measurement of clinical indicators. Head Neck. 2007;29(4):378-386.
23. Ouwens MM, Hermens RR, Hulscher MM, Merkx MA, van den Hoogen FJ, Grol RP, Wollersheim HC, Marres HA. Impact of an integrated care program for patients with head and neck cancer on the quality of care. Head Neck. 2009;31(7):902-910.
24. de Bree R, Veenvliet P, van Driel M, Verdonck-de Leeuw I, Goverde K, Koense YJ, Bijvank E, Leemans CR. Development of a clinical pathway for head and neck cancer patients (in Dutch). Nederlands tijdschrift voor oncologie. 2007;4(Ariez Publishing):308-309-315.
25. de Bree R. Booking recommended (in Dutch). Medisch Contact. 2007;8:344-347.
26. Olesen F, Hansen RP, Vedsted P. Delay in diagnosis: the experience in Denmark. Br J Cancer. 2009;101 Suppl 2:S5-8.
27. Berrino F, De Angelis R, Sant M, Rosso S, Bielska-Lasota M, Coebergh JW, Santaquilani M, EUROCARE Working group. Survival for eight major cancers and all cancers combined for European adults diagnosed in 1995-99: results of the EUROCARE-4 study. Lancet Oncol. 2007;8(9):773-783.
28. Malin JL, Schneider EC, Epstein AM, Adams J, Emanuel EJ, Kahn KL. Results of the National Initiative for Cancer Care Quality: how can we improve the quality of cancer care in the United States? J Clin Oncol. 2006;24(4):626-634.
29. Chen F, Puig M, Yermilov I, Malin J, Schneider EC, Epstein AM, Kahn KL, Ganz PA, Gibbons MM. Using breast cancer quality indicators in a vulnerable population. Cancer. 2011;117(15):3311-3321.
30. Mainz J. Developing evidence-based clinical indicators: a state of the art methods primer. Int J Qual Health Care. 2003;15 Suppl 1:i5-11.
31. Donabedian A. Quality assurance. Structure, process and outcome. Nurs Stand. 1992;7(11 Suppl QA):4-5.
32. Donabedian A. The role of outcomes in quality assessment and assurance. QRB Qual Rev Bull. 1992;18(11):356-360.
33. Donabedian A. 20 Years of Research on the Quality of Medical Care, 1964-1984. Salud Publica Mex. 1988;30(2):202-215.
34. Mainz J. Defining and classifying clinical indicators for quality improvement. Int J Qual Health Care. 2003;15(6):523-530.
35. Offerman, MPJ, Pruyn,JFA. Good care for people with head and neck cancer: quality criteria with a patients view (in Dutch: Goede zorg voor mensen met kanker in het hoofd-halsgebied: kwaliteitscriteria gezien van uit de patient.). . 2009;ISBN 9789090246352.
36. Mant J. Process versus outcome indicators in the assessment of quality of health care. Int J Qual Health Care. 2001;13(6):475-480.
37. Landon BE, Zaslavsky AM, Beaulieu ND, Shaul JA, Cleary PD. Health plan characteristics and consumers' assessments of quality. Health Aff (Millwood). 2001;20(2):274-286.
38. Donabedian A. Contributions of epidemiology to quality assessment and monitoring. Infect Control Hosp Epidemiol. 1990;11(3):117-121.
39. De Bleser L, Depreitere R, De Waele K, Vanhaecht K, Vlayen J, Sermeus W. Defining pathways. J Nurs Manag. 2006;14(7):553-563.
40. Vanhaecht K, De Witte K, Panella M, Sermeus W. Do pathways lead to better organized care processes? J Eval Clin Pract. 2009;15(5):782-788.

41. Panella M, Marchisio S, Di Stanislao F. Reducing clinical variations with clinical pathways: do pathways work? Int J Qual Health Care. 2003;15(6):509-521.

42. Waaijer A, Terhaard CH, Dehnad H, Hordijk GJ, van Leeuwen MS, Raaymakers CP, Lagendijk JJ. Waiting times for radiotherapy: consequences of volume increase for the TCP in oropharyngeal carcinoma. Radiother Oncol. 2003;66(3):271-276.

43. Huang J, Barbera L, Brouwers M, Browman G, Mackillop WJ. Does delay in starting treatment affect the outcomes of radiotherapy? A systematic review. J Clin Oncol. 2003;21(3):555-563.

44. Bradley PJ. Multidisciplinary clinical approach to the management of head and neck cancer. Eur Arch Otorhinolaryngol. 2012;269(12):2451-2454.


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CHAPTER 3

Reorganizing the multidisciplinary team meetings in a tertiary centre for gastro-intestinal oncology adds value to the internal and regional care pathways. A mixed method evaluation.

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ABSTRACT

Introduction

The reorganisation of the structure of a Gastro-Intestinal Oncology Multidisciplinary Team Meeting (GIO-MDTM) in a tertiary centre with three care pathways is evaluated on added value.

Methods

In a mixed method investigation, process indicators such as throughput times were analysed and stakeholders were interviewed regarding benefits and drawbacks of the reorganisation and current MDTM functioning.

Results

For the hepatobiliary care pathway, the time to treatment plan increased, but the time to start treatment reduced significantly. The percentage of patients treated within the Dutch standard of 63 days increased for the three care pathways. From the interviews, three themes emerged: added value of MDTMs, focus on planning integrated care and awareness of possible improvements.

Discussion

The importance of evaluating interventions in oncology care pathways is shown, including detecting unexpected drawbacks. The evaluation provides insight into complex dynamics of the care pathways and contributes with recommendations on functioning of an MDTM.

Conclusions

Throughput times are only partly determined by oncology care pathway management, but have influence on the functioning of MDTMs. Process indicator information can help to reflect on integration of care in the region, resulting in an increase of patients treated within the Dutch standard.

Keywords

Oncology, integrated care, critical pathways (MeSH), care pathways,
multidisciplinary team meetings (MDTM), added value, mixed method evaluation

INTRODUCTION

Care pathways are accepted as a means to manage oncology care[1]. The management team of an oncological care pathway, tumour board, generally consists of a group of specialists that focus on 1) communication between different specialists on managing evidence-based treatment for oncology patients, 2) decision making in multidisciplinary team meetings (MDTMs) for oncology patients who need complex treatment plans and 3) multidisciplinary coordination of integrated care with timely start of treatment within the region[2] [3] [4]. MDTMs use digital medical records and clinical decision support systems in different ways[5] [6]. MDTMs make a valuable contribution to the choice and planning of treatment[7] [8] [9] and lead to a better survival rate[10] [11] [12] [13]. Consequently, MDTMs are considered the gold standard in oncology care pathway management[14] [15] [16] [17] [18] [19] [20] [21] and the platform to accomplish clinical integration[22]. For optimal coordination and clear communication with patients, uniformity in working methods with standardised formats for MDTMs are advocated by European[23] [24], Canadian[25] and American cancer treatment associations[26]. Additionally, MDTMs are also used for coordinating research, education, promoting and for diffusing best practices and new developments, so called 'functional integration'[22].

The Gastro-Intestinal Oncology (GIO) tumour board of our University Medical Centre (UMC) is a tertiary centre that organises oncology care together with partners in the northern region of the Netherlands and shares responsibility for optimising quality and improving the integration of care. This GIO tumour board manages care pathways for three groups of malignancies: colorectal, hepatobiliary and esophagus-stomach. In the Netherlands, the number of gastrointestinal cancer cases rose from 12,877 in 1989 to 23,985 in 2018, an increase of 86%. Especially the increase in fragile, elderly patients with gastrointestinal cancer led to a need for more complex care. This complexity led to lengthier discussions, longer MDTMs and longer throughput times for the patient to get a treatment plan. Given these trends, the UMC-GIO tumour board decided to reorganise the care pathways according to a previous developed model[27]. The aim of that reorganization was to make the care pathways more patient-centred, enabling shared decision making and to reduce throughput times to comply with the standards set by the Dutch Healthcare Inspectorate, formulated in the SONCOS standards (Stichting Oncologische Samenwerking: Council for Oncological Collaboration)[28]. The main interventions were: 1) immediate triage with direct ordering of missing diagnostics upon receival of the referral, 2) assessment of the patient before the MDTM in the outpatient clinic on the same day as the MDTM, 3) presence of the right specialisms during each MDTM to formulate an optimal multidisciplinary treatment plan and 4) seeing the patient shortly after the MDTM, on the same day, to share the proposal for treatment and decide together with the patient (shared decision making).

The care pathways start with referral to the UMC by a general practitioner or a specialist (tertiary or quaternary; Supplement 1). Before the reorganisation, patients following the colorectal and esophagus-stomach care pathways were seen at the oncology outpatient clinic before their treatment plan was discussed in an MDTM[29]. In several cases the diagnostic work-up was not yet complete. In the hepatobiliary care pathway usually images with a treatment plan were discussed at the MDTM before patients were invited to the oncology outpatient clinic. Due to the quaternary function, consultation 'on paper' is requested

regularly and not all patients require to visit the UMC (e.g. a non-resectable tumour eligible for palliative chemotherapy can be handled by their local physician). As of April 2015, the triage with direct ordering of missing diagnostics was implemented. The first assessment of the patient in the outpatient clinic, GIO-intake, was on the same day as the MDTM in which their treatment plan was formulated (Figure 1). Decisions in the MDTMs are made by dedicated specialists involved in diagnostics and treatment for that GIO pathway. Directly after the MDTM, on the same day, the treatment options and consequences are explained to the patient. Specialisms involved in the treatment have the opportunity to speak with the patient. The reorganization did not change the role of the case managers, they plan the activities for diagnostic procedures and treatment in the same way.

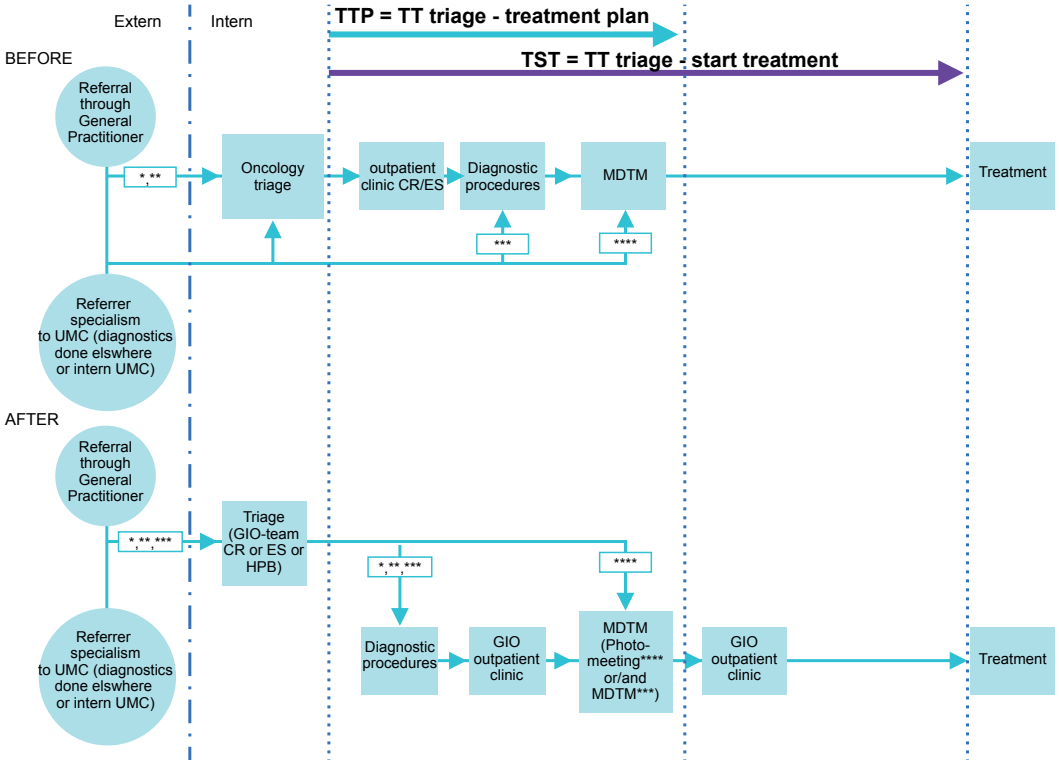


Figure 1. Before and after the reorganization with indicators

The green and purple arrows indicate TTP and TST respectively. For an explanation see the methods section Process evaluation and study design.

Abbreviations: GIO: Gastro-Intestinal Oncology, MDTM: Multidisciplinary team meeting; TTP: Time to Treatment Plan and TST: Time to Start Treatment, TT: Throughput Time, UMC: University Medical Centre.

In the schematic arrows: *: Colorectal (CR), **: Esophagus-Stomach (ES), ***: Hepatobiliary (HPB) tertiary, ****: Hepatobiliary quaternary.

When throughput times started to increase again, the GIO tumour board felt the need to evaluate the reorganisation by comparing its throughput times and the number of MDTMs per patient. In this study, we evaluated quantitatively the throughput times, number of hospital visits and number of MDTMs[11] [30], and qualitatively the benefits and drawbacks

of the reorganisation by interviewing specialists and case managers. This mixed methods approach sought to answer two questions:

1. What is the added value of the GIO-MDTM reorganisation in terms of throughput times, number of MDTMs and number of hospital visits?
2. What benefits and drawbacks do stakeholders of each care pathway perceive from the reorganisation of the GIO-MDTM and how could functioning of MDTMs be further improved?

METHODS

Quantitative component

Sample size estimation

In a previous study on the effects of reorganising a care pathway for patients with head-and-neck cancers, data retrieved from 25 medical records before and 25 after a reorganisational intervention were sufficient to show a significant reduction in throughput times and hospital visits[31].

We therefore choose to analyse, for each care pathway, two sets of medical records, 25 before and 25 after the reorganisation. The first set included data on 25 consecutive patients referred at least four months before the start of the GIO-MDTM reorganisation, working back from December 31st 2014. The other set included data who were referred four months after the reorganisation, i.e. from August 1st 2015 onwards. Data were included on patients who were at least 18 years old and who had been discussed in a GIO-MDTM in our UMC. The following tumours were selected (ICD-O-03 ed1/ed3[32]): esophagus C15, stomach C16, colon C18, rectum C209, pancreas C250, liver C220 and gall bladder C239. Data on patients treated for benign or neuroendocrine tumours were not included.

Process evaluation and study design

For process evaluation of the reorganization of GIO-MDTM, throughput times, the number of MDTMs per patient and the number of hospital visits were used as process indicators (i.e. quantitative outcome variables for this study). Throughput times were measured as the times from triage to the moment the treatment plan was available and to start treatment (Figure 1).

National standards

In assessing the added value, or efficiency, of the reorganisation we used modified SONCOS standards. The tertiary centre's responsibility starts the moment the referral request is received and the centre obviously has no direct influence on the part of the care pathway before this referral. The standards state that, for patients with a GIO tumour, the throughput time for diagnostic procedures should be no more than 21 days; and that the throughput time from oncology intake, if referred to a tertiary treatment facility, to the start of primary treatment no more than 63 days. As the starting point for these throughput times, the standards take the day that the results of the biopsy, taken in the referring hospital, are known. Instead, we took timing of triage in our institution as starting day for throughput times. Thus, in this study, we set targets of 21 days for the time to get the treatment plan and 63 days for the time to start treatment (Figure 1).

Sometimes, tumour size was missing in the treatment plan. In these instances, we used Netherlands Cancer Registry data to retrieve missing tumour size data and to confirm dates we extracted from medical records.

Statistical analysis

To analyse whether the GIO-MDTM reorganisation had different effects for the different care pathways, a univariate general linear model analysis was performed. However, the assumptions for this type of analysis were not satisfied. Subsequently, several attempts were made to transform the data to meet the assumptions, but these failed because our data were too skewed. Instead we analysed effects of the reorganisation within each care pathway non-parametrically and report medians and interquartile ranges (IQR). Differences in age, gender, tumour localisation (ICD-O), tumour size, diagnostic type, treatment type and compliance with the 21-days standard and the 63-days standard, before and after the reorganisation of the GIO-MDTM, were analysed using Chi-Squared tests or Chi-Squared test exact if requirements were not met. Mann-Whitney-U tests were used to analyse throughput time differences. Statistical analyses were performed using SPSS 23.0 for Windows software. Statistical significance was set at 5%.

Qualitative component

Semi-structured interviews were held with gate-keeping specialists and case managers from the three care pathways. The interviews focussed on perceived benefits and drawbacks, and the value of the reorganisation, the current functioning of the GIO-MDTM and how MDTMs could be further improved.

Interviews

During October and November 2019, three surgeons, three gastroenterologists and three case managers were interviewed. After receiving their verbal informed consent, semi-structured interviews started with providing information on the quantitative results of this study. The interview continued with the question: 'What do you think is the role of the gate-keeping specialist / case manager in a GIO-MDTM?'. The interviewer used a topic list as interview guide (Supplement 2). Interviews lasted 25 to 40 minutes, were audio recorded and transcribed.

Thematic analysis

Quotes were extracted from the transcripts. The participants were asked to review and confirm their personal transcripts and extracted quotes. Quotes were then anonymised. In the first stage of the inductive analysis[31] [32], codes were given to quotes related to the reorganisation of the GIO-MDTM and its current functioning[30] [33] [34] [35]. The codes were placed in a coding tree in relation to the research question with three main themes: planning for integrated care, added value of the MDTM and the management of the care pathway (Supplement 3)[36] [37]. Thereafter a second coder gave quotes codes from the coding tree. Codes were judged as either being a benefit or a drawback that could be improved. Disagreements in coding between the coders and the researcher were discussed. After the preliminary results were collated, a member check was performed to ensure credibility[38].

RESULTS

Quantitative analysis

In total, data from 194 medical records were included in this study; 96 before and 98 after the reorganisation (Supplement 4: Tables a-c). All groups had at least 25 patients that started treatment. A data check revealed that 3% of the data were not in accordance with the Netherlands Cancer Registry and were changed accordingly. The throughput times based on the Netherlands Cancer Registry database were shorter than those based on medical records (mean difference 0.5 days). Staging verification showed no differences for the tumour sizes. Mean (sd) age of patients before and after the reorganisation was 66.2 (9.3) respectively 65.4 (12.5) years. In all the pathways, tumours were somewhat larger after the reorganisation. Outliers were explored and, in most cases, comorbidity induced extended throughput times.

In the colorectal care pathway, after the reorganisation, the number of hospital visits in the period from triage to start of treatment tended to increase ($p = .092$) (Table 1 and Figure 3a). Nevertheless, the standards for throughput times from triage to get the treatment plan and from triage to start treatment were met for a higher proportion of patients after the reorganisation (85 vs 93%).

In the hepatobiliary care pathway, more primary tumours were treated after the reorganisation ($p = .039$) (Supplement 4: Table b), the time to get the treatment plan increased ($p = .035$) but the time to start treatment decreased ($p = .029$) (Table 1 and Figure 2a). The number of hospital visits between triage and treatment plan increased ($p = .027$), and more MDTMs were needed to come to a treatment plan ($p = .026$) after the reorganisation. After the reorganisation fewer patients got their treatment plan within 21 days. The percentage of patients that started their treatment within 63 days increased to 88% ($p = .024$).

In the esophagus-stomach care pathway, patients in our post-reorganisation sample were older than those in the pre-reorganisation sample ($p = .050$) and the number of hospital visits needed to come to a treatment plan was less after the reorganisation ($p = .037$). The number of MDTMs per patient tended to decrease ($p = .079$; Table 1). The percentage of patients that started their treatment within 63 days increased and in 2015 the standard of 63 days was met for all.

Figure 2a. Box and whisker plots time to treatment plan

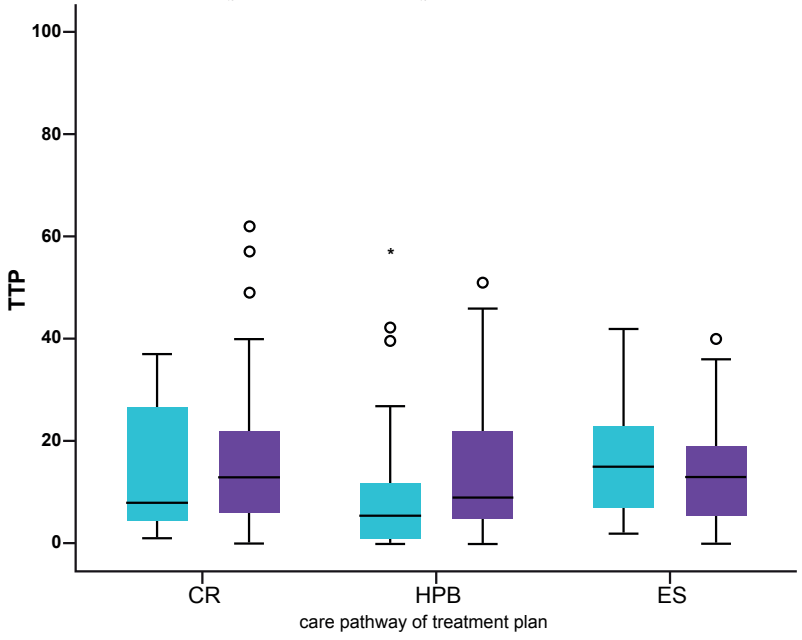
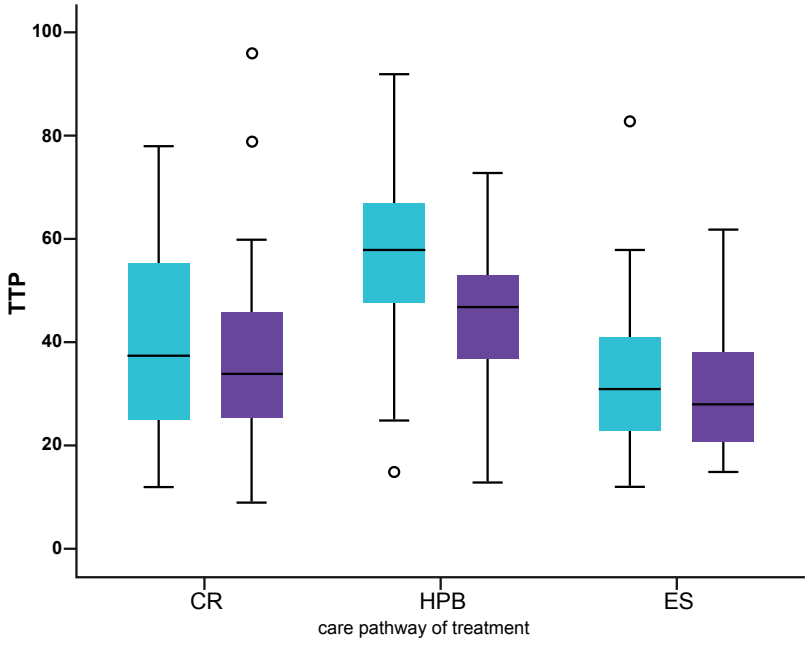


Figure 2b. Box and whisker plots time to start treatment



CR: colorectal, HPB: hepatobiliary, ES: esophagus-stomach; TST: time to start treatment; TTP: time to treatment plan. Blue is before and purple is after the MDTM reorganisation; O: outlier, *: outlier Tukey's method IQR; IQR: Inter Quartile Range.

Figure 3a. Box and whisker plots number of hospital visits from triage to treatment plan

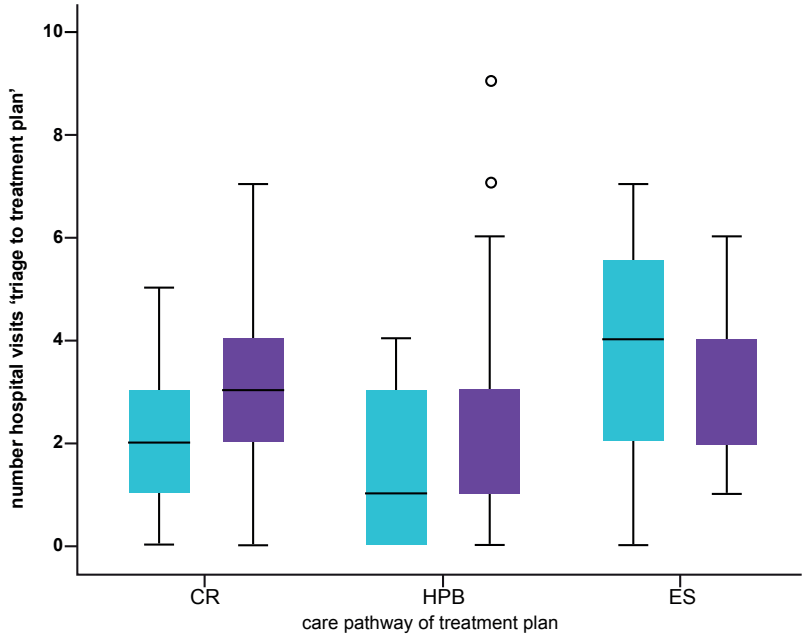
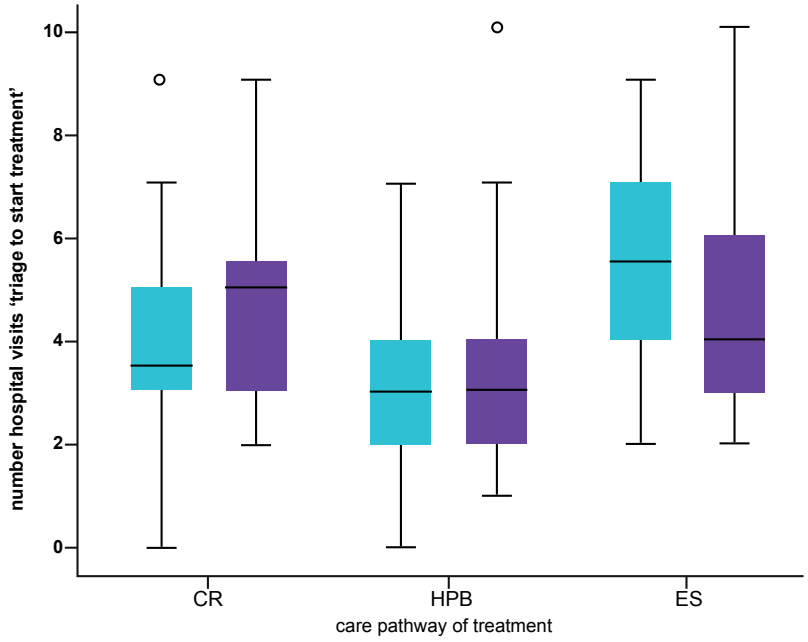


Figure 3b. Box and whisker plots number of hospital visits between triage and start treatment



Hospitals visits per patient (CR: colorectal, HPB: hepatobiliary, ES: esophagus-stomach).
Blue is before and purple is after the MDTM reorganisation; °: outlier.

Table 1. Throughput times, number of MDTMs and hospital visits before and after the reorganisation in the different pathways

	Colorectal			Hepatobiliary			Esophagus-Stomach		
	Before	**After**		**Before**	**After**		**Before**	**After**	
Number of patients diagnosed*	2014 (n = 32)	2015 (n = 34)	p	2014 (n = 36)	2015 (n = 32)	p	2014 (n = 28)	2015 (n = 32)	p
	Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)	
Throughput time (days)									
TTP triage – treatment plan	8.0 (4.3;26.8)	13.0 (6.0;22.5)	.653	5.5 (1.0;12.0)	9.0 (5.0;22.0)	.035	15.0 (7.0;23.0)	13.0 (5.3;19.0)	.292
treatment plan within 21 days**	66%	74%	.485	89%	72%	.075	71%	87%	.370
TST triage – start treatment	37.5 (24.3;55.8)	34.0 (24.0;46.0)	.663	58.0 (46.5;68.5)	47.0 (37.0;54.0)	.026	31.0 (22.5;41.5)	28.0 (20.5;39.5)	.521
start treatment within 63 days**	85%	93%	.420	60%	88%	.024	96%	100%	1.000
Number of MDTMs	1.0 (1.0;2.0)	1.0 (1.0;2.0)	.307	1.0 (1.0;1.0)	1.0 (1.0;2.0)	.026	2.0 (1.0;2.0)	1.0 (1.0;2.0)	.079
Number of patients treated***	2014 (n = 26)	2015 (n = 27)		2014 (n = 25)	2015 (n = 25)		2014 (n = 25)	2015 (n = 25)	
Number of hospital visits									
triage – treatment plan	2.0 (1.0;3.0)	3.0 (2.0;4.0)	.092	1.0 (0.0;3.0)	1.0 (1.0;3.0)	.027	4.0 (2.0;5.8)	3.0 (2.0;4.0)	.037
triage – start treatment	3.5 (3.0;5.0)	5.0 (3.0;6.0)	.157	3.0 (2.0;4.0)	3.0 (2.0;4.0)	.933	5.5 (4.0;7.0)	5.0 (3.0;6.0)	.238

Abbreviations: IQR: Inter Quartile Range (25th and 75th percentiles), MDTM: Multidisciplinary team meeting, TST: time to start treatment, TTP: time to treatment plan; *: number of patients consecutively discussed in the MDTM in the UMC of the care pathways. Differences between before and after the reorganisation were tested using Mann-Whitney-U, except the percentages **: 'treatment plan within 21 days' and 'treatment within 63 days' were tested using with Chi^2 test, ***: number of patients discussed in the UMC MDTM that were treated in the UMC or in the region.

Qualitative analysis

From the transcripts, 251 quotes were extracted. In total 50 codes (Supplement 3) were identified related to the reorganisation of the GIO-MDTM and its current functioning. These codes were given 630 times (Supplement 3). Inter-coder agreement was 62.5%. Codes representing a benefit (30 codes identified, 418 times) were given twice as often than those representing a drawback (20 codes, 212 times). The 10 most frequently given codes were given to 56 % of the 251 quotes.

During a thematic synthesis, three main themes emerged from the data; 1) increase of the added value of the MDTMs, for example availability of expert specialisms had increased, 2) greater focus in the planning on continuity and integration of care, for example planning in cooperation with other regional hospitals had improved, 3) greater awareness that improvements could be made in the management of GIO care pathways, such as using a dashboard to monitor 'real time' relevant throughput times for GIO patients on the hospital's MDTM registration list.

The added value of the GIO-MDTMs (codes 17-34)

Most interviewees regarded a GIO-MDTM as the moment where all expertise comes together to decide an optimal multidisciplinary treatment plan. A gastroenterologist explained:

"The value of the MDTM is twofold: 1) for the patient who visits the GIO outpatient clinic, you have thought carefully about the possible diagnosis and multidisciplinary treatment (code 24) 2) it is good for the cohesion within the team, to know your colleagues with whom you work well, which means that you can also find each other easily in other circumstances." (code 18).

During a GIO-MDTM, the gate-keeping specialism for each patient is responsible for the quality of the intake and presents their patients. That specialism thus plays a key role for patients and also for colleagues. In addition, the chair of the GIO-MDTM also fills an important role. The chair has to monitor and guide the meeting process, summarise discussions and formulate the conclusions. The chair needs to distinguish non-complex cases, or 'formalities', from complex cases to ensure an efficient discussion. A surgeon said:

"As chair, I prepare for a meeting thoroughly. I review the patients to estimate the time needed for each one: a 'formality' or an extended discussion." (code 26).

Each care pathway had different dynamics reflecting differences in the biology of the tumours. Although participants noted that it is important to prepare for the MDTM, most specialisms did not schedule time for this. A surgeon said:

"It is both time consuming and important for a chair to prepare well for the MDTM, but no time is scheduled for this the day before our MDTM." (code 23).

The participants stated that good preparation makes the MDTM more efficient for all persons present and it is good for patient care. A case manager said:

"Everybody wants time to reflect on their own preparation for the MDTM, because it is their patient being presented who needs an optimal treatment plan." (code 32).

Focus in planning on continuity and integrated care (codes 1-16)

The case managers played a distinct role in the care pathway. They focused on all patients' needs, including psychosocial aspects. They aim to speed up the diagnostic process by getting information from the referrer where possible and, during that process, they stay in contact with the patient, the referring hospital and the treating specialist, signalling problems in throughput times and acting to prevent delays when possible. A case manager said:

"The role of the case manager is to prepare the agenda for the MDTM and to act upon decisions of the MDTM." (code 8).

A surgeon member of a tumour board put it like this:

"We steer tightly, using the case manager to acquire diagnostic results from the periphery on time. A few times, the results had not arrived on time, but we decided to discuss the patient at the MDTM with the information at hand." (code 11).

The latter part of this quote reflects a dilemma we heard several times: helping the patient is more important than a perfect process in the hospital. Another aspect of the case manager's focus on the patient and on integrated care was that they implemented an improvement shortly after the reorganisation of the GIO-MDTM. Patients had commented that they understood the diagnosis and the treatment plan, but that the explanation of the different treatment options and consequences was too much for them to digest in a single hospital visit.

GIO care pathways management and improvement awareness (codes 35-50)

Most interviewees stated that further improvements could be made, but that finding time to reflect and gain support to implement improvements was difficult. Throughput times cannot always be influenced by a physician or care pathway management. The available time in the operating theatre is in part determined by the capacity of the anaesthesiology department. A gastroenterologist said:

"The throughput time of 6-8 weeks for an Endoscopic Retrograde Cholangiopancreatography is determined by the sedation capacity of [the department of] anaesthesiology.". A dashboard with indicators was seen as potentially helpful. A surgeon member of a tumour board said:

"We should have a dashboard to monitor our registration list for the GIO-MDTM in relation to relevant throughput times." (code 46).

Another aspect highlighted was that not all parties involved in the GIO-MDTM were invited to meetings where policy and improvement opportunities were discussed. A case manager said:

"A tumour board manages our care pathway. As a case manager or nursing consultant, you are not invited to the policy meetings." (code 45).

DISCUSSION

Quantitative results

After the reorganisation, throughput times to start treatment decreased significantly but throughput times to get the treatment plan increased in the hepatobiliary pathway. In the two other pathways, the percentages of cases meeting the 21-day standard set for the treatment plan increased somewhat but not significantly. In all the pathways, a higher percentage of cases met the standard to start treatment within 63 days, but only significantly in the hepatobiliary pathway. The number of MDTMs increased significantly in the hepatobiliary pathway. The number of hospital visits from triage to treatment plan increased significantly in the hepatobiliary pathway but decreased significantly in the oesophagus-stomach pathway.

The reorganisation aimed to reduce throughput times by standardising the work for the majority of non-complex patients and thereby gaining time to discuss the more complex cases. In the UMC, as a tertiary and quaternary centre, an increasing number of older patients with more comorbidities are seen, which explains an increase in larger tumours. Generally complex patients with advanced diseases benefit most from MDTM discussions, also described as the 'Flying Dutchman phenomenon' blown from one site-specific MDTM to another until finally reaching safe haven[29]: patients getting the best possible treatment plan through a multidisciplinary approach in a tertiary centre[12] [29] [39] [40]. Developments required more intensive discussion and coordination between professionals and this is reflected in increased throughput times and number of hospital visits from triage to treatment plan in the hepatobiliary pathway. During the reorganization there were no task shifts from doctors to nurses or to general practitioners. An explanation for the decrease in throughput time from triage to start treatment in the hepatobiliary pathway (a 9-day difference in median times), despite a longer throughput time from triage to treatment plan, could be improved case coordination as a result of the reorganisation of the MDTM. Given the increasing percentage of complex cases, we argue that the SONCOS standards are too strict in expecting throughput times to be met for all patients. Indeed, for head-and-neck cancer patients in the Netherlands[41] [42], there has been a modification, now expecting 80% of patients to meet the time to start treatment. Therefore, we would recommend healthcare policymakers to set throughput time standards but expect hospitals to only meet these for about 75%[43] [44].

In the hepatobiliary pathway, before the reorganisation, patients were not seen in the outpatient clinic before the MDTM and decisions were taken based on imaging and documents. After the reorganisation, patients were seen before the MDTM, and additional hospital visits were scheduled to prepare for the treatment. This change resulted in longer throughput times and an increase in the number of MDTMs. Recently a re-evaluation project was started with the region to optimize the care pathway including the development of a dashboard.

In the colorectal care pathway, the number of hospital visits also tended to increase after the reorganisation. Intake and assessment by different specialties on the same day as the GIO-intake resulted in an overwhelming amount of information being presented to the patient. It was therefore decided to arrange an additional visit to explain the medical situation and the alternative treatments to the patient and their supporters. For such patients, efficiency has its limits: they need time for explanation and reflection in order to make a 'well-weighted, shared decision' with their treating specialist e.g. in an elderly MDTM[45].

Conversely, for the esophagus-stomach care pathway, the number of MDTMs tended to decrease as well as the number of hospital visits needed to come to a treatment plan. Another improvement was seen in the integration of surgical capacity. Here, since January 2019, a secondary hospital in the region shares its surgical capacity with the UMC's GIO centre for stomach surgery. The MDTMs held by UMC and by the secondary hospital have been merged and using video-conferencing to reduce the number of MDTMs and decrease throughput times. Research on care pathway management in Scotland has shown that throughput time measurements on several levels should be taken into account to improve coordination in a region[46], and this is reflected in our recommendations below.

Qualitative results

Twice as many codes were annotated as benefits than as drawbacks for the functioning of the GIO-MDTM. However, some of the benefits were already experienced as an advantage of having MDTMs before the reorganisation. From the interviews, it became clear that, following the reorganisation, the value of the MDTMs had increased. The different treatment modalities were better discussed between the appropriate specialisms with more attention to patient wishes. This was largely caused by availability of all expertise at the meeting to discuss complex cases and to cooperate in a multidisciplinary way in formulating an optimal treatment plan for individual patients. In this way, the reorganisation enhanced quality and integration of care for the three patient groups and, what is more, the interviewees said that the reorganised MDTMs also improved interpersonal relations between participants. These improvement contributed positively to discussions and resulted in better treatment plans. These findings are in line with previous study findings[47] [48]. Another observation was the improvement in case coordination due to the more complete presence of required disciplines during the MDTM and the better relationships. Although the importance of improved case coordination between healthcare professionals with better interpersonal relationships has also been found previously[49] [50] [51] [52], more research is needed to understand the underlying processes and the way it adds value to a care pathway.

Case managers believed that throughput times to get the treatment plan and throughput times to start treatment could be further reduced through stricter monitoring of the completeness of the diagnostic information needed to start treatment. The importance of strict monitoring has been identified elsewhere[53] [54] but we noticed that the 'circle of influence' of a care coordinator or case manager is limited. The case manager has no control over or mandate for discipline-bounded capacities such as slots for diagnostic procedures. Such a mandate depends on the leadership and style of communication in the tumour board and the MDTM.

From the interviews, it became clear that the GIO-MDTMs would benefit from participants being better prepared. Specialists within the same department could discuss treatment possibilities from their perspective before the MDTM, and prepare questions to discuss with other specialists to optimise the proposed treatment. In general, there is no preparation time scheduled for the MDTM participants. The chair should be well prepared, and should earmark time for the different disciplines, so that discussions within a discipline during an MDTM would then take less time and the MDTM would be more efficient. Surgical oncologists elsewhere have reported that MDTM members have good insight into their own

multidisciplinary team performance and state that all MDTMs would benefit from good leadership, good preparation of MDTMs and appropriate presentation of information by the gate-keeping specialists[55] [56] [57] [58].

All participants of the GIO-MDTMs were highly motivated to improve efficiency of the meetings but they experienced a lack of time to prepare the meetings. Although the UMC, as a tertiary centre, treats mainly the more complex cases, there are sufficient surgical treatments to meet the SONCOS indicator for the 'number of surgical cases', which is an indicator for being a 'competent' surgeon[28]. However, this indicator should not be seen as justification for adversely affecting the time available for participants to prepare for an MDTM. Additionally, there remains a dilemma for the hepatobiliary pathway. The efficiency of the care pathway in terms of diagnostic procedures against the importance of meeting the patient before making a treatment plan at the MDTM so that the patient's wishes concerning treatment can get more attention and can be optimally included[59].

Combining quantitative and qualitative results

The interviews provided an insight into the complex dynamics of oncology care pathways and the functioning of their MDTMs. Collaboration in an MDTM is not only about efficiency and indicators like throughput times, but also about cooperation, respect for other team members and the commitment of all team members, and good leadership[12] [48] [60].

The importance of evaluating interventions in oncology care pathways is shown, including detecting unexpected drawbacks. This study showed the importance of evaluating adjustments or interventions in internal and regional care pathways in order to detect any unexpected drawbacks, to structure continuous improvement[43] [61] and to organize care pathways in an integrated way. This mixed method approach, provides insight into how an oncology care pathway operates, the contribution of the individual members, their appreciation and assessment of the cooperation[62].

Limitations of this study

A limitation of this study is the lack of generally accepted indicators for care pathway management and definitions of those indicators that do exist[46] [57] [63]. We modified Dutch SONCOS standardised indicators to evaluate the reorganisation of the care pathways in order to be comparable to the indicators used in earlier research on the care pathway of head-and-neck cancer patients[31]. Contrary to our expectations, we did not find a significant decrease in throughput times for the different GIO care pathways. We saw that the clinical presentation, the biological behaviour of tumours, types of treatment and treatment combinations differed considerably from the care pathway of head-and-neck cancers. Further, we noted that the UMC's focus increasingly on the care of complex patients with larger tumours, that the incidence of tumours in the elderly is increasing, and that these factors may be important confounders in not finding a significant change following reorganisation.

Recommendations

Based on the results of our study, we formulated the following recommendations

1. Make a policy plan with the region, for a specific period with accurate, recent performance data and reflect on possibilities to improve the care pathway (code 17).
2. Create a team of people who know and trust each other, who promote interaction and commitment using a U-form table in their meeting rooms (code 44) where colleagues can confront each other respectfully about desirable and undesirable behaviours (code 18).
3. Ensure all specialist disciplines attend the MDTM (code 24 and code 25) to formulate the best treatment plan for each patient, including customisation for complex or comorbid cases (code 10).
4. Make medical and psychosocial information available during MDTMs (code 31) and include patient wishes in the treatment plan e.g. by planning an elderly MDTM before the treatment MDTM (code 14).
5. Provide clarity on everybody's individual role, before, during (code 22) and after the meeting to optimise time management during the MDTM (code 30).
6. The chair should show leadership and motivate the team by taking responsibility for directing the discussion in the meetings and summarise the conclusions and formulate the treatment plans according to the format in the guidelines (code 26).
7. Provide all MDTM participants with dedicated time to prepare for the meeting (code 23) since this will increase meeting efficiency and the quality of the treatment plan (code 22).
8. Set up an integrated dashboard to monitor relevant real time indicators for your care pathway, such as 'throughput time differences from standard' or hospital visits, and evaluate the performance (code 46).

The results and recommendations show that improving performance requires an improved functioning of MDTMs (clinical integration), participation of all specialists with clear roles (professional integration), resources such as time, sufficient performance information and quality improvement efforts (functional integration), a regional policy (organizational integration) and shared commitment and mutual trust to improve the performance of the pathway (normative integration)[22].

However 'real time'-dashboard implementation is complicated for functional integration in a care pathway, but is currently under development.

Further Research

To justify the existence of time-consuming events such as MDTMs in oncological care pathways, it is important to measure their added value. Further research could be directed at investigating the value of real time dashboard information, and consider the waiting times and the status of diagnostic procedures in reaching a personalised treatment plan in an MDTM. On the tumour board level, further research could focus on what indicators enable effective care pathway management. For example, indicators that 1) present real time throughput time information on diagnostic procedures and treatment steps, 2) enable informed decision-making on diagnostic and therapeutic capacity and 3) increase efficiency by reducing non-value adding diagnostic procedures or treatments.

CONCLUSIONS

Reorganising the GIO-MDTM and outpatient clinic had different effects on each care pathway. For the hepatobiliary pathway, the throughput time from triage to treatment plan increased, but the throughput time from triage to start treatment reduced. No other significant changes were identified. Overall, the percentage of patients treated within the Dutch standard of 63 days increased.

The efficacy of an integrated multidisciplinary care pathway needs constant attention. It can be assessed with a mixed method approach. Beside results of quantitative evaluation like throughput times, a qualitative approach is recommended for assessment of the human factor in cooperation between different disciplines.

DATA ACCESSIBILITY STATEMENT

Datasets will be available from the corresponding author on reasonable request.

ADDITIONAL FILES

Supplementary file 1: Illustration GIO care pathway before the reorganization (Figure - 1 page).
Supplementary file 2: Interview Guide (Table - 1 page).
Supplementary file 3: Coding tree reorganization GIO-MDTM (Table – 3 pages).
Supplementary file 4: Patient and tumour characteristics of the care pathways (Table – 3 pages).

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

This study was approved by and performed according to standards of our UMC Ethics Committee (2016, ref. M16.195849). The committee concluded that the study was not a 'clinical research study with human subjects' under the Dutch Medical Research Involving Human Subject Act (WMO).

PATIENT INVOLVEMENT IN STUDY DESIGN

Patients did not participate in the study design because the main purpose of the study was to evaluate the reorganization of the GIO-MDTM on efficiency in the care pathways for healthcare professionals.

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REVIEWERS

Guus Schrijvers, former-professor of Public Health and health economist, the Netherlands.
One anonymous reviewer.

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHORS CONTRIBUTION

The first author was involved in the study concept and design; carried out the study; performed the statistical analysis and the analysis and interpretation of the data; and drafted the manuscript. The second, the eighth and last author, the supervisor, were involved in the study design and concept, analysis and interpretation of the data, and revision of the manuscript. The supervisor and the second author were involved in the coding of the interview quotations and, together with the other authors were involved in the acquisition of the data and the revision of the manuscript.

All authors read and approved the final manuscript.

AUTHORS INFORMATION

The University Medical Center Groningen (UMCG) is developing patient-centred, integrated care pathways for various patient groups. In addition to medical and logistic aspects, laws and regulations for quality and patient safety are included. The UMCG has an institutional ISO 9001 for Healthcare certificate and ISO 27001 Information Security certificate for their care, research and educational processes. The Quality and Patient Safety research group evaluates the implementation of care pathways and MDTMs to develop indicators for the management level of care pathways led by healthcare professionals. The four leading researchers for this paper are LvH, PUD, KA and JR. Of these, LvH works as a consultant for quality and patient safety for different care pathways seeking to implement improvements and is involved in certification of these care pathways at the regional level. PUD works as a researcher in the field of rehabilitation and is an epidemiologist. KA chaired the Quality and Patient Safety research group of the UMCG and now chairs the Health Services Management & Organisation Department of the Erasmus School of Health Policy & Management. His research interest is quality improvement and value-based healthcare. JR was chair of the multidisciplinary Head and Neck Oncology Group of the UMCG for 30 years and chair of the Dutch Multidisciplinary Head and Neck Oncology Group for 8 years. The centralisation of head and neck cancer care in eight centres was achieved under his leadership in 1993.

REFERENCES

1 van Hoeve JC, Vernooij RWM, Fiander M, et al. Effects of oncological care pathways in primary and secondary care on patient, professional and health systems outcomes: a systematic review and meta-analysis. *Systematic reviews* 2020;**9**(1):246,020-01498-0.

2 Patkar V, Acosta D, Davidson T, et al. Cancer multidisciplinary team meetings: evidence, challenges, and the role of clinical decision support technology. *International journal of breast cancer* 2011;**2011**:831605.

3 Kodner DL, Spreeuwenberg C. Integrated care: meaning, logic, applications, and implications--a discussion paper. *International journal of integrated care* 2002;**2**:e12.

4 Minkman MMN. The current state of integrated care: an overview. *Journal of Integrated Care Pathways* 2012;**6**:346-58.

5 Berlin A, Sorani M, Sim I. A taxonomic description of computer-based clinical decision support systems. *Journal of Biomedical Informatics* 2006;**39**(6):656-67.

6 Patkar V, Acosta D, Davidson T, et al. Using computerised decision support to improve compliance of cancer multidisciplinary meetings with evidence-based guidance. *BMJ open* 2012;**2**(3):10.1136/bmjopen,2011-000439. Print 2012.

7 Davies AR, Deans DA, Penman I, et al. The multidisciplinary team meeting improves staging accuracy and treatment selection for gastro-esophageal cancer. *Diseases of the esophagus : official journal of the International Society for Diseases of the Esophagus* 2006;**19**(6):496-503.

8 Riedel RF, Wang X, McCormack M, et al. Impact of a multidisciplinary thoracic oncology clinic on the timeliness of care. *Journal of thoracic oncology : official publication of the International Association for the Study of Lung Cancer* 2006;**1**(7):692-6.

9 Basta YL, Bolle S, Fockens P, et al. The Value of Multidisciplinary Team Meetings for Patients with Gastrointestinal Malignancies: A Systematic Review. *Annals of surgical oncology* 2017;**24**(9):2669-78.

10 Bydder S, Nowak A, Marion K, et al. The impact of case discussion at a multidisciplinary team meeting on the treatment and survival of patients with inoperable non-small cell lung cancer. *Internal Medicine Journal* 2009;**39**(12):838-41.

11 Ye YJ, Shen ZL, Sun XT, et al. Impact of multidisciplinary team working on the management of colorectal cancer. *Chinese medical journal* 2012;**125**(2):172-7.

12 Munro A, Brown M, Niblock P, et al. Do Multidisciplinary Team (MDT) processes influence survival in patients with colorectal cancer? A population-based experience. *BMC cancer* 2015;**15**:686,015-1683-1.

13 Prades J, Remue E, van Hoof E, et al. Is it worth reorganising cancer services on the basis of multidisciplinary teams (MDTs)? A systematic review of the objectives and organisation of MDTs and their impact on patient outcomes. *Health policy (Amsterdam, Netherlands)* 2015;**119**(4):464-74.

14 van Drielen E, de Vries AW, Ottevanger PB, et al. Beter multidiscplinair overleg past bij betere zorg. [Better multidisciplinary team meetings are linked to better care.]. *Nederlands tijdschrift voor Geneeskunde* 2012;**156**(45):A4856 [in Dutch].

15 Homs MY, van Oijen MG, Wijnhoven BP, et al. Changes in diagnostic and treatment strategies of oesophageal cancer in the period from 2001 to 2009: a survey in the Netherlands. *European journal of gastroenterology & hepatology* 2012;**24**(2):126-33.

16 Kolfschoten NE, Gooiker GA, Bastiaannet E, et al. Combining process indicators to evaluate quality of care for surgical patients with colorectal cancer: are scores consistent with short-term outcome? *BMJ quality & safety* 2012;**21**(6):481-9.

17 Swellengrebel HA, Peters EG, Cats A, et al. Multidisciplinary discussion and management of rectal cancer: a population-based study. *World journal of surgery* 2011;**35**(9):2125-33.

18 van Steenbergen LN, Lemmens VE, Rutten HJ, et al. Was there shortening of the interval between diagnosis and treatment of colorectal cancer in southern Netherlands between 2005 and 2008? *World journal of surgery* 2010;**34**(5):1071-9.

19 Taylor C, Munro AJ, Glynne-Jones R, et al. Multidisciplinary team working in cancer: what is the evidence? *BMJ (Clinical research ed.)* 2010;**340**:c951.

20 Lamb B, Green JS, Vincent C, et al. Decision making in surgical oncology. *Surgical oncology* 2011;**20**(3):163-8.

21 Slavova-Azmanova NS, Johnson CE, Platell C, et al. Peer review of cancer multidisciplinary teams: is it acceptable in Australia? *The Medical journal of Australia* 2015;**202**(3):144-7.

22 Valentijn PP, Schepman SM, Opheij W, et al. Understanding integrated care: a comprehensive conceptual framework based on the integrative functions of primary care. *International journal of integrated care* 2013;**13**:e010.

23 European Partnership Action Against Cancer consensus group, Borras JM, Albreht T, et al. Policy statement on multidisciplinary cancer care. *European journal of cancer (Oxford, England : 1990)* 2014;**50**(3):475-80.

24 van Zelm R, Coeckelberghs E, Sermeus W, et al. Effects of implementing a care pathway for colorectal cancer surgery in ten European hospitals: an international multicenter pre-post-test study. *Updates in surgery* 2020;**72**(1):61-71.

25 Sanmartin C, Berthelot JM, McIntosh CN. Determinants of unacceptable waiting times for specialized services in Canada. *Healthcare policy = Politiques de sante* 2007;**2**(3):e140-54.

26 Brady JT, Xu Z, Scarberry KB, et al. Evaluating the Current Status of Rectal Cancer Care in the US: Where We Stand at the Start of the Commission on Cancer's National Accreditation Program for Rectal Cancer. *Journal of the American College of Surgeons* 2018;**226**(5):881-90.

27 Basta YL, Tytgat KMAJ, Greuter HH, et al. Organizing and implementing a multidisciplinary fast track oncology clinic. *International journal for quality in health care : journal of the International Society for Quality in Health Care* 2017;**29**(7):966-71.

28 SONCOS Normeringsrapport 7, pagina's 22-26 [Standardization report 7, pages 22-26]. *https://www.soncos.org/kwaliteit/normeringsrapport* **2019**(07/11):[in Dutch].

29 Munro AJ. Multidisciplinary Team Meetings in Cancer Care: An Idea Whose Time has Gone? *Clinical oncology (Royal College of Radiologists (Great Britain))* 2015;**27**(12):728-31.

30 Plochg T, Juttman RE, Klazinga NS, et al. *Handbook health research (Handboek gezondheidszorgonderzoek).* 1st ed. Houten: Bohn Stafleu van Loghum 2007.

31 van Huizen LS, Dijkstra PU, van der Laan BFAM, et al. Multidisciplinary first-day consultation accelerates diagnostic procedures and throughput times of patients in a head-and-neck cancer care pathway, a mixed method study. *BMC health services research* 2018;**18**(1):820,018-3637-1.

32 Vlaams Kankerregistratienetwerk. Vlaams Kankerregistratienetwerk[International Classification of Diseases for Oncology, third edition, updates]. *https://www.rivm.nl/media/WHO-FIC/ICS-O-3.pdf* 2011;**2019**:[240 [in Dutch]].

33 Gioia DA, Gorley KG, Hamilton AL. Seeking Quality Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods* 2012;**16**(I):15,16-31.

34 Charmaz K. *Contructing Grounded Theory. A Practical Guide through Qualitative Analysis.* London: Sage Publications 2006.

35 O'Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Academic medicine : journal of the Association of American Medical Colleges* 2014;**89**(9):1245-51.

36 Creswell J, Plano Clark V. *Designing and conducting mixed methods research.* Los Angeles: Sage 2011.

37 Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *International journal for quality in health care : journal of the International Society for Quality in Health Care* 2007;**19**(6):349-57.

38 Birt L, Scott S, Cavers D, et al. Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation? *Qualitative health research* 2016;.

39 Segelman J, Singnomklao T, Hellborg H, et al. Differences in multidisciplinary team assessment and treatment between patients with stage IV colon and rectal cancer. *Colorectal disease : the official journal of the Association of Coloproctology of Great Britain and Ireland* 2009;**11**(7):768-74.

40 Chinai N, Bintcliffe F, Armstrong EM, et al. Does every patient need to be discussed at a multidisciplinary team meeting? *Clinical radiology* 2013;**68**(8):780-4.

41 de Ridder M, Balm AJM, Baatenburg de Jong RJ, et al. Variation in head and neck cancer care in the Netherlands: A retrospective cohort evaluation of incidence, treatment and outcome. *European journal of surgical oncology : the journal of the European Society of Surgical Oncology and the British Association of Surgical Oncology* 2017;**43**(8):1494-502.

42 Guy JB, Benna M, Xia Y, et al. Quality insurance in head and neck cancer multidisciplinary team meetings: A watchful eye on real-life experience. *Oral oncology* 2019;**91**:35-8.

43 Gray R, Gordon B. Meeting patients' needs. Improving the effectiveness of multidisciplinary teams meetings in cancer services. 2017;**2019**(07/11).

44 Markar SR, Schmidt H, Kunz S, et al. Evolution of standardized clinical pathways: refining multidisciplinary care and process to improve outcomes of the surgical treatment of esophageal cancer. *Journal of gastrointestinal surgery : official journal of the Society for Surgery of the Alimentary Tract* 2014;**18**(7):1238-46.

45 Festen S, Kok M, Hopstaken JS, et al. How to incorporate geriatric assessment in clinical decision-making for older patients with cancer. An implementation study. *Journal of geriatric oncology* 2019;**10**(6):951-9.

46 Gagliardi AR, Simunovic M, Langer B, et al. Development of quality indicators for colorectal cancer surgery, using a 3-step modified Delphi approach. *Canadian journal of surgery.Journal canadien de chirurgie* 2005;**48**(6):441-52.

47 Vinod SK, Sidhom MA, Delaney GP. Do multidisciplinary meetings follow guideline-based care? *Journal of oncology practice* 2010;**6**(6):276-81.

48 Gittell JH, Hajjar L. Strengthening Patient-Centered Care in the VHA: A Relational Model of Change. *Journal of general internal medicine* 2019;**34**(Suppl 1):7-10.

49 Noyes K, Monson JR, Rizvi I, et al. Regional Multiteam Systems in Cancer Care Delivery. *Journal of oncology practice* 2016;**12**(11):1059-66.

50 Middenveldt I, Regts G. De ontwikkeling van oncologie netwerken in Nederland. [The development of Oncology Networks in the Netherlands.] Aanbevelingen rond organisatie en financiering. [Recommendations regarding organization and financing]. *https://www.oncologienetwerken.nl/sites/default/files/2018-09/Oncologienetwerken%20en%20financiering%20-%20rapport.pdf* 2018;:[1,54 [in Dutch]].

51 van Huizen LS, Dijkstra P, Halmos GB, et al. Does multidisciplinary videoconferencing between a head-and-neck cancer centre and its partner hospital add value to their patient care and decision-making? A mixed-method evaluation. *BMJ open* 2019;**9**(11):e028609,2018-028609.

52 Gittell JH, Logan C, Cronenwett J, et al. Impact of relational coordination on staff and patient outcomes in outpatient surgical clinics. *Health care management review* 2020;**45**(1):12-20.

53 Fleissig A, Jenkins V, Catt S, et al. Multidisciplinary teams in cancer care: are they effective in the UK? *The Lancet.Oncology* 2006;**7**(11):935-43.

54 Delilovic S, Hasson H, Ahstrom M, et al. Implementing standardized cancer patient pathways (CPPs) - a qualitative study exploring the perspectives of health care professionals. *BMC health services research* 2019;**19**(1):577,019-4413-6.

55 Lamb BW, Sevdalis N, Mostafid H, et al. Quality improvement in multidisciplinary cancer teams: an investigation of teamwork and clinical decision-making and cross-validation of assessments. *Annals of surgical oncology* 2011;**18**(13):3535-43.

56 Ottevanger N, Hilbink M, Weenk M, et al. Oncologic multidisciplinary team meetings: evaluation of quality criteria. *Journal of evaluation in clinical practice* 2013;**19**(6):1035-43.

57 Gort M, Broekhuis M, Regts G. How teams use indicators for quality improvement - a multiple-case study on the use of multiple indicators in multidisciplinary breast cancer teams. *Social science & medicine (1982)* 2013;**96**:69-77.

58 Jalil R, Soukup T, Akhter W, et al. Quality of leadership in multidisciplinary cancer tumor boards: development and evaluation of a leadership assessment instrument (ATLAS). *World journal of urology* 2018;**36**(7):1031-8.

59 van der Werf LR, Kok NFM, Buis CI, et al. Implementation and first results of a mandatory, nationwide audit on liver surgery. *HPB : the official journal of the International Hepato Pancreato Biliary Association* 2019;.

60 Deneckere S, Robyns N, Vanhaecht K, et al. Indicators for follow-up of multidisciplinary teamwork in care processes: results of an international expert panel. *Evaluation & the health professions* 2011;**34**(3):258-77.

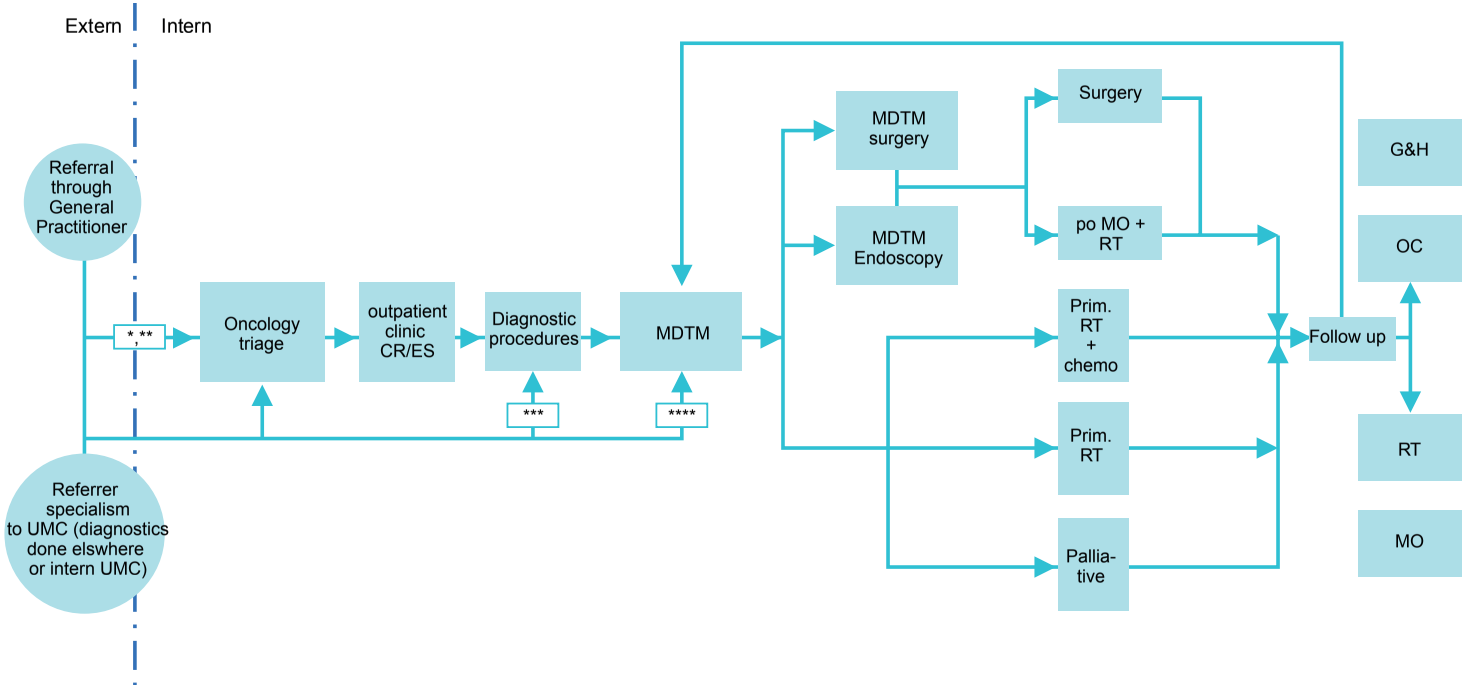
61 Jalil R, Ahmed M, Green JS, et al. Factors that can make an impact on decision-making and decision implementation in cancer multidisciplinary teams: an interview study of the provider perspective. *International journal of surgery (London, England)* 2013;**11**(5):389-94.

62 Lemieux-Charles L, McGuire WL. What do we know about health care team effectiveness? A review of the literature. *Medical care research and review : MCRR* 2006;**63**(3):263-300.

63 Dikken JL, Stiekema J, van de Velde CJ, et al. Quality of care indicators for the surgical treatment of gastric cancer: a systematic review. *Annals of surgical oncology* 2013;**20**(2):381-98.

ADDITIONAL FILES

Supplementary file 1. Illustration GIO Care pathway before the reorganization



The care pathways start with referral to the UMC by a general practitioner in case of population screening for bowel disease or a specialist (tertiary or quaternary). During the oncology triage the diagnostic work is reviewed before a patient is invited to the outpatient clinic and discussed in the MDTM. After the GIO-MDTM additional MDTMs are needed to prepare for a specific treatment, e.g. MDTM for surgery and Endoscopic Retrograde Cholangiopancreatography. After the treatment the gate-keeping specialism performs a short follow-up before the patient is transferred back to the referring hospital or general practitioner.

Abbreviations: Chemo: Chemotherapy, G&H: Gastroenterology & Hepatology, GIO: Gastro-Intestinal Oncology, MDTM: Multidisciplinary team meeting, MO: Medical Oncology OC: Oncology surgery, Po: Preoperative, Prim.: Primary, RT: Radiotherapy, UMC: University Medical Centre.

In the schematic arrows: *: Colorectal, **: Esophagus-Stomach, ***: Hepatobiliary tertiary, ****: Hepatobiliary quaternary.

Supplementary file 2. Interview Guide

Topic	Questions
Results interpretation	These are the results of the evaluation measures: throughput times, MDTMs and hospital visits. Can you describe the relevance of these results for you? What is your impression of the reorganisation of the MDTM in your care pathway?
Role of gate-keeping specialist or case manager	What is the role of the gate-keeping specialist / case manager in the GIO-MDTM? Holding MDTMs is required by the SONCOS guidelines and the Dutch Health Care Inspectorate, how useful do you think MDTMs are with your patient category?
Added value	What would be an ideal GIO-MDTM? What do you think could be modified in the GIO-MDTM to make the consultation more effective and more efficient? How are MDTMs evaluated?

GIO: Gastro-Intestinal Oncology, MDTM: Multidisciplinary team meeting, SONCOS: Stichting Oncologische Samenwerking (Dutch)

Supplementary file 3. Coding tree evaluation reorganisation Gastro-Intestinal Oncology multidisciplinary team meeting

Major theme	*Minor theme*	*Code*	*Code description*	*Scores*		*Total*
				coder 1	*coder 2*	
Integrated care	Continuity of care	1	The case manager should be a counsellor throughout the entire care pathway, also psychosocial.	14	9	23
	Triage including regional care	2	The GIO-MDTM of the tertiary centre (University Medical Centre) coordinates regional care.	6	8	14
		3	Combining adequate triage of the referral letter with requesting additional information leads to more efficient outpatient visits and GIO-MDTM.	9	4	13
		4	Triage requires expertise of specialist and case manager.	8	5	13
		5	Seeing all patients before GIO-MDTM is not feasible.	3	4	7
		6	Regional secondary centres are sending complex malign and benign cases to expertise in tertiary centre.	3	4	7
		7	The discipline to which the patient is referred (the gate-keeping specialist) is the 'face' of the UMC for the patient.	2	0	2
	Timely treatment plans and treatment	8	The case manager monitors throughput times of the entire care pathway.	14	9	23
		9	The case manager influences diagnostic requests.	15	1	16
		10	GIO-MDTMs lead to customised treatment plan and actions for complex cases.	8	7	15
	Adequate information	11	The case manager accelerates the process to gather information for the GIO-MDTM, often from regional hospitals.	21	5	26
		12	External communication for the tertiary referral works, for instance because of the comprehensive information on the website.	1	3	4
		13	It is not always clear to the patient who the main responsible physician is.	1	1	2
	Patients' wishes	14	Screening on patient wishes with elderly patients (>65 years).	5	10	15
		15	Avoids patients making unnecessary long journeys, also in view of the environment.	1	8	9
		16	Patient satisfaction should be measured.	1	1	2

Major theme	Minor theme	Code	Code description	Scores		Total
				coder 1	coder 2	
Added value Multi-disciplinary team meeting (MDTM)	Goals MDTM	17	The policy, goals and value of the GIO-MDTM are important.	7	0	7
	Team performance	18	In the GIO-MDTMs there is always a good team spirit, where colleagues confront each other about undesirable and desirable behaviour.	2	8	10
		19	The physician feels supported by the MDTM.	6	3	9
		20	Unite the case manager and nurse practitioner in the same position.	5	2	7
	Meeting preparation	21	Non-complex cases or 'formalities' and complex cases should be distinguished for efficiency.	8	12	20
		22	Preparation cases mono- or bi-disciplinary for GIO-MDTMs makes them more efficient.	8	3	11
		23	The additional task of specialists to prepare the GIO-MDTM is not scheduled.	4	3	7
	Attendance key members	24	GIO-MDTMs are the moments where all expertise comes together once a week to make an optimal multidisciplinary treatment plan.	21	15	36
		25	Improve structural participation of various specialisms.	3	2	5
	Role of chair	26	The role of the chair of the GIO-MDTM is to monitor the meeting process, summarise discussions and formulate the conclusions.	18	13	31
		27	The chair of the GIO-MDTM rotates between the surgery and the gastroenterology & hepatology teams.	4	5	9
	Role of gate-keeping specialist in MDTM	28	The gate-keeping specialism is responsible for a good intake and presents the patient in the GIO-MDTM – this is a key role.	15	17	32
		29	For HPB, 'bilateral' adjustments are often implemented after the GIO-MDTM without reference in the treatment plan.	2	6	8
	Time to discuss patients	30	Better planning and time management during GIO-MDTM.	9	10	19
		31	There is not enough time for input from case managers in the GIO-MDTM, which hampers discussion on fragile elderly patients and psychosocial aspects.	7	6	13
		32	There is a risk that specialists do not give correct advice due to too much or too little communication - long lists of patients.	2	4	6
	Software database	33	Work more often from EPD during GIO-MDTM.	8	5	13
	Education	34	Knowledge and skills are shared in GIO-MDTM, for instance for training specialists.	3	1	4

Major theme	*Minor theme*	*Code*	*Code description*	*Scores*		*Total*
				coder 1	*coder 2*	
Management care pathway	Process and clinical outcomes	35	Lead time on which the physician has no influence.	8	17	25
		36	There is not enough therapeutic capacity, in particular OR capacity for surgery and Endoscopic Retrograde Cholangiopancreatography.	4	0	4
	Slot 'diagnostics'	37	More awareness is needed of the importance of slots for 'diagnostic procedures'.	7	7	14
	Slot 'intake'	38	Better estimation of slots for GIO-intake needed on day of outpatient visit.	5	4	9
	Requirement for MDTM discussion	39	HPB GIO-MDTM can be done 'on paper', a GIO-intake is not always needed to make a treatment plan.	3	2	5
	Evaluation of MDTM	40	GIO-MDTM is valuable for quality and an internal second opinion.	6	5	11
		41	There is an increase in the number of patients, which means less time per patient, monitor capacity to prevent quality degradation.	6	2	8
		42	Efficiency: GIO-MDTM stimulates presence.	7	3	10
		43	Reorganisation of the GIO-MDTM did not offer benefits in all care pathways.	5	5	10
		44	Importance of meeting space, more interaction and commitment in U-form.	7	9	16
		45	Case managers are not always invited to the separate meetings on policy and improvement opportunities.	18	6	24
		46	Willingness to improve – a dashboard with indicators gives insight into management results.	5	15	20
	Evidence-based guidelines	47	Discussing all patients from the region in accordance with the guidelines, also the non-complex cases or 'formalities'.	2	5	7
	Complex	48	Because only complex care is provided in the UMC this means additional workload.	8	4	12
		49	Better indication of patients with comorbidity or fragile elderly patients.	7	3	10
	Clinical trials	50	GIO-MDTMs are important for inclusion of patients in clinical trials.	4	3	7
Total				346	284	630

Coding tree evaluation reorganisation GIO-MDTM:
This coding tree has major and minor themes that were derived from the first research question (effect of reorganisation on integration of care) and second research question (added value as described in perceived benefits and drawbacks) and minor themes derived from researcher's field notes.
If a code was seen as a benefit it is shown in green, 30 codes were identified 418 times (66.3% of the total); drawbacks are shown in red, 20 codes were identified 212 times (33.7%).
The number of scores is given for the first coder, the second coder and the total.
GIO-MDT = Gastro-Intestinal Oncology multidisciplinary team; MDTM = MDT Meeting; HPB = Hepatobiliary; EPD = Electronic Patient Dossier.

Supplementary file 4. Tables Patient and tumour characteristics of the care pathway
Table a. Patient and tumour characteristics of the colorectal pathway

	Before reorganisation		After reorganisation		Sign.
	2014 (n = 32)		2015 (n = 34)		
Age* Mean (sd)	68	(9)	63	(13)	.090
Gender**	n	%	n	%	.088
Female	15	47	23	68	
Tumour localisation***					.804
Colon	6	19	6	18	
Recto-Sigmoid	5	16	5	15	
Rectum	19	59	19	56	
Peritonitis	2	6	2	6	
Abdomen	0	0	2	6	
Tumour size***					.201
T1	2	6	5	15	
T2	1	3	5	15	
T3	11	34	13	38	
T4	5	16	5	15	
Not reported****	13	41	6	18	
Type of diagnosis					
Primary tumour***	12	38	22	65	.114
Locally Adv	2	6	0	0	
Metastases	6	19	5	15	
Recurrence	8	25	6	18	
Restaging	3	0	0	0	
Infection	1	3	1	3	

* = Mann-Whitney-U; ** = Chi^2; *** = Chi^2 Exact; **** Tumour-size not given in MDTM report

Table b. Patient and tumour characteristics of the hepatobiliary pathway

	Before reorganisation		After reorganisation		Sign.
	2014 (n = 36)		2015 (n = 32)		
Age* Mean (sd)	66	(10)	65	(13)	.863
Gender**	n	%	n	%	.666
Female	15	42	15	47	
Tumour localisation***					1.000
Gall bladder	1	3	1	3	
Pancreas Intra	12	33	11	36	
Ampulla Vateri	1	3	1	3	
Liver	22	61	18	58	
Tumour size***					.549
T1	2	6	3	9	
T2	3	8	4	13	
T3	10	28	7	22	
T4	4	11	7	22	
Not reported****	17	47	11	34	
Type of diagnosis***					
Primary tumour	12	33	18	56	.039
Locally Adv	0	0	1	3	
Metastases	17	47	13	41	
Recurrence	2	6	0	0	
Restaging	3	8	0	0	
Infection	2	6	0	0	

* = Mann-Whitney-U; ** = Chi^2; *** = Chi^2 Exact; **** Tumour-size not given in MDTM report

Table c. Patient and tumour characteristics of the esophagus-stomach pathway

	Before reorganisation		After reorganisation		Sign.
	2014 (n = 28)		2015 (n = 32)		
Age* Mean (sd)	64	(9)	69	(10)	.050
Gender**	n	%	n	%	.061
Female	9	32	18	56	
Tumour localisation***					.301
Esophagus	24	86	24	75	
Stomach	4	14	8	25	
Tumour size***					.873
T1	4	14	2	6	
T2	4	14	6	19	
T3	14	50	16	50	
T4	5	18	6	19	
Not reported****	1	4	2	6	
Type of diagnosis***					
Primary tumour	26	93	25	78	.802
Metastases	1	4	3	9	
Recurrence	1	4	1	3	
Restaging	0	0	1	3	
Lymphoma	0	0	1	3	
Gist	0	0	1	3	

* = Mann-Whitney-U; ** = Chi^2; *** = Chi^2 Exact; **** Tumour-size not given in MDTM report


INEKE BRUIN 2020

CHAPTER 4

Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review

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ABSTRACT

Introduction

Various forms of video-conferenced collaborations exist in oncology care. In regional oncology networks, multidisciplinary teams (MDTs) are essential in coordinating care in their region. There was no recent overview of the benefits and drawbacks of video-conferenced collaborations in oncology care networks. This scoping review presents an overview of videoconferencing (VC) in oncology care and summarises its benefits and drawbacks regarding decision-making and care coordination.

Design

We searched MEDLINE, Embase, CINAHL and the Cochrane Library from inception to October 2020 for studies that included VC use in discussing treatment plans and coordinating care in oncology networks between teams at different sites. Two reviewers performed data extraction and thematic analyses.

Results

Fifty studies were included. Six types of collaboration between teams using VC in oncology care were distinguished ranging from multidisciplinary teams collaborating with similar teams or with national or international experts to interactions between palliative-care nurses and experts in that field. Patient benefits were less travel for diagnosis, better coordination of care, better access to scarce facilities, and treatment in their own community. Benefits for healthcare professionals were optimised treatment plans through multidisciplinary discussion of complex cases, an ability to inform all healthcare professionals simultaneously, enhanced care coordination, less travel and continued medical education. VC added to the regular workload in preparing for discussions and increased administrative preparation.

Discussion

Benefits and drawbacks for collaborating teams were tied to general VC use. VC enabled better use of staff time and reduced the time spent travelling. VC equipment costs and the lack of reimbursement were implementation barriers.

Conclusion

VC is a highly useful for various types of collaboration in oncology networks and improves decision-making over treatment plans and care coordination, with substantial benefits for patients and specialists. Drawbacks are additional time related to administrative preparation.

Keywords

Added value, collaborating teams, multidisciplinary team meeting, regional oncology network, videoconferencing (MeSH term)

Strengths and limitations of this scoping review

- Scoping review that identified benefits and drawbacks of videoconferencing for collaborating teams in oncology networks.
- In-depth analysis with detailed mapping of multidisciplinary teams collaborating in regional oncology networks showing the benefits and drawbacks.
- Organisational, logistical and technical recommendations for collaborating teams who want to consider or optimise videoconferencing usage.
- The results of some included studies were open to possible misinterpretation because the aims and qualitative descriptions were often not clearly explained.

INTRODUCTION

In oncology care, there are different types of collaboration between teams when coordinating integrated care for their patients[1-4]. Some teams treating rare tumours search out the expertise of specialised national and international experts who then share their knowledge. Some teams in palliative oncology care consult specialists while caring for patients in the last phase of their life. Further, multidisciplinary teams (MDTs, see list of abbreviations) in regional oncology networks are essential to provide a treatment plan and to coordinate care in their region. MDTs consist of specialists who focus on evidence-based treatment of patients. Oncology guidelines summarise the various key specialisms required for treating modalities surgery, medical oncology and radiotherapy, and for the different imaging specialisms depending on the biology of the tumour[5, 6].

In the 1990s, videoconferencing (VC) was introduced in oncology networks to address care pathways for high complexity - low volume care and for rare tumours. With VC, members of MDTs based in different locations but treating the same patient do not need to physically attend the multidisciplinary team meetings (MDTMs). Imaging, pathology and lab information could be shared during a VC session[7, 8]. VC-MDTMs are often in addition to institution-based meetings, increasing workload and requiring coordination.

Scoping reviews are used to identify, retrieve and summarize literature relevant to a particular topic. They aim to identify and map the key concepts underpinning a research area, the main sources, and types of evidence available[9-11]. They typically do not include a process of quality assessment[10, 12]. In an earlier scoping review of clinical applications of VC[13], the characteristics of the studies included were summarised, but benefits and drawbacks were not evaluated. In a more recent review regarding e-health, VC was mentioned, along with its benefits and drawbacks, but not specifically for collaborating teams within oncology networks[14]. An overview of the benefits and drawbacks would be helpful for policymakers and for teams collaborating across different locations in deciding whether to introduce VC to improve care coordination, lower costs and reduce travel time.

The current scoping review was designed to provide an overview of different types of VC by teams collaborating in oncology networks. It then focussed on those MDTs that discuss diagnostic and treatment plans, and coordinate care within their regional oncology network. As such, our research questions were formulated as:

How does videoconferencing contribute to decision-making collaborating teams in oncology care at different locations?

What benefits and drawbacks of videoconferencing are perceived by MDTs in coordinating care in their regional oncology network?

METHODS

This review is reported according to the Preferred Reporting items for Systematic Reviews and Meta-Analysis for scoping reviews (PRISMA-Scoping-Review)[15]. The objectives, inclusion criteria and methods adopted in this scoping review were specified in advance and documented in a protocol (Supplement 1).

Sources and search strategy

We searched four electronic databases: MEDLINE (PubMed), Embase (embase.com), CINAHL (EBSCO) and the Cochrane Library, from inception of the databases to October 27th 2020.

The searches were developed in collaboration with an information specialist (SvdW). The search strategies were based on three concepts: 1) multidisciplinarity, 2) videoconferencing and 3) oncology. For each concept, a controlled vocabulary (including MeSH terms) and free-text terms were combined (Supplement 2). No time or language restrictions were applied. In addition to the database searches, the references of included studies were also screened for additional relevant articles.

Screening and selection

Two reviewers (LvH and PD) independently assessed titles and abstracts. If a title and abstract provided insufficient information, or the reviewers disagreed, the full text was assessed by the same reviewers to determine inclusion. If the reviewers disagreed over a full-text assessment it was then discussed and, if no consensus was achievable, an independent reviewer (JR) provided a binding verdict.

Inclusion and exclusion criteria

To map different types of VC collaboration in oncology networks, we included studies if they were: 1) describing research on oncology care pathways, 2) original research, 3) full-text, 4) describing VC to communicate between teams at different locations, and 5) reporting benefits and drawbacks of VC use. Studies were excluded if: 1) VC was only used for telemedicine[16, 17], indicating one of the groups at a location were patients only; 2) VC was solely used for research or education, or 3) the article was a review, letter to an editor, or congress abstract.

Data extraction and analysis of subsets

In Phase 1 of this scoping review, the following data were extracted for all the included studies: country of the teams using VC, aim of the study, research method and data source, number of cases discussed, number of VC and face-to-face MDTMs, benefits and drawbacks, frequency of VC-MDTMs, tumour type and study period. Based on these data, we performed a thematic analysis to distinguish different types of collaboration through VC. The similarities and differences were mapped by type.

Since we were particularly interested in the types of collaboration adopted within regional oncology networks, we mapped the specific types of VC collaboration in detail regarding similarities and differences, and summarised the reported benefits and drawbacks, the members of the MDTs who discuss diagnostic and treatment plans, and specifics of the VC platform used. In assessing the collaborating MDTs, we mapped VC participants for the cancer treatment's surgery, oncology and radiotherapy modalities, and described the VC Platform used.

If data were not sufficiently described in the paper reviewed, we looked in referred papers (describing the same study) or contacted the corresponding author via email, asking them to provide the missing information.

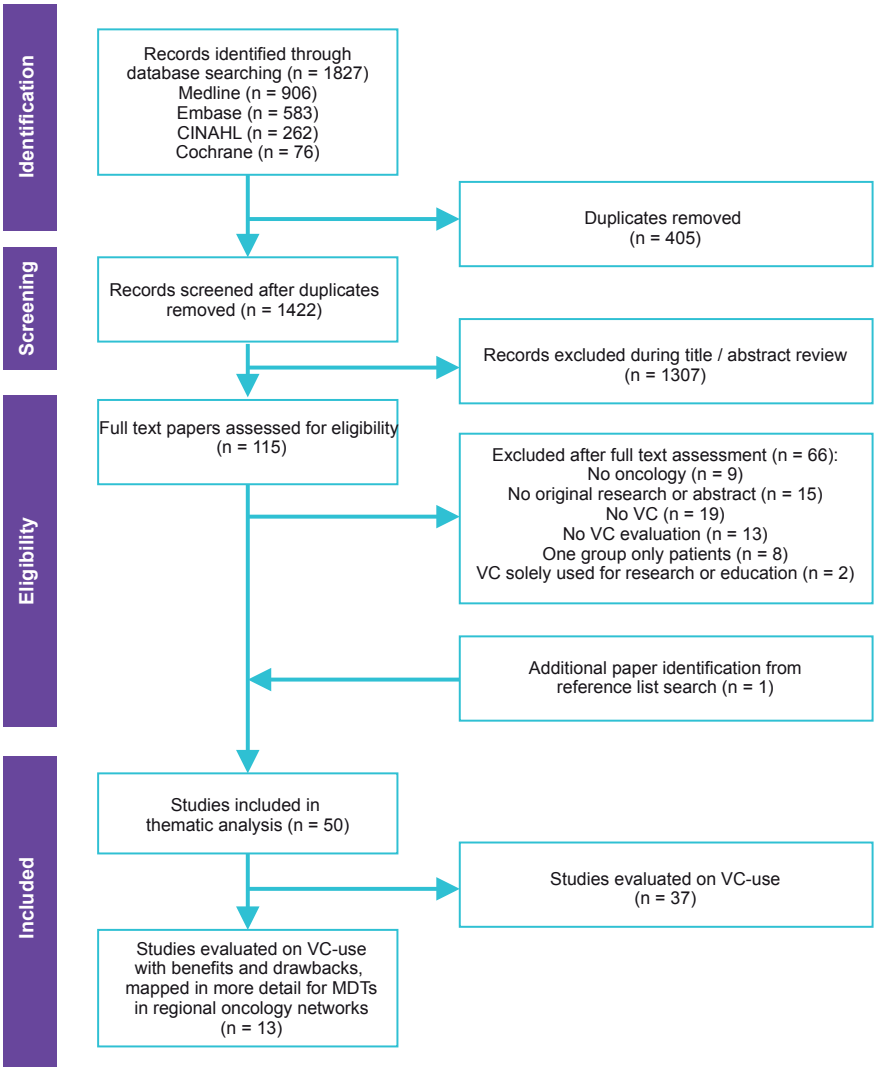
Patient and public involvement

This study was a scoping review on the use of VC by collaborating teams in oncology networks and therefore the study design did not seek patient and public involvement.

RESULTS

A total of 1422 unique records were identified (Figure 1). From this, 115 papers were selected for full text assessment, and one further paper was found in a reference list of an included study. After full text assessment, 50 studies remained for data extraction (Supplement 3).

Figure 1. PRISMA-Scoping-Review flow diagram of study selection



Study characteristics

VC was described in 37 studies related to oncology treatment for adults, 5 studies for children and adolescents and 8 studies on palliative care. VC was most frequently described for teams working in the USA (n = 12), the UK (n = 7) and Germany (n = 5) (Supplement 4). In 11 studies, multiple types of tumours were treated, 12 focussed on breast cancer, 11 on gastro-intestinal cancer, 8 on lung cancer, 6 on head & neck cancer and 17 on various other specific cancer types (Supplement 5). The frequency of multidisciplinary meetings ranged from daily to monthly.

Considerable heterogeneity was found between the studies concerning research methods, data sources, primary outcome, and details of reporting. Four prospective studies of which 2 randomized controlled trials were included. Qualitative research methods (e.g. interviews and participating observations) and quantitative methods (e.g. surveys and database analysis) and as well as mixed methods were applied in the studies.

The most frequently used research method in the reported studies was review of databases, case records or VC notes (31 studies). A survey among healthcare professionals, or patients and their families, on the use of VC was also a frequently applied method (23 studies). In 23 studies, two or more data sources were combined. In some studies, the aims, methods and data sources were not clearly described; we deduced the most likely aims, methods and data sources, which are shown in *italics* in the tables.

Thematic analysis and synthesis of subsets

Six types of VC usage in team collaboration in oncology care were distinguished (Table 1). Expert MDTM-National: providing expertise and experience on rare tumours nationally (17 studies)[18-34], 2) Expert MDTM-International: providing international expertise and experience on rare tumours (5 studies)[35-39], 3) Expert Consultation: physicians caring for complex patients seeking a consultation with experts (11 studies)[40-50], 4) Consultation Specialist – Nurse: nurses consulting with palliative treatment specialists in specialised palliative care units or hospices (4 studies)[51-54], 5) MDT-Equal: involving more-or-less equal MDTs that use each other for a 'fresh look' to optimise the diagnostic and treatment plans for complex cases (5 studies)[55-59] and 6) MDTM-Collaborate: MDTs collaborating to form one MDTM (8 studies)[60-67] (Supplement 5).

We used the term 'MDT-Equal' for teams that had broadly equal expertise and know-how in treating a specific type of patient. Here, the opting to use VC was to optimise treatment plans and to coordinate care. To be classified as such a team, at least two key specialisms for diagnosing and treatment and at least two 2 specialists needed to be present at each site. In comparison, the term 'MDTM-Collaborate' is used for teams that have complementary expertise and need each other to make a complete team of experts to treat and to coordinate care for a specific type of patient. Together the individual teams form an MDTM and, through this, comply with national legislation and oncology guidelines.

Table 1. Features of the types of VC collaboration identified in oncology networks

Feature vs type	*Expert MDTM-National*	*Expert MDTM-International*	*Expert Consultation*	*Consultation Specialist – Nurse*	*MDT-Equal**	*MDTM-Collaborate***
Healthcare professionals in VC meeting	Same type of specialists in national expert team discuss with MDTs at different locations via VC	Specialists of an MDT in one country give advice to and discuss with MDTs in a low-income country via VC	Specialists with expertise give advice via VC to treating physicians	Consultant for palliative care gives advice via VC to nurses in palliative care unit or hospice on care plan	Same type of specialists in MDTs at different locations discuss via VC	Complementary specialists at different locations together form a single MDTM via VC
# healthcare professionals	≥ 2 each site	≥ 2 each site	1 or more	1 or more	≥ 2 each site	≥ 2 each site
Purpose	Provide expert opinion and advice on diagnostic or treatment plan	Provide expert opinion and advice on diagnostic or treatment plan	Provide expert opinion and advice on treatment plans	Provide medical specialist advice on care plans and incident handling	Optimize diagnostic or treatment plan made in onsite MDTM	Formulate diagnostic or treatment plan
Setting	National outreach***: university centre to regional oncology networks	International outreach***: experts support oncology treatment in another country	Consultancy for specific expertise for rare tumours	Regional network specific collaboration	Regional network: cancer centre with general hospital	Regional network: cancer centre with general hospital
Patient travel	No	No	No	No	Prevent unnecessary travel	Yes, to location of scarce facility; triage via VC-MDTM
Responsibility for care	Advice on diagnostic and treatment plan	Advice on diagnostic and treatment plan	Treatment and palliative care in region	Palliative care in region	Coordinating patient care in region	Coordinating patient care in region
Treatment coordination	Own patients and sometimes referral to scarce facility	Own patients	Own patients	Specialised nurses provide care for own patients	Own patients	Refer patients to each other
Frequency	Diverse (daily - monthly)	Monthly (1 study thrice per week)	Bi-weekly (4 studies weekly)	Weekly (1 study Monthly)	Weekly (1 study monthly)	Weekly

= number of; MDT = multidisciplinary team, MDTM = multidisciplinary team meeting; VC-MDTM = video-conferenced multidisciplinary team meeting.

* the MDT specialists are more or less equivalent in terms of experience, detailed techniques may differ depending on experience or specialist preference;

** medical oncologists and surgeons refer patients, if necessary, to each other after a VC-MDTM;

*** outreach is the activity of providing services to any parts of the population that might not otherwise have access to those services.

Since the focus of this scoping review was on the collaboration of teams in regional oncology networks, we reported on the detailed mapping for MDT-Equal and MDTM-Collaborate (13 studies, Supplement 6). We discussed the different topics with the amount of studies in which it is reported.

Benefits and drawbacks of MDT-Equal and MDTM-collaborate

VC in MDT-Equal and MDTM-Collaborate is aimed at collaboration in a regional oncology network. First we will discuss common benefits and drawbacks related to the collaboration in a regional oncology network and thereafter we will discuss the separate benefits and drawbacks of MDT-Equal and MDTM-Collaborate (Table 2, Supplement 6 and Supplement 7).

Table 2. MDT-Equal and MDTM-Collaborate, mapping of benefits and drawbacks

MDT-Equal and MDTM-Collaborate (n=13)	MDT-Equal (n=5)	MDTM-Collaborate (n=8)
Common Benefits	Benefits	Benefits
Multidisciplinary discussion (13)	Complex case discussion, optimised treatment plans (5)	Form a single MDTM to draw up treatment plan (8)
Improved coordination of care (11)	Recommendations with enhanced care coordination (3)	Improved access to scarce facilities, enhanced coordination of care (8)
Training on-the-job (5)	Align protocols, peer review (2)	Improved compliance to standards and guidelines (7)
Less travel MDs (6)		Less travel for patients (2)
	Insurance companies favour lower cost (1)	Reduced cost VC, less than FtF (3)
Common drawbacks with *solutions*	Drawbacks with *solutions*	Drawbacks with *solutions*
Difficult getting information complete (9) *Format case presentations (5)*	Additional VC increased workload (2) *Integrate VC in onsite MDTM*	Equipment flaws (3) *Technical support*
Administrative workload increased (5)	VC less suitable for research (1)	VC required attendance is troublesome (2)
Costs / no reimbursement (3)	Professional relationships decreased (1) *U-shaped table*	VC reduced confidentiality (1)

Common benefits

VC enhanced multidisciplinary discussions between specialists and other healthcare professionals on diagnostic and treatment plans in all 13 studies where this was investigated[55-67]. VC strengthened their collegial networks, or established new partnerships, resulting in virtual management of regional oncology networks. In this way, VC facilitated collegial support and reduced professional isolation. VC was shown to reduce travel for specialists (6 studies)[56, 58, 62-64, 67], although only two studies evaluated costs in detail[57, 58].

Care coordination was considered to be improved (11 studies) [55-57, 59-63, 65-67]. VC discussions on complex cases were considered educational for younger specialists and were a form of on-

the-job training (5 studies)[56, 57, 60, 61, 66]. Most studies reported that MDTM participants would be willing to replace face-to-face meetings to discuss treatment plans for their patients with VC-MDTMs if the benefits outweighed the drawbacks and the technology would support it at lower costs[55-63, 65-67].

Common drawbacks and solutions

It was difficult to get all the information needed prior to case presentations during VC, and workload increased as more cases were registered over time (9 studies)[55, 57-59, 61, 62, 64, 66, 67]. Using a structured format to gather information made case presentations more concise and complete, and it reduced the workload. Discussions in MDTs were found to be time consuming and MDT members questioned whether all cases should be presented, as in the guidelines, or only complex cases that would benefit patients by optimising treatment plans (5 studies)[58-60, 66, 67]. The costs of VC equipment and the lack of reimbursement were reported as an implementation barrier, although some insurance companies were willing to discuss reimbursement if VC costs would be lower than face-to-face (3 studies)[57, 58, 61]. The administrative workload increased because digital CT images had to be transmitted to a viewing station, which had to be planned and executed by all teams involved before a meeting (5 studies)[57, 60-62, 64]. Also, the available bandwidth could not be used for both data and video (images and sounds) at the same time.

Benefits of MDT-Equal

Using videoconferencing between equal teams led to optimised diagnostic or treatment plans for complex cases and provided easy access to second opinions (5 studies)[55-59]. Recommendations given during videoconferencing to treatment plans resulted in less correspondence between MDT members (3 studies)[56, 58, 59]. VC was also used for aligning protocols, with peer review principles being used to stimulate working according to oncology guidelines (2 studies)[58, 59]. VC between collaborating institutes within a region was stimulated by the health insurance company favouring VC if it lowered costs (1 study)[58].

Drawbacks and solutions of MDT-Equal

In the collaboration of a cancer centre with its partner, holding three MDTMs weekly (two face-to-face onsite MDTMs and one VC-MDTM) was seen as time consuming in terms of preparing, making notes and taking additional actions (2 studies)[58, 59]. It was proposed to integrate the VC into the institutional MDTMs by standardising the meeting formats[59]. Professional relationships between members with different disciplines decreased, resulting in less sharing of uncertainties and less inclination to think of ways to collaborate for the benefit of the patient (1 study)[55]. When the participants faced each other (across a U-shaped table) and after VC training, interaction between the different specialisms improved (1 study)[55]. VC was considered less suitable for research discussions and for including patients in clinical trials (1 study)[56].

Benefits of MDTM-Collaborate

VC also helped specialists in oncology networks that required each other to bring together all the disciplines needed to draft diagnostic, or collaborate over, treatment plans to form a single

MDTM. Using videoconferencing could help them plan with the patient and avoid unnecessary travel for patients (8 studies)[60-67]. VC facilitated the access of patients from rural communities to scarce, urban facilities such as radiotherapy units (8 studies)[60-67]. VC enhanced care coordination through case management that could identify the best treatment in a timely manner. VC enabled MDTs to meet national standards and guidelines when addressing rare tumours (7 studies)[60-66], of those studies only three evaluated VC in relation to waiting times[60, 62, 67]. VC reduced travel for patients (2 studies)[61, 67].

Drawbacks and solutions of MDTM-Collaborate

Equipment problems had occurred during project start-up but these were reduced by technical support (3 studies)[60, 62, 64]. Ensuring the attendance of the mandatory specialisms required to fulfil guideline compliance was troublesome (2 studies)[64, 67]. Other drawbacks of VC were reduced confidentiality and not having the possibility to examine a patient. Privacy issues should be addressed in guidelines (1 study)[61].

DISCUSSION

We have provided an overview of current VC use by collaborating teams in oncology networks. Six different types of team collaborating through VC were distinguished in oncology care: Expert MDTM-National, Expert MDTM-International, Expert Consultation, Consultation Specialist - Nurse MDT-Equal and MDTM-Collaborate. For the MDT-Equal type, VC constituted an additional MDTM held to discuss complex cases and provide optimised treatment for these patients. For the MDTM-Collaborate type, VC enabled specialists to form a single MDTM that included the complementary specialisms required to meet guidelines, and resulted in their patients getting access to treatment in scarce facilities. For both types, the most important benefits were enhanced coordination of care and on-the-job training compared to the situation with only face-to-face MDTMs at the collaborating locations or institutes.

Some of the benefits and drawbacks were not unique to the MDT-Equal or MDTM-Collaborate types, they were also reported in studies addressing the other four types. The sustainability of VC was determined by the way the different teams collaborated, how well they knew each other, and how well VC was embedded in the organisation. The perceived benefits and the behaviour of members in overcoming barriers and finding solutions together were helpful in gaining VC acceptance. Some papers reported reduced efficiency[55, 57, 58], although others reported more cases being discussed in a VC than a face-to-face MDTM due to more efficient discussions[64, 67]. During VC meetings, behaviour tended to become more formal and the different disciplines would merely state their views, and not help each other to formulate an optimal treatment plan for the patient. This behaviour could result in using more time than necessary to discuss a patient. However, if the teams met each other physically at least once a year and received VC training, this would consolidate feelings of solidarity and the VC communication between the teams improved[55, 59, 61, 68, 69]. To summarise, a well-functioning MDTM, either by VC or face-to-face, requires the active participation of qualified and effective experts and optimised functioning in terms of format, structure, case selection and presentation, review, leadership and interaction between the participants[70].

The benefits gained by discussing complex cases would be enhanced if the MDTs could choose which cases to focus upon, but several European guidelines require all patients to be discussed in an MDTM[58, 59, 62], whether it is through video-conferencing or face-to-face. There are also no standardised formats or guidelines worldwide for MDTMs, although some countries have evaluated and then standardised formats for MDTMs that include VC use[3, 71]. These formats can, for instance, require completing an electronic form prior to the start of the MDTM that is then summarised at the start of the group discussion on a patient. Also clearly defined roles of participants of VC is important[70].

This review showed that exploiting VC can lead to the better use of staff time compared to face-to-face meetings by reducing the time spent travelling, although some studies cautioned that VC preparation required additional extra time. Elsewhere, the costs of VC equipment and the lack of reimbursement mechanisms were an implementation barrier[72]. It was noted that insurance companies favour VC if it lowers costs[58]. Besides these costs also societal impact of improved health and wellbeing of patients in rural areas should be taken into account[65,73].

All over the world, collaborating teams in oncology networks now use VC to: 1) bring evidence-based care to the best place for a patient to receive it; 2) discuss complex cases and rare tumours; 3) simultaneously and quickly inform and update all healthcare professionals involved

in the treatment of an individual patient; and 4) share expertise to educate and provide on-the-job training. The role of opinion leaders was seen as important for the successful adoption of VC, to counter reservations on using VC, meticulous planning and cultivation of support is key to gaining and sustaining provider acceptance[60].

In one study it was concluded that a speed of at least 2 Mbps is needed to simultaneously stream video, see each other and 'walk through' CT or MRI images. It was seen as essential during complex case discussions to be able to see each other and at same time the detailed patient data in order to be able to diagnose a patient, evaluate the tumour stage and draw up an optimal multidisciplinary treatment plan[59].

Most studies reported that participants would willingly replace face-to-face MDTMs with ones based on videoconferencing to discuss treatment plans for their patients if the benefits outweighed the drawbacks and the technology would deliver sufficient support at lower costs. However, as of 2018, only a minority of institutions in the USA had videoconferencing available (26%); although the majority would participate (57%) if it was available[72]. VC should be tailored to the local needs and the specific requirements for diagnosis and treatment that depend on the biology of the tumour[29, 49].

Limitations

This review included a broad range of studies that used different research designs, settings and methods. Some studies were project set-up descriptions. Often, research methods were not well described. In fact, if we had excluded all the studies that did not follow guidelines for reporting research, we would have been left with very few studies to review. As such, the value of the included studies would have improved substantially if these guidelines had been followed[13, 74].

During the analysis of the data contained in the included studies, we saw that the methodology used in the studies and the description of results were often open to interpretation. Therefore two reviewers read all the studies in detail and extracted data in an iterative process. Thereafter , the information was mapped to provide an overview of benefits and drawbacks.

Recommendations

Based on the review of studies, we have formulated practical recommendations for the use of VC by collaborating teams, which we list in three categories.

Organisation of collaboration

- Create institutional commitment with local leadership, coordination and dedicated time for VC-MDTM members[19, 25, 34, 61].
- Meet in person at least annually to discuss policies, improve knowledge, and to come to know and trust each other[59, 61].
- Evaluate your VC-MDTMs with a focus on[58]:
  - patient perspectives and
  - strengthening the contributions of care personnel.
- Arrange the participation of qualified and effective experts[58].

- Organise weekly meetings and use a pre-meeting checklist to minimise delays in starting treatment[28].
- Organise administrative support so that physicians can concentrate on medical aspects and the number of cases to be discussed can be optimised[57, 58, 60].
- Tailor the videoconferencing to local needs and disease-specific aspects including diagnosis and the treatment phase depending on the biology of the tumour[29].

VC meeting logistics

- Run VC meetings within an established framework such as used with local MDTMs[61].
- Ensure appropriate case selection ('admission rules')[48].
- Use a standardised format to present cases[30, 58].
- Minimise the impact on healthcare professionals' practices, minimise the workload in preparing for a VC meeting and respect traditional referral patterns[61].

VC platform requirements

- VC platform with at least two cameras and microphones:
  - U-form seating plan so as to face each other[55];
  - bandwidth more than 2 Mbps[59].
- An ability to see, at the same time, on two screens:
  - participants for optimal personal interaction[55].
  - real time actual data, such as imaging, histology and required test results to verify the diagnosis, tumour stage and treatment options[58, 59].

Further research

Future research on VC should include pre- and post-designs. Team collaboration over decision-making for treatment plans and care coordination should be compared in face-to-face and VC situations. The benefits and drawbacks should be assessed using well-defined quantitative and qualitative criteria.

COVID-19 pandemic

The data analysis phase of this review coincided with the start of the COVID-19 pandemic. To help bring this pandemic under control, VC was introduced as a communication medium in various domains to avoid contamination between participants. As a result, there is now a higher acceptance of VC as an alternative to face-to-face meetings. VC has enabled multidisciplinary discussions on treatment plans, that otherwise would be difficult, to continue[75-79]. Given this rapid implementation, it is important to not only understand the benefits, but also acknowledge the drawbacks, of VC.

CONCLUSIONS

VC enables sharing expertise for complex treatment or palliative care for specific tumours, and to coordinate care for adults, adolescents and children.

Benefits for patients are less travel to obtain a treatment plan, better coordination of care, improved access to scarce facilities and treatment in their own community. Benefits for healthcare professionals are optimised treatment plans for complex cases through multidisciplinary discussions and informing all healthcare professionals at the same time to enhance care coordination. VC also contributes to aligning protocols and continued medical education.

The costs of VC equipment and the lack of reimbursement were reported as an implementation barrier. Also the administrative workload increased because digital CT images had to be transmitted to a viewing station, which had to be planned and executed by all teams involved before a meeting.

LIST OF ABBREVIATIONS

DDS	Doctor of Dental Surgery
ENT	Ear, Nose and Throat
FtF	Face-to-face (physically)
MD	Medical Doctor
MDT	Multidisciplinary Team
MDTM	Multidisciplinary Team Meeting
MF	Maxillofacial
MeSH	Medical Subject Headings
PRISMA	Preferred Reporting Items for Systematic reviews and Meta-Analyses
PT	Physio Therapist
RT	Radiotherapy
RCT	Randomized Controlled Trial
UMCG	University Medical Center Groningen
USA	United Stated of America
UK	United Kingdom
VC	Videoconferencing or video-conferenced

SUPPLEMENTARY FILES

Supplementary file 1:	Protocol (13 pages)
Supplementary file 2:	Literature search strategies (3 pages)
Supplementary file 3:	Excluded full texts – reasons for exclusion (Table - 4 pages)
Supplementary file 4:	Number of papers vs countries vs continents (Figure - 1 page)
Supplementary file 5:	Descriptives regarding VC use (Table - 12 pages)
Supplementary file 6	Benefits, drawbacks, VC team participants and VC platform used in MDT-Equal and MDTM-Collaborate videoconferencing (Table - 4 pages)
Supplementary file 7:	Mapping of disciplines present during VC (Table - 2 pages)

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CONTRIBUTORS

The first author (LvH) and the second author (PD) were involved in developing the study concept and designing this scoping review. The third author (SvdW) was responsible for the

search strategies. After the search two reviewers (LvH and PD) independently assessed titles, abstracts and full texts. If the reviewers disagreed over a full-text assessment it was then discussed and, if no consensus was achievable, an independent reviewer, also the last author (JR) provided a binding verdict. The first and second authors (LvH and PD) extracted the data and thereafter drafted the manuscript. The third (SvdW), fourth (KA) and fifth author (JR) were involved in the revision of the manuscript.

All the authors have read and approved the final manuscript. The first author (LvH) accepts full responsibility for the work, has access to the data, and controlled the decision to publish.

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Four authors are engaged at the University Medical Center Groningen (UMCG) which is developing patient-centred, integrated care pathways for various patient groups. The Quality and Patient Safety research group evaluates the implementation of care pathways and MDTMs in order to develop management-level indicators for the care pathways led by healthcare professionals. In addition to medical and logistic aspects, all laws and regulations concerning quality and patient safety have to be observed. The UMCG has an institutional ISO 9001 for Healthcare certificate and ISO 27001 Information Security certificate for their care, research and educational processes.

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REFERENCES

1 Kodner DL, Spreeuwenberg C. Integrated care: meaning, logic, applications, and implications--a discussion paper. *Int J Integr Care* 2002;2:e12 doi:10.5334/ijic.67 [doi].

2 Minkman MM, Vermeulen RP, Ahaus KT, et al. A survey study to validate a four phases development model for integrated care in the Netherlands. *BMC Health Serv Res* 2013;13:214,6963-13-214 doi:10.1186/1472-6963-13-214 [doi].

3 Meeting patients' needs. Improving the effectiveness of multidisciplinary teams meetings in cancer services. Available at: https://www.cancerresearchuk.org/sites/default/files/full_report_meeting_patients_needs_improving_the_effectiveness_of_multidisciplinary_team_meetings_.pdf. Accessed 07/11, 2019.

4 Taylor C, Munro AJ, Glynne-Jones R, et al. Multidisciplinary team working in cancer: what is the evidence?. *BMJ* 2010;340:c951 doi:10.1136/bmj.c951 [doi].

5 Patkar V, Acosta D, Davidson T, et al. Cancer multidisciplinary team meetings: evidence, challenges, and the role of clinical decision support technology. *Int J Breast Cancer* 2011;2011:831605 doi:10.4061/2011/831605 [doi].

6 Taylor C, Atkins L, Richardson A, et al. Measuring the quality of MDT working: an observational approach. *BMC Cancer* 2012;12:202,2407-12-202 doi:10.1186/1471-2407-12-202 [doi].

7 Eedy DJ, Wootton R. Teledermatology: a review. *Br J Dermatol* 2001;144:696-707 doi:4124 [pii].

8 Roine R, Ohinmaa A, Hailey D. Assessing telemedicine: a systematic review of the literature. *CMAJ* 2001;165:765-71.

9 Munn Z, Peters MDJ, Stern C, et al. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol* 2018;18:143,018-0611-x doi:10.1186/s12874-018-0611-x [doi].

10 Grant MJ, Booth A. A typology of reviews: an analysis of 14 review types and associated methodologies. *Health Info Libr J* 2009;26:91-108 doi:10.1111/j.1471-1842.2009.00848.x [doi].

11 Colquhoun HL, Levac D, O'Brien KK, et al. Scoping reviews: time for clarity in definition, methods, and reporting. *J Clin Epidemiol* 2014;67:1291-4 doi:10.1016/j.jclinepi.2014.03.013 [doi].

12 Weeks LC, Strudsholm T. A scoping review of research on complementary and alternative medicine (CAM) and the mass media: looking back, moving forward. *BMC Complement Altern Med* 2008;8:43,6882-8-43 doi:10.1186/1472-6882-8-43 [doi].

13 Fatehi F, Armfield NR, Dimitrijevic M, et al. Clinical applications of videoconferencing: a scoping review of the literature for the period 2002-2012. *J Telemed Telecare* 2014;20:377-83 doi:10.1177/1357633X14552385 [doi].

14 Janssen A, Brunner M, Keep M, et al. Interdisciplinary eHealth Practice in Cancer Care: A Review of the Literature. *Int J Environ Res Public Health* 2017;14:10.3390/ijerph14111289 doi:E1289 [pii].

15 Tricco AC, Lillie E, Zarin W, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. *Ann Intern Med* 2018;169:467-73 doi:10.7326/M18-0850 [doi].

16 Doolittle GC, Harmon A, Williams A, et al. A cost analysis of a tele-oncology practice. *J Telemed Telecare* 1997;3 Suppl 1:20-2 doi:10.1258/1357633971930850 [doi].

17 Kunkler IH, Rafferty P, Hill D, et al. A pilot study of tele-oncology in Scotland. *J Telemed Telecare* 1998;4:113-9 doi:10.1258/1357633981932055 [doi].

18 Axford AT, Askill C, Jones AJ. Virtual multidisciplinary teams for cancer care. *J Telemed Telecare* 2002;8 Suppl 2:3-4 doi:10.1177/1357633X020080S202 [doi].

19 Billingsley KG, Schwartz DL, Lentz S, et al. The development of a Telemedical Cancer Center within the Veterans Affairs Health Care System: A report of preliminary clinical results. *Telemedicine J e-Health* 2002;8:123-30.

20 Bumm R, Siess M, Lange M, et al. Requirements for an interdisciplinary cancer center - Technology, documentation and telecommunication. *Dtsch Med Wochenschr* 2002;127:907-12 doi:10.1055/s-2002-25382.

21 Delling G, Werner M, Bernd L, et al. Telecommunication and telepathology. New diagnostic routes for orthopaedics and orthopaedic pathology. *Pathologe* 2002;23:327-31 doi:10.1007/s00292-002-0551-3.

22 Niemeyer P, Delling G, Werner M, et al. Telecommunication and telepathalogy in orthopedic oncology. Potentialities and chances in diagnosis and treatment of malignant bone tumors. *Orthopade* 2003;32:949-54 doi:10.1007/s00132-003-0546-7.

23 Bauman G, Winquist E, Chin J. A pilot study of regional participation in a videoconferenced multidisciplinary genitourinary tumor board. *Can J Urol* 2005;12:2532-6.

24 Norum J, Jordhoy MS. A university oncology department and a remote palliative care unit linked together by email and videoconferencing. *J Telemed Telecare* 2006;12:92-6 doi:10.1258/135763306776084374 [doi].

25 Dickson-Witmer D, Petrelli NJ, Witmer DR, et al. A statewide community cancer center videoconferencing program. *Ann Surg Oncol* 2008;15:3058-64 doi:10.1245/s10434-008-0101-1 [doi].

26 Salami AC, Barden GM, Castillo DL, et al. Establishment of a Regional Virtual Tumor Board Program to Improve the Process of Care for Patients With Hepatocellular Carcinoma. *J Oncol Pract* 2015;11:e66-74 doi:10.1200/JOP.2014.000679 [doi].

27 Thillai K, Repana D, Korantzis I, et al. Clinical outcomes for patients with liver-limited metastatic colorectal cancer: Arguing the case for specialist hepatobiliary multidisciplinary assessment. *Eur J Surg Oncol* 2016;42:1331-6 doi:10.1016/j.ejso.2016.03.031 [doi].

28 Wilson EE, Thompson SK, Bull J, et al. Improving care for patients with oesophageal and gastric cancer: impact of a statewide multidisciplinary team. *ANZ J Surg* 2016;86:270-3 doi:10.1111/ans.12869 [doi].

29 Powell SF, Dib EG, Bleeker JS, et al. Delivering precision oncology in a community cancer program: Results from a prospective observational study. *JCO Precis Oncol* 2018;2 doi:10.1200/PO.17.00220.

30 Rosell L, Wihl J, Hagberg O, et al. Function, information, and contributions: An evaluation of national multidisciplinary team meetings for rare cancers. *Rare Tumors* 2019;11:2036361319841696 doi:10.1177/2036361319841696 [doi].

31 Brandl A, Westbrook S, Nunn S, et al. Clinical and surgical outcomes of patients with peritoneal mesothelioma discussed at a monthly national multidisciplinary team video-conference meeting. *BJS Open* 2020;4:260-7 doi:10.1002/bjs5.50256 [doi].

32 Fitzgerald R, Pryor D, Aland T, et al. Quality and access - Early experience of implementing a virtual stereotactic chart round across a national network. *J Med Imaging Radiat Oncol* 2020;64:422-6 doi:10.1111/1754-9485.13031 [doi].

33 Pan M, Seto T, Yu J, et al. Feasibility and Value of Establishing a Community-Based Virtual Multidisciplinary Sarcoma Case Conference. *JCO Oncol Pract* 2020:OP2000110 doi:10.1200/OP.20.00110 [doi].

34 Rosell L, Wihl J, Nilbert M, et al. Health Professionals' Views on Key Enabling Factors and Barriers of National Multidisciplinary Team Meetings in Cancer Care: A Qualitative Study. *J Multidiscip Healthc* 2020;13:179-86 doi:10.2147/JMDH.S240140 [doi].

35 Bharadwaj P, Vasava S, Pisharodi S. Los Angeles to mumbai: providing palliation using technology. *J Palliat Med* 2007;10:1037-9.

36 Qaddoumi I, Musharbash A, Elayyan M, et al. Closing the survival gap: implementation of medulloblastoma protocols in a low-income country through a twinning program. *Int J Cancer* 2008;122:1203-6 doi:10.1002/ijc.23160 [doi].

37 Qaddoumi I, Mansour A, Musharbash A, et al. Impact of telemedicine on pediatric neuro-oncology in a developing country: the Jordanian-Canadian experience. *Pediatr Blood Cancer* 2007;48:39-43 doi:10.1002/pbc.21085 [doi].

38 Amayiri N, Swaidan M, Abuirmeileh N, et al. Video-Teleconferencing in Pediatric Neuro-Oncology: Ten Years of Experience. *J Glob Oncol* 2018;(4):1-7. doi:1-7 doi:10.1200/JGO.2016.008276 [doi].

39 Mayadevi M, Thankappan K, Limbachiya SV, et al. Interdisciplinary Telemedicine in the Management of Dysphagia in Head and Neck. *Dysphagia* 2018;33:474-80 doi:10.1007/s00455-018-9876-9.

40 Sezeur A, Degramont A, Touboul E, et al. Teleconsultation before chemotherapy for recently operated on patients. *Am J Surg* 2001;182:49-51 doi:S0002-9610(01)00662-6 [pii].

41 Stalfors J, Björholt I, Westin T. A cost analysis of participation via personal attendance versus telemedicine at a head and neck oncology multidisciplinary team meeting. *J Telemed Telecare* 2005;11:205-10 doi:10.1258/1357633054068892.

42 Chekerov R, Denkert C, Boehmer D, et al. Online tumor conference in the clinical management of gynecological cancer: Experience from a pilot study in Germany. *Int J Gynecol Cancer* 2008;18:1-7 doi:10.1111/j.1525-1438.2007.00971.x.

43 Schroeder JK, Kuemmel S, Pietzner K, et al. Optimizing the clinical management of gynecological and breast cancer via online tumor conferences. *Anticancer Res* 2011;31:2669-73.

44 Seeber A, Mitterer M, Gunsilius E, et al. Feasibility of a multdisciplinary lung cancer videoconference between a peripheral hospital and a comprehensive cancer centre. *Oncology* 2013;84:186-90 doi:10.1159/000345314 [doi].

45 Stevenson MM, Irwin T, Lowry T, et al. Development of a Virtual Multidisciplinary Lung Cancer Tumor Board in a Community Setting. *J ONCOL PRACT* 2013;9:e77-80 doi:10.1200/JOP.2013.000882.

46 Crispen C, Kellini OM, Kumar M. Analysis of an inter-centre, web-based radiation oncology peer-review case conference. *J Radiother Pract* 2014;14:135-42 doi:10.1017/S1460396915000102.

47 Shea CM, Teal R, Haynes-Maslow L, et al. Assessing the feasibility of a virtual tumor board program: a case study. *J Healthc Manag* 2014;59:177-93.

48 Frappaz D, Sunyach MP, Le Rhun E, et al. Adolescent and Young Adults (AYAS) brain tumor national Web conference. On behalf of ANOCEF, GO-AJA and SFCE societies. *Bull Cancer* 2016;103:1050-6 doi:S0007-4551(16)30277-6 [pii].

49 Burkard ME, Deming DA, Parsons BM, et al. Implementation and clinical utility of an integrated academic-community regional molecular tumor board. *JCO Precis Oncol* 2017;2017:1-10 doi:10.1200/PO.16.00022.

50 Abu Arja MH, Stanek JR, Morales La Madrid AE, et al. The Latin American Brain Tumor Board teleconference: results of a web-based survey to evaluate participant experience utilizing this resource. *Child's Nerv Syst* 2018 doi:10.1007/s00381-018-4000-x.

51 Saysell E, Routley C. Telemedicine in community-based palliative care: evaluation of a videolink teleconference project...including commentary by Becker R. *Int J Palliat Nurs* 2003;9:489-94.

52 O'Mahony S, Marthone P, Santoro G, et al. Preliminary report of a pilot tele-health palliative care and bioethics program for residents in skilled nursing facilities. *PALLIAT CARE RES TREAT* 2009:13-27.

53 Donnem T, Ervik B, Magnussen K, et al. Bridging the distance: a prospective tele-oncology study in Northern Norway. *Support Care Cancer* 2012;20:2097-103 doi:10.1007/s00520-011-1319-1 [doi].

54 Watanabe SM, Fairchild A, Pituskin E, et al. Improving access to specialist multidisciplinary palliative care consultation for rural cancer patients by videoconferencing: report of a pilot project. *Support Care Cancer* 2013;21:1201-7 doi:10.1007/s00520-012-1649-7.

55 Delaney G, Jacob S, Iedema R, et al. Comparison of face-to-face and videoconferenced multidisciplinary clinical meetings. *Australas Radiol* 2004;48:487-92 doi:ARA1349 [pii].

56 Savage SA, Nixon I, MacKenzie K. Teleconferencing in the management of head and neck cancer. *Clin Otolaryngol* 2007;32:130-2 doi:COA1329 [pii].

57 Marshall CL, Petersen NJ, Naik AD, et al. Implementation of a regional virtual tumor board: a prospective study evaluating feasibility and provider acceptance. *Telemed J E Health* 2014;20:705-11 doi:10.1089/tmj.2013.0320.

58 Alexandersson N, Rosell L, Nilbert M, et al. Determinants of variable resource use for multidisciplinary team meetings in cancer care. *Acta Oncol* 2018;57:675-80 doi:10.1080/0284186X.2017.1400682.

59 van Huizen LS, Dijkstra P, Halmos GB, et al. Does multidisciplinary videoconferencing between a head-and-neck cancer centre and its partner hospital add value to their patient care and decision-making? A mixed-method evaluation. *BMJ Open* 2019;9:e028609,2018-028609 doi:10.1136/bmjopen-2018-028609 [doi].

60 Hunter DC, Brustrom JE, Goldsmith BJ, et al. Teleoncology in the department of defense: A tale of two systems. *Telemedicine J* 1999;5:273-82 doi:10.1089/107830299312023.

61 Olver IN, Selva-Nayagam S. Evaluation of a telemedicine link between Darwin and Adelaide to facilitate cancer management. *Telemedicine J* 2000;6:213-8.

62 Davison AG, Eraut CD, Haque AS, et al. Telemedicine for multidisciplinary lung cancer meetings. *J Telemed Telecare* 2004;10:140-3.

63 Kunkler I, Fielding G, Macnab M, et al. Group dynamics in telemedicine-delivered and standard multidisciplinary team meetings: results from the TELEMAM randomised trial...6th International Conference on Successes and Failures in Telehealth, SFT-6, Brisbane, Queensland, Australia, 24-24 August, 2006. *J Telemed Telecare* 2006;12:S3:55-8.

64 Kunkler IH, Prescott RJ, Lee RJ, et al. TELEMAM: A cluster randomised trial to assess the use of telemedicine in multi-disciplinary breast cancer decision making. *Eur J Cancer* 2007;43:2506-14 doi:10.1016/j.ejca.2007.08.026.

65 Stevens G, Loh J, Kolbe J, et al. Comparison of recommendations for radiotherapy from two contemporaneous thoracic multidisciplinary meeting formats: co-located and video conference. *Intern Med J* 2012;42:1213-8 doi:10.1111/j.1445-5994.2012.02817.x [doi].

66 Murad MF, Ali Q, Nawaz T, et al. Teleoncology: improving patient outcome through coordinated care. *Telemed J E Health* 2014;20:381-4 doi:10.1089/tmj.2013.0100 [doi].

67 Novoa NM, Gomez MT, Rodriguez M, et al. e-Consultation Improves Efficacy in Thoracic Surgery Outpatient Clinics. *Arch Bronconeumol* 2016;52:549-52 doi:S0300-2896(16)30063-1 [pii].

68 Munro AJ, Swartzman S. What is a virtual multidisciplinary team (vMDT)?. *Br J Cancer* 2013;108:2433-41 doi:10.1038/bjc.2013.231 [doi].

69 Ashton MA. The multidisciplinary team meeting: how to be an effective participant. *Diagnostic Histolopathology* 2008;14:519-23.

70 Lamb B, Green JS, Vincent C, et al. Decision making in surgical oncology. *Surg Oncol* 2011;20:163-8 doi:10.1016/j.suronc.2010.07.007 [doi].

71 Verhoef J, Toussaint PJ, Vliet Vlieland TP, et al. The impact of structuring multidisciplinary team conferences mediated by ICT in the treatment of patients with rheumatic diseases. *Stud Health Technol Inform* 2004;103:183-90.

72 Scott Kruse C, Karem P, Shifflett K, et al. Evaluating barriers to adopting telemedicine worldwide: A systematic review. *J Telemed Telecare* 2018;24:4-12 doi:10.1177/1357633X16674087 [doi].

73 Sabesan S. Medical models of teleoncology: current status and future directions. *Asia Pac J Clin Oncol* 2014;10:200-4 doi:10.1111/ajco.12225 [doi].

74 Pham MT, Rajic A, Greig JD, et al. A scoping review of scoping reviews: advancing the approach and enhancing the consistency. *Res Synth Methods* 2014;5:371-85 doi:10.1002/jrsm.1123 [doi].

75 Abbasi AN. Tumor Boards during COVID-19 Pandemic. *J Coll Physicians Surg Pak* 2020;30:1-2 doi:10.29271/jcpsp.2020.Supp1.S1 [doi].

76 Aseem R, Warren O, Mills S, et al. Adjusting to the COVID-19 pandemic: challenges and opportunities of frontline colorectal cancer teams in the UK. *Int J Colorectal Dis* 2020;35:1783-5 doi:10.1007/s00384-020-03647-2 [doi].

77 Elkaddoum R, Kourie HR, Kassis NE, et al. Treating cancer patients in times of COVID-19 pandemic: A virtual women cancers multidisciplinary meeting experience. *Bull Cancer* 2020;107:738-40 doi:S0007-4551(20)30266-6 [pii].

78 Salari A, Shirkhoda M. COVID-19 pandemic & head and neck cancer patients management: The role of virtual multidisciplinary team meetings. *Oral Oncol* 2020;105:104693 doi:S1368-8375(20)30129-9 [pii].

79 Dharmarajan H, Anderson JL, Kim S, et al. Transition to a virtual multidisciplinary tumor board during the COVID-19 pandemic: University of Pittsburgh experience. *Head Neck* 2020;42:1310-6 doi:10.1002/hed.26195 [doi].

SUPPLEMENTARY FILES
SUPPLEMENT 1 – Protocol

PROTOCOL SCOPING REVIEW

How and why does videoconferencing add value to patient care and decision making when healthcare professionals working in teams at different locations use it.

A mixed approach of scoping and systematic review.

PROTOCOL SIGNATURE SHEET

Name	Signature	Date
Coordinating Investigator: Lidia S. van Huizen, MSc		19-12-'18
Epidemiologist: Prof. dr. P.U. Dijkstra		19-12-'18

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Review team members

Affiliations of each member of the review team

title	first name	last name	affiliation
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PT, PhD	Pieter	Dijkstra	University of Groningen, University Medical Center Groningen, Department of Oral and Maxillofacial Surgery, Groningen, The Netherlands University of Groningen, University Medical Center Groningen, Center for Rehabilitation, Groningen, The Netherlands
MSc	Sjoukje	van der Werf	University of Groningen, University Medical Center Groningen, Central Medical Library, Groningen, The Netherlands
PhD	Kees	Ahaus	University of Groningen, Faculty of Economics and Business, Centre of Expertise Healthwise, University Medical Center Groningen, Groningen, The Netherlands
DDS, MD, PhD	Jan	Roodenburg	University of Groningen, University Medical Center Groningen, Department of Oral and Maxillofacial Surgery, Groningen, The Netherlands

Background

Videoconferencing is a commonly used technical tool for collaborating teams in regional oncology networks, but it is not often used in healthcare. Videoconferencing can be used for collaborating teams of healthcare professionals at different locations regarding patient care.

We want to analyse settings in which videoconferencing is used as a medium of support for or replaces the multidisciplinary face-to-face meeting.

Review Questions

The aim of this scoping review is to describe and understand what the added value for patient care might be when healthcare professionals working in teams at different locations use videoconferencing for their decision making as compared to meeting face-to-face.

This review will focus on 5 sub questions:

1. What kind of videoconferencing between professionals working in teams are described in biomedical journals? (i.e. teams working within the same organisation, between organisations; with formal and informal status of collaboration)
2. What kind of performance is reached with videoconferencing as compared to a 'face-to-face' meeting '(i.e. number of patients discussed or recommendations given)?
3. What were circumstances (i.e. outcome variables on which the videoconferences were evaluated with regard to added value (i.e. efficacy and successful communication)?
4. What factors have been identified that inhibit or enhance effective communication or success of the videoconferences (i.e. infrastructure, personnel / professionals working in groups)? Was additional communication used (i.e. Skype, e-mail, telephone)?
5. What kind equipment was used (i.e. availability of equipment, diagnostic features like imaging, monitor size)?

Methods

1. Searches

We will search PUBMED/Medline (American), Cinahl (Nursing and Alied Health), Embase (European), Cochrane. If authors contact will be contacted, additional information will be listed. The search strategy is developed in collaboration with an experienced university librarian.

2. Search Strategy

The search strategy is given in appendix 1.

3. Inclusion / Exclusion criteria

We will show exclusions in the PRISMA-P-ScR-chart, see appendix 3.

Phase one

Inclusion:

- all time spans
- all languages (if needed translation will be done)
- published papers describing videoconferencing
- videoconferencing for communication in Healthcare, between 2 or more groups (minimal number per groups = 2) of professionals at different sites aimed at collaboration over patient care

Exclusion criteria (we will show exclusions in the PRISMA-P-ScR-chart):

- reviews not applicable, only original research
- no videoconferencing used
- e-Health,
- telemedicine

- educations purposes
- one professional to one other professional videoconferencing
- professional with patient(s) videoconferencing

Study quality will be assessed if possible by the EPOC (Effective Practice and Organisation of Care-Checklist) as used for Cochrane Reviews or the QI-MQCS questions (Quality Improvements – Minimal Quality Criteria Set, Hempel et al 2015) to review how well the intervention is described or JBI (Joanna Briggs Institute Manual for scoping reviews, JBI 2015)[1].

4. Primary Outcome(s)

For healthcare professionals working in teams on different locations.

-primary outcomes:

- Medical specialisms present during teleconferencing
- equipment used for teleconferencing
- decision making on which patient categories

-secondary outcomes:

- how do groups prepare for teleconferencing, is a protocol involved?
- what information is shared during teleconferencing (medical records of different types)?
- what topics are shared (e.g. complication- or incident registration; deviation of diagnostic or treatment plan)?
- information shown and referred to (e.g. diagnostic tests, imaging and history, treatment cure or palliative)
- equipment used for teleconferencing and sharing information
- can participants see each other during videoconferencing when sharing patient data?
- are the same participants present during different sessions, is there a registration of participants?
- amount of patient cases in the study, are patients present during videoconferencing?

5. Data extraction (selection and coding)

In phase one the screening will be done by two researchers (LH and PD) who will independently assess titles and abstracts for in and exclusion criteria.

In the phase two the same review authors will assess the full text of the articles included in phase one (first screening) for the same in- and exclusion criteria. Reasons for exclusion will be registered. Matters of doubt will be discussed, until consensus is reached. If no consensus van be reached, a third independent assessor will give a binding verdict.

1.Arksey H, O'Malley L. Scoping studies: towards a methodological framework. International Journal of Social Research Methodology 2005, 8(1):19-32.

2.Levac D, Colquhoun H, O'Brien KK. Scoping studies: advancing the methodology. Implementation science: IS 2010, 5:69.

3.Colquhoun HL, Levac D, O'Brien KK, Straus S, Tricco AC, Perrier L, Kastner M, Moher D. Scoping reviews: time for clarity in definition, methods, and reporting. Journal of clinical epidemiology, 67, 2014.

4.Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. International journal of evidence-based healthcare 2015, 13(3):141-146.; Joanna Briggs Guidance, comes with a supplement

5.Munn Z, Peters MDJ, Stern C, Tufanaru C, McArthur A, Aromataris E. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. BMV Medical Research Methodology.

Figure. symbolic coding tree

In phase three data extraction will be undertaken independently by the two reviewers. Of each study general study characteristics will be collected concerning setting, design, unit of analysis, etc.
The form 'screening and criteria' was developed and will be used for phase one, two and three. A pilot test with the screening form was performed early in the first phase.

6. Risk of bias (quality) assessment
This scoping review will include different study types, therefore based on the included studies an appropriate quality assessment tool will be selected and applied.

7. Strategy for data synthesis
The included articles will be summarized into tables regarding study and participant characteristics (author, publication, aim, partners / authors, methods, etc).

The flowchart chart (PRISMA) and overview chart will constitute a basis for the data analysis and narrative synthesis (mindmap with associations) in accordance with the integrative review method developed by Whittemore and Knafl and for the scoping part by Joanna Briggs.

The scoping review is an iterative process, when the first screening is performed the results will be discussed with users from the head & neck tumour group or care pathway that uses videoconferencing for their multidisciplinary meeting with their preferred partner.
The consensus of that discussion will be reported.

8. Analysis of subgroups or subsets
Where there are similarities in concept of evaluation videoconferencing and a sufficient number of studies (4 or more) is included, we will consider a meta-analysis. The subset of the papers found with the search strategy will be followed-up with a detailed search strategy to that specific topic. Where there are differences we will describe mind map with similarities and differences.

Planning

Anticipated or actual start date is December 2018, anticipated completion date is May 2019.

Stage of review at time of this submission

The review has not yet started.

Review stage	started	completed
Preliminary searches	yes	yes
Piloting of the study selection process	yes	no
Formal screening of search results against eligibility criteria	no	no
Data extraction	no	no
Risk of bias (quality) selection	no	no
Data analysis	no	no

The design will be communicated together with an evaluation on added value of videoconferencing research of our centre to healthcare professionals that work together in the UMCG Oncology Committee.
The outcomes of the review will be communicated in the UMCG with the groups that use videoconferencing and in the Netherlands at different locations.
Abstract of the results will be presented in relevant seminars.
Furthermore we will publish the findings of the review in a peer reviewed journal.

Appendix 1: Search Strategies

PubMed

("Interprofessional Relations"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR interprofes*[tiab] OR inter-profes*[tiab] OR professional[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR multidisciplin*[tiab] OR multi-disciplin*[tiab] OR team[tiab] OR teams[tiab] OR tumor board*[tiab] OR tumour board*[tiab])

AND

("Telecommunications"[Mesh:NoExp] OR "Telemedicine"[Mesh] OR "Videoconferencing"[Mesh] OR videoconferenc*[tiab] OR video conferen*[tiab] OR teleconferenc*[tiab] OR tele-conferenc*[tiab] OR video record*[tiab] OR video facilit*[tiab] OR web conferen*[tiab] OR teleonco*[tiab] OR tele-onco*[tiab] OR ((online-based[tiab] OR webbased[tiab] OR web-based[tiab] OR computer-based[tiab] OR internet-based[tiab] OR virtual[tiab]) AND (communicat*[tiab] OR conferen*[tiab] OR meeting*[tiab] OR collaborat*[tiab] OR mdt[tiab] OR mdts[tiab])))

AND

("Neoplasms"[Mesh] OR "Cancer Care Facilities"[Mesh] OR "Medical Oncology"[Mesh] OR "Oncologists"[Mesh] OR "cancer" OR "cancers" OR oncolog* OR "tumor" OR "tumors" OR "tumour" OR "tumours" OR palliat* OR cancer[sb])

CINAHL (ebsco)

(((MH "Interprofessional Relations+") OR (MH "Multidisciplinary Care Team+") OR (interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*"))

AND

(((MH "Telecommunications") OR (MH "Teleconferencing") OR (MH "Videoconferencing+") OR (MH "Wireless Communications") OR (MH "Communications Software+") OR (videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*") OR
((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts))))

AND

(((MH "Cancer Care Facilities") OR (MH "Neoplasms+") OR (MH "Oncology+") OR (MH "Oncologists") OR cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*))

Embase (via embase.com)

('multidisciplinary team meeting'/exp OR 'interdisciplinary communication'/exp OR 'public relations'/exp OR 'multidisciplinary team'/de OR 'collaborative care team'/exp OR 'interpersonal communication'/de OR (interprofes* OR 'inter-profes*' OR professional OR interdisciplin* OR 'inter-disciplin*' OR multidisciplin* OR 'multi-disciplin*' OR team OR teams OR 'tumor board*' OR 'tumour board*'):ab,ti)

AND

('telecommunication'/de OR 'teleconference'/exp OR 'videoconferencing'/exp OR 'communication software'/exp OR (videoconferenc* OR 'video conferen*' OR teleconferenc* OR 'tele-conferenc*' OR 'video record*' OR 'video facilit*' OR teleoncol* OR 'tele-oncol*'):ab,ti
OR
((online OR webbased OR 'web based' OR web OR computer OR internet OR virtual OR tele OR video) NEAR/8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)):ab,ti)

AND

('neoplasm'/exp OR 'oncology'/exp OR 'oncologist'/exp OR 'cancer center'/exp OR 'oncologist'/exp OR (cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*):ab,ti,de)
NOT
'conference abstract'/it

Cochrane Library (ti,ab,kw)
(interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*")

AND

(videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*" OR
((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) near (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)))

AND

(cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)

Appendix 2a: In- and exclusion criteria

Eligible criteria phase one		
Selection criteria	***Inclusion***	***Exclusion***
Study design	All study designs	Reviews not applicable, only original research
Settings, domain	Videoconferencing for communication in Healthcare, between 2 or more groups (minimal number per groups = 2) of professionals at different sites aimed at collaboration over patient care	Telemedicine, e-Health, Education purposes only
Settings, healthcare professionals - teams		Professional with patient(s) videoconferencing (if not Telemedicine); One professional to one other professional videoconferencing.
Equipment		No videoconferencing used or only communication with telephone or mail
Time Frame	All time spans	
Languages	All (if needed translation will be done)	

Appendix 2b: form screening title and abstract

Form selection abstract Scoping Review Videoconferencing (VC)

(form results will be marked on the abstract on paper and registered in Excel overview)

Try out will be performed on abstract numbers: 1, 11, 21, 31, 41, 51, 61, 71, 81, 91 and 101.

Refworks Number		
Assessor	Lidia van Huizen	Pieter Dijkstra
Date (of assessing)		
Title (first 3 words)		
Authors (first author)		
Year of publication		
Journal		

When answering questions: Black: if NO, stop; Red: if Yes, stop.

	Questions on in- and exclusion criteria	**Yes**	**No**	**Not clear**
1	Is the paper original research?			
2	Is VC described?			
3	Is the added value of VC described?			
4	Are participants Healthcare professionals?			
5	Does VC take place between 2 or more groups?			
6	Do the groups consist of 2 or more participants?			
7	Do the groups reside at different locations?			
8	Is collaboration aimed at patient care or cure?			
9	Is telemedicine, e-Health or Education the only purpose of the VC?			
10	Are patients involved in the VC?			

Appendix 2c: form screening full text

Part 2, full text, data extraction after abstract selection

General Reviewers	
Name	
Date (of extraction)	

General information on title / abstract (Result presentation as in Table 1)	
Title	
Authors	
Year publication, source	
Country	
Study location and context	
Study population and size / duration of study	

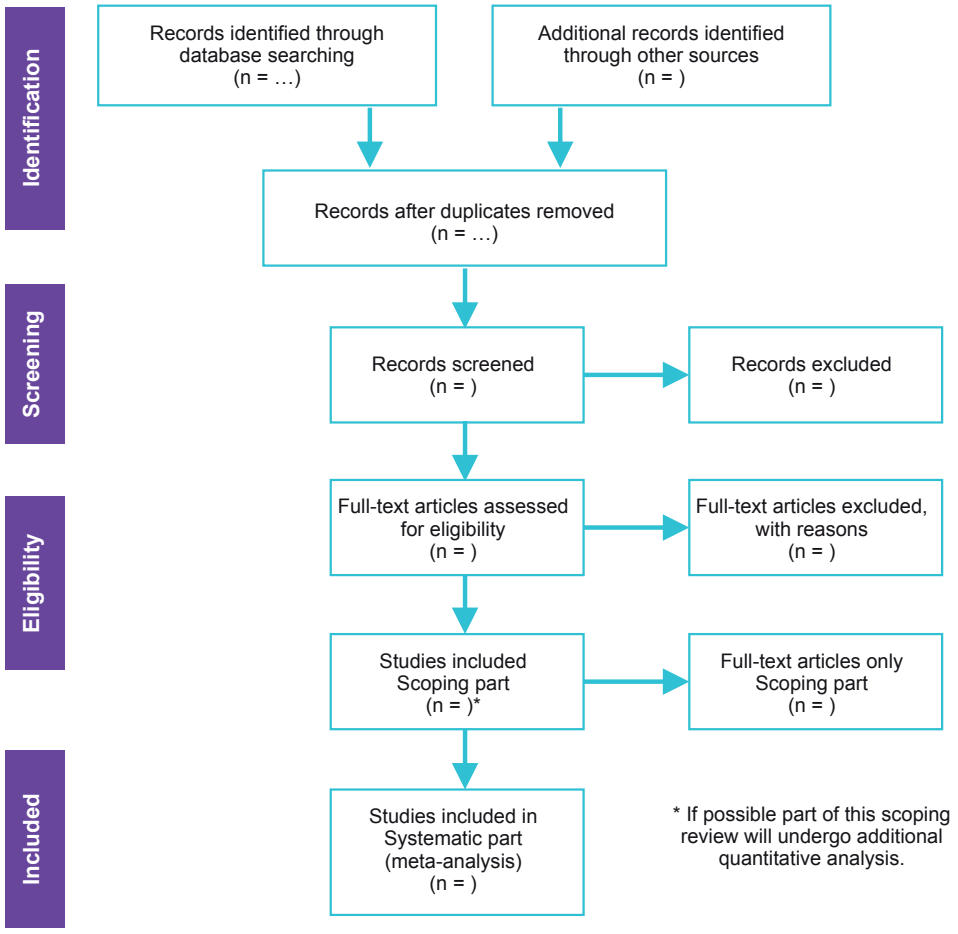
Objective and methods (study design)	
Aims of the study or objective	
Methodology or methods description	
Inclusion and exclusion criteria	
Methodology / data presented or obtainable	
Data collection period	
Sample size	
Equipment used	
Intervention type	

Results, discussion and conclusions	
Participants	
Key findings related review question	
Limitations of the study	
Other comments / remarks	

Type of information	
Outcome characteristics	
Setting of study	
Setting of participants	
Quality of evidence (specify)	
Is the value of VC discussed?	
Structure of VC	
Participants of videoconferencing (VC) EPOC 4: profession, level of training, clinical specialty (specify)	
Additional setting information	
Is the VC prepared?	

Are recommendations mentioned? Are changes in decisions due to the VC registered? Is incident or complication discussion part of the agenda?	
Outcome characteristics	
If patients involved specify	
Purpose of videoconference	
Factors for successful videoconference	
Team collaboration	
Formal agreement	
Performance measurement?	
Criteria added value?	
Can participants see each other during interchange of patient information	
Other means of communications for participants besides videoconferencing in the same group?	
Results reported	
Equipment	
Equipment used How many sceens or computer monitors are available?	
Is it possible to show registrations in the medical records	

Appendix 3: PRISMA-ScR Flow Diagram Videoconferencing



Guidance for the Conduct of JBI Scoping Reviews, September 2017; In book: Joanna Briggs Institute Reviewer's Manual, Chapter: 11; Publisher: The Joanna Briggs Institute, Editors: Edoardo Aromataris, Zachary Munn; Project: Guidance for the Conduct and Reporting of Scoping Reviews.

SUPPLEMENT 2 – Search strategies

MEDLINE (PubMed)

("Interprofessional Relations"[Mesh] OR "Patient Care Team"[Mesh:NoExp] OR interprofes*[tiab] OR inter-profes*[tiab] OR professional[tiab] OR interdisciplin*[tiab] OR inter-disciplin*[tiab] OR multidisciplin*[tiab] OR multi-disciplin*[tiab] OR team[tiab] OR teams[tiab] OR tumor board*[tiab] OR tumour board*[tiab])

AND

("Telecommunications"[Mesh:NoExp] OR "Telemedicine"[Mesh] OR "Videoconferencing"[Mesh] OR videoconferenc*[tiab] OR video conferen*[tiab] OR teleconferenc*[tiab] OR tele-conferenc*[tiab] OR video record*[tiab] OR video facilit*[tiab] OR web conferen*[tiab] OR teleonco*[tiab] OR tele-onco*[tiab] OR ((online-based[tiab] OR webbased[tiab] OR web-based[tiab] OR computer-based[tiab] OR internet-based[tiab] OR virtual[tiab]) AND (communicat*[tiab] OR conferen*[tiab] OR meeting*[tiab] OR collaborat*[tiab] OR mdt[tiab] OR mdts[tiab])))

AND

("Neoplasms"[Mesh] OR "Cancer Care Facilities"[Mesh] OR "Medical Oncology"[Mesh] OR "Oncologists"[Mesh] OR “cancer” OR “cancers” OR oncolog* OR “tumor” OR “tumors” OR “tumour” OR “tumours” OR palliat* OR cancer[sb])

CINAHL (EBSCO)

((MH "Interprofessional Relations+") OR (MH "Multidisciplinary Care Team+") OR TI (interprofes* OR “inter-profes*” OR professional OR interdisciplin* OR “inter-disciplin*” OR multidisciplin* OR “multi-disciplin*” OR team OR teams OR “tumor board*” OR “tumour board*”) OR AB (interprofes* OR “inter-profes*” OR professional OR interdisciplin* OR “inter-disciplin*” OR multidisciplin* OR “multi-disciplin*” OR team OR teams OR “tumor board*” OR “tumour board*”))

AND

((MH "Telecommunications") OR (MH "Teleconferencing") OR (MH "Videoconferencing+") OR (MH "Wireless Communications") OR (MH "Communications Software+") OR TI (videoconferenc* OR “video conferen*” OR teleconferenc* OR “tele-conferenc*” OR “video record*” OR “video facilit*” OR teleoncol* OR “tele-oncol*”) OR TI ((online OR webbased OR “web based” OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)) OR AB (videoconferenc* OR “video conferen*” OR teleconferenc* OR “tele-conferenc*” OR “video record*” OR “video facilit*” OR teleoncol* OR “tele-oncol*”) OR AB ((online OR webbased OR “web based” OR web OR computer OR internet OR virtual OR tele OR video) N8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)))

AND

((MH "Cancer Care Facilities") OR (MH "Neoplasms+") OR (MH "Oncology+") OR (MH "Oncologists") OR cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)

Embase (embase.com)
('multidisciplinary team meeting'/exp OR 'interdisciplinary communication'/exp OR 'public relations'/exp OR 'multidisciplinary team'/de OR 'collaborative care team'/exp OR 'interpersonal communication'/de OR (interprofes* OR 'inter-profes*' OR professional OR interdisciplin* OR 'inter-disciplin*' OR multidisciplin* OR 'multi-disciplin*' OR team OR teams OR 'tumor board*' OR 'tumour board*'):ab,ti)

AND

('telecommunication'/de OR 'teleconference'/exp OR 'videoconferencing'/exp OR 'communication software'/exp OR (videoconferenc* OR 'video conferen*' OR teleconferenc* OR 'tele-conferenc*' OR 'video record*' OR 'video facilit*' OR teleoncol* OR 'tele-oncol*'):ab,ti OR ((online OR webbased OR 'web based' OR web OR computer OR internet OR virtual OR tele OR video) NEAR/8 (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)):ab,ti)

AND

('neoplasm'/exp OR 'oncology'/exp OR 'oncologist'/exp OR 'cancer center'/exp OR 'oncologist'/exp OR (cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*):ab,ti,de)
NOT
'conference abstract'/it

Cochrane Library (Cochrane reviews + Trials)
(interprofes* OR "inter-profes*" OR professional OR interdisciplin* OR "inter-disciplin*" OR multidisciplin* OR "multi-disciplin*" OR team OR teams OR "tumor board*" OR "tumour board*")

AND

(videoconferenc* OR "video conferen*" OR teleconferenc* OR "tele-conferenc*" OR "video record*" OR "video facilit*" OR teleoncol* OR "tele-oncol*" OR ((online OR webbased OR "web based" OR web OR computer OR internet OR virtual OR tele OR video) near (communicat* OR conferen* OR meeting* OR collaborat* OR mdt OR mdts)))

AND

(cancer*OR oncolog* OR neoplasm* OR malign* OR carcin* OR leukem* OR tumor* OR tumour* OR palliat*)

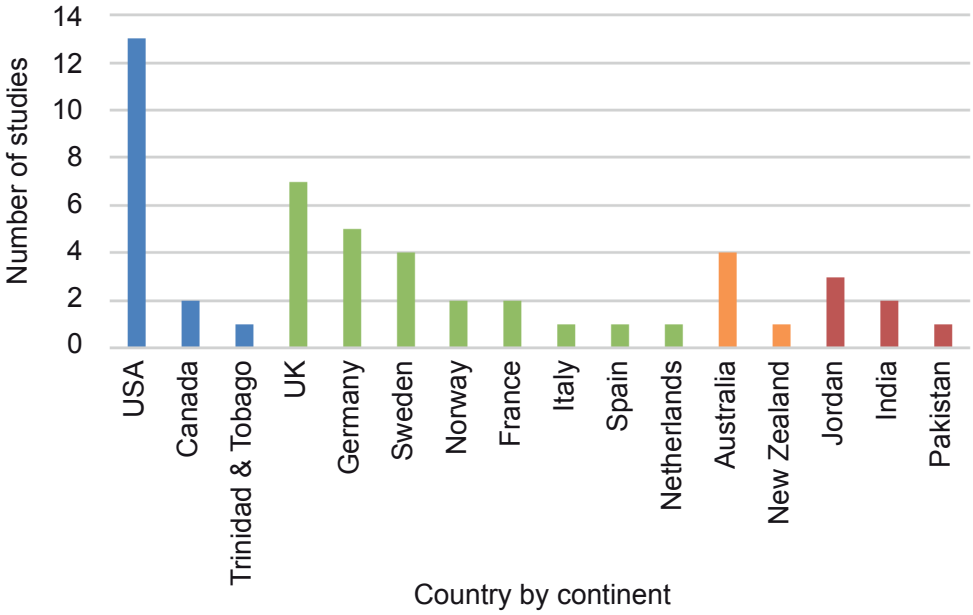
SUPPLEMENT 3 – Excluded full texts – reasons for exclusion

Characteristics of excluded studies

Authors	*Year*	*World part, country*	*Reason for exclusion*
Burgess et al.	1999	USA	Videoconferencing specialist with patients
Atlas et al.	2000	Israel-USA	No structured evaluation of videoconferencing
Larcher et al.	2002	Italy	No videoconferencing
Mitchell et al.	2002	Australia	No cancer
Barry et al.	2003	UK	Answers to question 5 and 7 stays unclear
Gagliardi et al.	2003	Canada	Research only
Mitchell et al.	2005	Australia	No cancer
Pradeep et al.	2006	India	No structured evaluation of videoconferencing
Gagliardi et al.	2007	Canada	No videoconferencing
Lehoux et al.	2007	Canada	No cancer
Ashton et al.	2008	UK	Review
Ferrer et al.	2008	France	No videoconferencing
Mitchell et al.	2008	Australia	No videoconferencing
Qaddoumi et al.	2008	Jordan	No videoconferencing
Lewis et al.	2009	UK	Answers to question 5 and 7 stays unclear
Underhill et al.	2010	Australia	Education only
Vezzoni et al.	2011	Italy	Not primarily aimed at cancer treatment
Burns et al.	2012	Australia	Videoconferencing specialist with patients
Fitzpatrick et al.	2012	Canada	No videoconferencing
Washington et al.	2012	USA	Not primarily aimed at cancer treatment
Xilinas et al.	2012	USA	No videoconferencing
Langfeldt et al.	2013	Norway	No structured evaluation of videoconferencing
Chalabreysse et al.	2014	France	Videoconferencing specialist with patients
Francescutti et al.	2014	Canada	No videoconferencing
Holden et al.	2014	USA	Editorial
Berlanga et al.	2015	Spain	No videoconferencing
Gruttadauria et al.	2015	Italy	No cancer
Hue et al.	2015	France	No videoconferencing
Washington et al.	2015	USA	Not primarily aimed at cancer treatment
Garica Adrian et al.	2016	Spain	No cancer
Horton et al.	2016	USA	Abstract only
Wey Pang et al.	2016	UK	Abstract only
van Gurp et al.	2016	Netherlands	Videoconferencing specialist with patients
Pang et al.	2016	UK	Abstract only
Mascarenhas et al.	2017	Portugal – Netherlands	No structured evaluation of videoconferencing
Qaddoumi et al.	2017	Brazil	No videoconferencing

Authors	*Year*	*World part, country*	*Reason for exclusion*
Cobb et al.	2018	UK	Abstract only
Ribelles et al.	2018	Australia	No structured evaluation of videoconferencing
Scott et al.	2018	USA	No structured evaluation of videoconferencing
Yu et al.	2018	China	No videoconferencing
Moss et al.	2019	UK	No videoconferencing
Nemecek et al.	2019	Austria	Videoconferencing specialist with patients
Terry et al.	2019	USA	Videoconferencing specialist with patients
Funderskov et al.	2019	Denmark	Videoconferencing specialist with patients
Jung et al.	2019	Australia	No videoconferencing
Abbasi et al.	2020	Pakistan	Editorial
Ambrosini et al.	2020	Italy	Videoconferencing specialist with patients
Anderson et al.	2020	Australia	Videoconferencing specialist with patients
Arlt et al.	2020	UK-Netherlands	Videoconferencing specialist with patients
Arrese et al.	2020	Chile	Editorial
Aseem et al.	2020	UK	Editorial
Dhamarajan et al.	2020	USA	No structured evaluation of videoconferencing
Doolittle et al.	2020	USA	No cancer
Elkaddoum et al.	2020	Lebanon	Editorial
Garcia Adrian et al.	2020	Spain	Abstract only
Hellingman et al.	2020	Netherlands	No videoconferencing
Henderson et al.	2020	USA	No structured evaluation of videoconferencing
Kedia et al.	2020	USA	No videoconferencing
Perri et al.	2020	Canada	No cancer
Podda et al.	2020	Italy	No videoconferencing
Rajasekaran et al.	2020	UK	No structured evaluation of videoconferencing
Rangabashyam et al.	2020	Singapore	No videoconferencing
Rao et al.	2020	USA	No videoconferencing
Salari et al.	2020	Iran	Editorial
Triesman et al.	2020	USA	No structured evaluation of videoconferencing
Wiggins et al.	2020	UK	No structured evaluation of videoconferencing

SUPPLEMENT 4: Number of papers vs countries vs continents



This figure shows the number of studies by continent and by country where the teams were based that are described in the 50 studies included in the analysis.
Blue = North America (16 studies); Green = Europe (23 studies); Orange = Oceania (5 studies); Red = Asia (6 studies).

SUPPLEMENT 5: Descriptives regarding videoconferencing use

For a detailed description of the six types of VC collaboration see Table 1.

For the convenience of the reader the legend of the table is provided above and below this table.

Abbreviations: CNS = Central Nervous System; ds = days; chemo = chemotherapy; ChemoRT = Chemoradiotherapy; CT = Computer Tomography; FtF = face-to-face, physically; GBI = Group Behaviour Inventory; GI = Gastro-Intestinal; GP = General Practitioner; HPB = Hepatobiliary; h = hour; ISDN = Internet Service Digital Network; MD = Medical Doctor; MDTM = Multidisciplinary Team Meeting; min. = minutes; PET = Positron Emission Tomography; POS = Palliative care Outcome Scale; QoL = Quality of Life; RCT = Randomized Controlled Trial; RT = Radiotherapy; SV = Survey; VC = Videoconferenced-MDTM.

Patient: information related to patients; HP: information related to healthcare professionals; Survey: information related to surveys; Interv.: information related to interviews.

We recorded VC for diverse wording in the studies: tumour board by VC or multidisciplinary team by VC or collaborative care team by VC or International Tumour Board by VC; Multidisciplinary Cancer Conferences by VC.

We used the term cases when a patient's case was presented or discussed in a VC or FtF meeting; one patient might be discussed multiple times in successive MDTMs.

Explanation of coding of frequency: Freq. = frequency of MDTM; W = Weekly, 2W or 3W = twice or trice per week, M = Monthly, 2M is twice per month, D = Daily, Bw = Bi-weekly.

Explanation of coding of treatment: At = Adult treatment, Pc = Palliative care, Pt = Paediatric treatment.

Additional information: * study period from main text, ** referred paper with details on study, *** corresponding author; ▼ = exchange rate 1999: for 1 USD you get 0.94 Euro; ▲ = exchange rate 2012: for 1 USD you get 0.78 Euro; ◄ = exchange rate 2002: for 1 British Pound you get 1.6 Euro; ► exchange rate 1999: for 1 SEK you get 0.116 Euro.

If authors had not clearly stated the aim of the study, the research method or the data sources, the text in *italics* is the interpretation of the authors of this review.

For the description of the aim of the study we used the word *'describe'* if the paper described, reported or showed the result; we used the word *'evaluate'* if the study evaluated, analysed or assessed outcomes. We used '*review of case records*' if the paper did not clearly state research method and the data source. If we could not retrieve the information in the results, we recorded '*Not reported*'.

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
1. Expert MDTM-National								
Axford et al. (2002)	United Kingdom (UK)	*Describe VC*	Review of audit form on cost, attendance and technical features	Patient: mean 4.8 cases in 42 VCs HP: mean 15 staff of which 8 participants in 42 VCs	W	Breast, lung, colorectal, esophageal, gastric	At	Nov 2000 to Oct 2001
Billingsley et al. (2002)	USA	Describe VC	Review of case records	Patient: 85 cases; 38% referred to cancer centre; improved access to multidisciplinary care HP: improved referral coordination	Bw	Head-and-neck, lung, colon, leukaemia, other	At, Pc	2000-2001
Bumm et al. (2002)	Germany	Describe VC	*Review of databases*	Patient: 3298 cases (2438 patients); 1 case in 5 min. HP: duration VC 30-35 min.	D	Esophagus, stomach, pancreas, colon, liver, rectum	At	Oct 1999 to Feb 2002
Delling et al. (2002)	Germany	Describe VC	*Review of databases*	Patient: 121 cases; 27 cases had frozen section pathology of which in 24 the concept diagnosis was correct HP: improved safety of diagnostic process; training for less experienced colleagues	W	Bone	At	Aug 2001 to May 2002*
Niemeyer et al. (2003)	Germany	*Describe VC*	*Review of databases*	Patient: 190 cases; 51 cases had frozen section pathology: 39 diagnostic and 12 during surgery, in which 11 showed tumour free surfaces HP: duration VC 45 min.	W	Bone	At	Aug 2001 to Feb 2003*
Bauman et al. (2005)	Canada	Feasibility of VC for regional participation	Survey among participants	Patient: mean 5 cases in 6 VCs HP: 1 case in 20 min.; in 60% of cases recommendations for change were made; clinical research associates attended VC to recruit for clinical trials (40% eligible) Survey: 17 of 21 SVs returned	M	Prostate, bladder, renal, testicular	At	Jan 2003 to June 2003
Norum et al. (2006)	Norway	Feasibility of VC and e-mail	*Review of case records*	Patient: 5 cases HP: 78% educational VC, costs were lower at > 12 VCs per y; 84% of 32 planned VCs succeeded	W	Breast, colorectal	Pc	Nov 2002 to Nov 2003
Dickson-Witmer et al. (2008)	USA	*Describe VC*	*Review of case records*	Patient: PET-scan 14-21 ds reduced to 7 d, CT 7 ds to 1 ds HP: 6-8 cases discussed with 40 HPs in 1 h; compliance to treatment standards was in 2004 92% and in 2006 to 95% for recommendations given; clinical trial accrual increased from 9.9% in 2001 to 20% in 2006	W	CNS, breast, chest, gynaecological, genitourinary, lymphoma	At	2006

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Salami et al. (2015)	USA	Evaluate VC	Review of databases	Patient: 116 cases, of which 41% in VC; in VC more were ≥ 65 years (29%), had higher degree of comorbidity (79%) and had portal hypertension (49%) compared to cases in FtF (15%, 44%, and 28%) HP: waiting time to diagnosis VC (median 26 d) vs FtF (median 63 d); in VC multidisciplinary (92%) and guideline driven evaluations (100%) vs FtF (65% and 75%)	W	HPB	At	2009 to 2013
Thillai et al. (2016)	UK	Evaluate VC for early referral	Review of databases	Patient: 159 cases; 42% referred at initial diagnosis HP: in 22 of 53 not referred cases, imaging was not available for evaluation	2W	Colorectal with liver metastases	At	2012, 6 months
Wilson et al. (2016)	Australia	Feasibility VC	Review of case records	Patient: mean 8.7 cases in 18 VCs (2010) vs mean 8.0 cases in 25 VCs (2011) HP: 28% increase in cases in 2011 due to improved administrative support; waiting time to case discussion in MDTM from referral (standard 14 d) mean 28% to 42%	Bw	Upper GI	At, Pc	Jan 2010 to Dec 2011
Powell et al. (2018)	USA	Feasibility VC for molecular profiling	Prospective cohort Molecular Profiles Tumour response and patient survival	Patient: 109 of 120 cases profiled; 16% of patients declined recommended treatment and preferred palliative care in a hospice, because they were too ill; tumour response and survival (n=16) in genome clinical trials were similar to that (n=16) receiving Food and Drug Administration off-label treatment HP: 58% of patients heard recommendations on their treatment plan from their treating physician in the community setting	2W	Advanced solid tumours	At	June 2014 to Dec 2015
Rosell et al. (2019)	Sweden	Evaluate VC	Survey among participants Observation of behaviour	Patient: - HP: meeting observational tool assesses functionality and participants' contribution to the case discussion: high scores for case histories, leadership, and teamwork; lower scores for patient-centred care and involvement of care professionals for national VC MDTM Survey: 125 of 241 SVs returned of which 87% MDs (56% surgery, 26% medical oncology, paediatric oncology 10%, radiology 6% and pathology 2%), 11% nurse, medical secretaries 2%	W	Esophageal, HPB, anal, vulvar, penile, childhood cancer	At, Pt	May 2017 to May 2018

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Brandl et al. 2020	UK – Ireland	Evaluate VC	Data base review Follow-up for survival information	Patient: mean 4.6 new cases in 34 VCs; 35 patients were discussed more than once; 19 of 22 had complete cytoreduction of cancer cells after surgery HP: effective selection for specialised, expensive treatment (87% diagnosis confirmed)	M	Peritoneal mesothelioma (GI)	At	Mar 2016 to Dec 2018
Fitzgerald et al. (2020)	Australia - New Zealand	Feasibility VC for review of stereotactic chart use	Review of case records	Patient: 285 cases of which 237 were new HP: 1126 attendances in 12 months from 114 participants of 21 locations including 27 radiotherapists from 13 locations; mean 1.2 recommendations per patient; inverse relationship between VC case load and recommendations ($p < 0.002$)	W	CNS, lung, liver, bone, spine	At	July 2018 to July 2019
Pan et al. (2020)	USA	Feasibility VC	Review of case records Survey among referring physicians	Patient: 1585 cases: 60 in 2013 increased to 364 in 2019 HP: implementation of recommendations increased from 18% in 2016 to 48% in 2019 as indicated by respondents; 50% of cases had pathology assessment in 2016, upon extra hire it increased to 95% in 2019 Survey: 6 months (2013): 6 SVs returned; 3 y (2015): 32 SVs returned; 6 y (2019): 54 SVs returned	M - Bw - W	Sarcoma	At	2013 to 2019
Rosell et al. (2020)	Sweden	Evaluate VC	Survey among participants	Patient: - HP: national level and regional level MDTM is valuable in sharing knowledge for treatment of specialty tumours and complex cases Survey: 125 of 241 SVs returned of which 87% MDs (53% surgery, 26% medical oncology, radiology 6%, pathology 2% and 'none of the name' 14%), 11% nurse	W	Esophageal, HPB, anal, vulvar, penile, childhood cancer	At, Pt	May 2017 to May 2018
2. Expert MDTM-International								
Bharadwaj et al. (2007)	USA – India	Evaluate VC	*Review of case records*	Patient: 26 cases; 50% had severe pain; 10% was hospitalized; mean care 40 d HP: duration VC 60 – 90 min.; 81 e-mails for follow-up, treatment strategies, doubts and clarifications; 4 text messages for urgent consultation; 11 cases presented in 'Subjective-Objective-Assessment-Plan'-format	3W	77% cancer, *not specified*	Pc	2006***, 2 months

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Qaddoumi et al. (2007)	Jordan – Canada	Feasibility of VC	*Review of case records*	Patient: mean 3.6 cases in 20 VC; in 23 cases recommendations on treatment plans were significant changes, which were followed in 21; increased survival HP: max. 6 cases per VC; optimal duration of collaboration is unclear	M	CNS	Pt	Dec 2004 to Apr 2006
Qaddoumi et al. (2008)	Jordan – Canada	Evaluate VC	*Review of case records*	Patient: mean 3.9 cases in 26 VC HP: review of radiation fields in interactive discussion through VC led to better surgery and RT practice	M	CNS	Pt	Dec 2002 to Dec 2006
Amayiri et al. (2018)	Jordan – Canada	Evaluate VC sustain-ability	Review meeting minutes	Patient: mean 3.6 cases in 20 VCs, 2004-2006; mean 4.9 cases in 33 VCs, 2007-2009; mean 3.8 cases in 32 VCs, 2011-2014; 16 suggestions for molecular testing, 2011-2014 were followed in 6 cases HP: recommendations given in 44% to 30% to 24% of cases; costs VC from 280 to 30 Euro ▲/ h	M	CNS	Pt	Dec 2004 to Apr 2006 vs Jan 2007 to Dec 2009 vs Aug 2011 to Apr 2014
Mayadevi et al. (2018)	India – USA	Feasibility of VC for dysphagia	Review of case records	Patient: mean 1.4 cases in 18 VCs; Functional Oral Intake Scale improved from 1.46 ± 0.989 to 3.92 ± 1.809 ($p < 0.0001$) HP: recommendations were followed in 22 of 26 patients, neuromuscular electrical stimulation was too costly or logistically impossible	M	Head-and-neck	At	18 months
3. Expert Consultation								
Sezeur et al. (2001)	France	Evaluate VC for transfer of patients	Review of case records Survey among patients	Patient: mean 3.2 cases in 27 VCs; 48 case discussions and 39 second opinions; in 2 of 48 cases treatment plans were changed; patients remembered 80.5% of information given after 24 h HP: saved € 77.85 per patient on transport by ambulance; low speed of connection gave less diagnostic image quality Survey: 16 of 16 SVs returned on VC; 12 of 16 SVs returned on memorization	2W	Gastric	At	Nov 1996 to Mar 1998**
Stalfors et al. (2005)	Sweden	Evaluate costs of FtF vs VC	Health economic analysis Survey among patients	Patient: 50 cases FtF, 68 cases VC HP: cost VC € 236▶ vs FtF € 263; MDs accompanied patients in 100% of VC-sessions vs 15% of FtF Survey: 39 of 50 FtF vs 45 of 68 VC patient SVs returned	W	Head-and-neck	At	Sept 1998 to Sept 1999

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Chekerov et al. (2008)	Germany	Feasibility of VC	Review of case records Survey among participants	Patient: mean 4 cases (range 2-7) in 39 VCs; 144 cases and 121 second opinions HP: mean 17 participants in 39 VCs, who attended median 6 VCs; 98% recommendations were accepted Survey: 43 of 75 SVs returned first; 51 of 75 SVs returned	Bw	Gynaecological	At	Dec 2004 to Aug 2006
Schroeder et al. (2011)	Germany	Evaluate VC	Survey among participants	Patient: mean 3.5 cases (range 1-7) in 131 VCs; 398 second opinions; no hospital visit for second opinion HP: median 14 participants in 131 VCs; 50% VC-participants asked more second opinions Survey: 205 of 275 SVs returned	Bw	Breast, gynaecological	At	Dec 2004 to June 2009
Seeber et al. (2013)	Italy – Austria	Feasibility of VC	*Review of case records (historical vs VC)*	Patient: 93 historical, 110 VC; mean 1 case in 104 VCs HP: 8 minor and 20 major treatment plan changes (25%); access to cancer-centre-specific treatment modalities 63 RT treatments in VC vs 34 historical	Bw	Lung	At	May 2003 to Aug 2007 Aug 2007 to May 2011
Stevenson et al. (2013)	USA	*Describe VC*	Review of case records Survey among participants	Patient: mean 1.7 cases in 10 VCs (2011), 22 cases in 13 VCs (2012) HP: mean 10 participants per VC; 1 case in 30 min.; reduction overall costs of MDTM by VC in rural community Survey: 10 of 20 SVs returned	Bw	Lung	At	2009-2013
Crispen et al. (2014)	Bahamas, Trinidad and Tobago	Evaluate VC for peer review in radiother-apy	Review of case records Survey among participants	Patient: 40 cases, 10 from each tumour type HP: Radiotherapists were satisfied with audio-visual aspects of VC; RT standard has no security or confidentiality guide for VC Survey: 10 of 10 SVs returned	W	Head-and-neck, breast, cervical, prostate	At	July to Nov 2013
Shea et al. (2014)	USA	Feasibility of VC	Survey among participants Interviews among participating specialists Observations of VC	Patient: 15 cases from 6 counties; HP: 14 VCs observed; VC is an opportunity for clinical trial recruitment; valuable discussion of complex cases Survey: 32 of 32 SVs returned Interv.: 28, 16 centre vs 12 community-based	Bw	All	At	Aug 2011 to March 2012

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Frappaz et al. (2016)	France	Describe VC national expert consultation	*Review of case records*	Patient: mean 3.7 cases in 46 VCs; 48% primary tumours HP: VC is an opportunity for clinical trial recruitment; valuable discussion of complex cases	W	CNS	Pt	2015
Burkard et al. (2017)	USA	Evaluate VC Precision Medicine Molecular Tumour Board	Review of databases	Patient: mean 3.2 case in 23 VCs; 48 cases in registry of which 38 had recommendations and clinical follow-up HP: max. 6 cases in 1 h; mean time referral to presentation 13.5 d; access to clinical trials which aim to find new biomarkers (18 genes); 1 of 14 patients enrolled in clinical trials in the state due to advanced illness, no outside-state trial enrolment	Bw	Breast, gastric, lung	At	Sept 2015 to Sept 2016
Abu Arja et al. (2018)	USA, Latin American countries	Evaluate Latin American VC	Survey among participants	Patient: - HP: 1 h sufficient to discuss requested cases from 20 countries; 39% attendees said sending pathology slides to USA was easy and helpful Survey: 95 of 159 SVs returned (66 frequent attendance, 23 not-frequent, 11 never attended)	W	CNS	Pt	Dec 2017 to Mar 2018***
4. Consultation Specialist - Nurse								
Saysell et al. (2003)	UK	Evaluate VC	Survey among participants Focus groups	Patient: mean 0.9 cases in 29 VCs; 96% cancer HP: mean 5 attendees in 29 VCs; 12 additional monthly educational VCs; 19 symptom control issues discussed Survey: 25 of 26 SVs returned	W	Breast, lung, bladder, prostate, gastric, ovarian	Pc	Oct 2001 to Oct 2005
O'Mahony et al. (2009)	USA	Evaluate VC for Bioethics and QoL	Pre- and post-education test for staff Survey among patients and staff with Palliative Care Outcome Scale (POS)	Patient: enhanced end-of-life care through better knowledge of nursing staff HP: mean 5.5 staff with 1 family member in 13 VCs vs mean 5.8 staff with 0.9 family member in 14 FtFs; up-to 90 min. preparations time in an off-unit conference room; 1 VC rescheduled due to internet problems Survey: 75 POS SVs returned: 33 staff, 23 family caregivers, 19 patients	2M	*Not specified*	Pc	Mar 2008 to Jan 2009

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Donnem et al. (2012)	Norway	Feasibility of VC	Review of case records Survey among participants	Patient: mean 1.6 cases in 106 VCs; 75% palliative; 82% stayed in community for symptom management (pain management and nutrition) after VC introduction vs 70% before VC HP: median 7 participants in 106 VCs; waiting time for consultation with oncologist at centre reduced with 8 ds to max. 7 ds Survey: 141 of 167 SVs returned	W	Breast, colorectal	At, Pc	Mar 2009 to Sept 2010
Watanabe et al. (2012)	Canada	Feasibility of VC for palliative RT consultation	Prospective case series Survey among participants and patients	Patient: 44 new cases from 29 communities with 28 follow-up visits; 7.96 h saved time, € 149.93▲ saved expense per visit HP: 1 new case in 90 min. and 1 follow-up visit in 30 min. in 1 VC; 1 visit completed by telephone due to technical difficulties Survey: 19 of 44 GP SVs returned; 44 of 44 patient SVs returned	W	All	Pc	Jan 2008 tot Mar 2011
5. MDT-Equal								
Delaney et al. (2004)	Australia	Evaluate FtF vs VC	Anthropological analysis of interpersonal interactions Pre- and post-survey among participants	Patient: median 4 cases per VC vs 6 FtF; HP: median 10 participants VC vs 8 FtF; more formal behaviour (less joking) Survey: pre 16 of 27 vs post 16 of 26 SVs returned	W	Breast	At	Feb to July 2000
Savage et al. (2007)	UK	Evaluate VC	*Review of case records* Survey among participants	Patient: 48 new cases with 182 issues; 29 complex cases HP: timing and frequency of VCs was appropriate (92% and 96%) Survey: 50 of 85 SVs returned	M	Head-and-neck	At	Nov 2003 to June 2006
Marshall et al. (2014)	United States of America (USA)	Feasibility of VC	Review of case records Survey among participants	Patient: access to cancer centre stayed 7.5 d HP: partner brought 14 of 90 cases by VC; 1 case in 13.1 min. VC vs 8.4 min. FtF (p = .004); 12 of 16 MDTMs used VC during part FtF MDTM Survey: 36 of 36 SVs returned	W	Breast, esophageal, gastric, HPB, colorectal, melanoma, sarcoma	At	4 months
Alexanders-son et al. (2018)	Sweden	Evaluate VC costs	Observation of VC Survey among participants	Patient: mean 12.7 cases per VC and FtF-session HP: mean duration VC 68 min. vs FtF 46 min.; 14 of 50 MDTMs used VC during part of FtF MDTM Survey: 104 of 105 SVs returned	W	All but hematologic cancers	At	Feb to July 2016

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Van Huizen et al. (2019)	Netherlands	Evaluate VC	Review of case records Observation of VC Interviews among participants	Patient: mean 18.6 cases per VC; 336 cases in 18 VCs got 8 recommendations (2%), that were major or minor changes aimed at optimization of treatment outcome HP: complex cases were discussed more than once; during 61% of VCs all key specialists were present Interv.: 6 specialists, 3 at each site	W	Head-and-neck	At	Sept 2016 to Feb 2017
6. MDTM-Collaborate								
Hunter et al. (1999)	USA, Pacific	Describe web-based VC	Survey among participants Assessment of technical features	Patient: 103 cases; 16 evacuations to cancer centre prevented HP: > 84% cases discussed were major contribution to VC session; audio and image quality: 79% and 100% > good; pathology and radiology imaging: 89% and 75% > good; costs centre vs remote partner € 304▼ vs € 511 Survey:38 of 38 SVs returned	W	All	At	Oct 1996 to Dec 1998
	USA, North Carolina	Describe ISDN VC	Survey among participants Assessment of technical features	Patient: 304 cases HP: > 95% case discussions were major contribution to VC session; audio and image quality: 100% good, pathology and radiology imaging: 95 and 95% > good; costs centre vs remote partners € 250▼ vs € 335 Survey: 22 of 25 SVs returned	W	Breast	At	Feb 1998 to Jan 1999
Olver et al. (2000)	Australia	Evaluate VC	*Review of case records* Survey among participants and patients	Patient: median 30 cases per y HP: 10 of 17 MDs using VC changed their way of working practice Survey: 20 of 20 participant SVs returned (including 3 nurses); 8 patient SVs returned	W	Breast	At, Pc	1999***, 3 months
Davison et al. (2004)	UK	*Describe VC*	*Review of case records*	Patients: 62% (15) cancer cases in 28 VCs; reduced length of stay with 0.67 d HP: range 1-7 cases in 1 VC; surgery access time reduced from 69 ± 38 to 54 ± 26 d; achieved standard treatment within 56 d; increased resection rate from 14.7 to 19.0 per y	W	Lung	At	Nov 2000 to Oct 2001
Kunkler et al. (2006)	UK	Evaluate FtF vs VC	Survey among participants before and in week 28 of the RCT	Patient: - HP: GBI showed positive scores for both FtF and VC, e.g. on decision making and efficiency; minor difference for FtF e.g. less physical resources Survey: 33 of 44 FtF returned (pre VC); 24 of 32 VC (post VC); 11 pre- / post VC returned of same participant	W	Breast	At	Mar 2004 to Apr 2005

Authors (publication year)	Country	Aim	Method with data source	Outcomes regarding videoconferencing use	Freq.	Tumour type	Treatment type	Evaluation period
Kunkler et al. (2007)	UK	Evaluate FtF vs VC	Participant satisfaction on case discussions Economic evaluation	Patient: median 7 cases in FtF vs 5 in VC; 195 cases in FtF vs 278 VC HP: 28 FtF- and 48 VC-sessions; same confidence level treatment plan decisions; costs were lower at > 40 VCs per y	W	Breast	At	Mar 2004 to Apr 2005
Stevens et al. (2012)	New Zealand	Evaluate FtF vs VC	Review of meeting minutes	Patient: 35% RT-cases VC vs 29% RT-cases FtF HP: no sign. differences FtF vs VC in waiting time from diagnosis to start RT and on % recommended RT vs treatment performed	W	Lung	At	Jan to June 2009
Murad et al. (2014)	Pakistan	Evaluate VC	*Review of case records*	Patient: mean 3.7 cases, mean 13 min. per case; drop-outs for chemotherapy after surgery reduced from 36% to 19% HP: 31% minor changes, 12% major changes; departmental database was started for management evaluation purposes	W	Breast, gastric, endocrine, skin, soft tissue	At	Nov 2009 to Dec 2011
Novoa et al. (2016)	Spain	Evaluate occasional vs regular weekly VC	*Review of databases*	Patient: 563 cases occasional vs 464 cases weekly VC HP: ratio 0.70 thoracic surgery cases / new cases seen in occasional VC went up to 0.87 in weekly VC	W	Lung	At	2008-2010 vs 2011-2013

Abbreviations: CNS = Central Nervous System; ds = days; chemo = chemotherapy; ChemoRT = Chemoradiotherapy; CT = Computer Tomography; FtF = face-to-face, physically; GBI = Group Behaviour Inventory; GI = Gastro-Intestinal; GP = General Practitioner; HPB = Hepatobiliary; h = hour; ISDN = Internet Service Digital Network; MD = Medical Doctor; MDTM = Multidisciplinary Team Meeting; min. = minutes; PET = Positron Emission Tomography; POS = Palliative care Outcome Scale; QoL = Quality of Life; RCT = Randomized Controlled Trial; RT = Radiotherapy; SV = Survey; VC = Videoconferenced-MDTM.

Patient: information related to patients; HP: information related to healthcare professionals; Survey: information related to surveys; Interv.: information related to interviews.

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We used the term cases when a patient's case was presented or discussed in a VC or FtF meeting; one patient might be discussed multiple times in successive MDTMs.

Explanation of coding of frequency: Freq. = frequency of MDTM; W = Weekly, 2W or 3W = twice or trice per week, M = Monthly, 2M is twice per month, D = Daily, Bw = Bi-weekly.

Explanation of coding of treatment: At = Adult treatment, Pc = Palliative care, Pt = Paediatric treatment.

Additional information: * study period from main text, ** referred paper with details on study, *** corresponding author; ▾ = exchange rate 1999: for 1 USD you get 0.94 Euro; ▴ = exchange rate 2012: for 1 USD you get 0.78 Euro; ◂ = exchange rate 2002: for 1 British Pound you get 1.6 Euro; ▸ exchange rate 1999: for 1 SEK you get 0.116 Euro.

If authors had not clearly stated the aim of the study, the research method or the data sources, the text in *italics* is the interpretation of the authors of this review.

For the description of the aim of the study we used the word '*describe*' if the paper described, reported or showed the result; we used the word '*evaluate*' if the study evaluated, analysed or assessed outcomes. We used '*review of case records*' if the paper did not clearly state research method and the data source. If we could not retrieve the information in the results, we recorded '*Not reported*'.

SUPPLEMENT 6: Benefits, drawbacks, VC team participants and VC platform used in MDT-Equal and MDTM-Collaborate videoconferencing

Abbreviations: ENT = Ear-Nose-Throat; FtF = face-to-face, physically; HC = Healthcare professional; MD = Medical Doctor; MDT = Multidisciplinary Team, MDTM = Multidisciplinary Team Meeting; MF = Maxillofacial; pub = publication; RT = Radiotherapy; VC = Videoconferenced-MDTM; * from corresponding author.

VC team participants: MDt: Medical Doctors in therapeutic disciplines: surgeons, (medical) oncologists and radiotherapists; MDd: Medical Doctors in diagnostic disciplines: radiologist, pathologist, nuclear medicine physician; Sd: supportive disciplines related to treatment and palliative care: nurses, dieticians, etc; Other: staff, medical secretaries and medical administration; see supplement 7.

PC Platform abbreviations: CCD = charge-coupled device camera; DICOM = Digital Imaging and Communications in Medicine; DSL = Digital Subscriber Line; EMR = Electronic Medical Record; HW = hardware; ISDN = Integrated Service Digital Network; M / Kbps = Mega / Kilobits per second; PACS = picture archiving & communication system; PC = personal computer; SW = software; TCP / IP = Transmission Control Protocol / Internet Protocol.
** Kunkler's studies used the same VC-Platform; *** Novoa described two MDTMs that use the same VC-Platform.

If authors had not clearly stated the data sources, the text in *italics* is the interpretation made by the authors of this review. Where we could not retrieve information, we put '*Not reported*'.

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
MDT-Equal					
Delaney et al. (2004)	Patient: Improved access to multidisciplinary care HC: improved access to multidisciplinary discussions; U-shaped table improved interaction between participants because they then face each other	HC: More formalised and regimented professional relationships of MDs; 1 of the 2 district hospitals did not want to continue because of time constraints	Liverpool Hospital, Sydney*: MDt: oncologist, radiotherapist; MDd: pathologist, radiologist; Other: medical students	2 general district hospitals*: MDt: surgeon, oncologist, radiotherapist	HW: PictureTel Swiftsite-2, PictureTel Venue 2000 and PictureTel Concord 4500 SW: bridge support; bandwidth 384 Kbps Room: U-shaped table
Savage et al. (2007)	Patient: recommendations concerning major or minor changes to treatment plans for complex cases HC: less travel for specialists; served as an educational tool	Patient: less suitable for recruitment for clinical trials and research discussions HC: less suitable for research discussions	Centre, Glasgow*: MDt: ENT-, MF-surgeons, oncologists; MDd: radiologists, pathologists; Sd: specialist nurses, dieticians, speech and language therapists; Other: staff	6 locations, West of Scotland Managed Clinical Network*: MDt: ENT-physician, oncologists; Other: staff	Support: level of technical support varied across the locations

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
Marshall et al. (2014)	HC: served as an educational tool; logistics on services not available at remote partner are discussed	HC: costs were an implementation barrier	Michael E. DeBakey Veterans Affairs Medical Center, Houston: MDt: oncologists, radiotherapist, surgeon, gastroenterologist; MDd: pathologists, radiologists, nuclear medicine physician; Other: medical administration	New Orleans (NOLA): MDt: oncologists, radiotherapist, pulmonologist; MDd: radiologist; Other: medical administration	HW: high-resolution VC equipment SW: Veterans Affairs linked IP-lines Room: 1th screen for real-time VC interactions, 2nd screen for sharing EMR data and case presentations Faults: audio quality slightly less than FtF
Alexan-ders-son et al. (2018)	Patient: better treatment plans for complex cases HC: gave shared culture and common understanding of cancer pathways in the networks; medical protocol and peer-review principles were advocated	HC: estimated cost of VC-MDTM was higher than MDTM, but there was no account taken for reduced time for travel	University hospital, Lund: [22 MDTMs, 13 VC] MDt: surgeons, oncologists; MDd: pathologists, radiologists; Sd: nurses	6 county hospitals: [28 MDTMs, 11 VC] MDt: surgeons, oncologists; MDd: pathologists, radiologists; Sd: nurses	*Not reported*
Van Huizen et al. (2019)	Patient: better treatment plans for complex cases due to discussion with 'fresh team' HC: kept viewpoints on medical protocols aligned in the network	HC: partner could not choose which patients to discuss due to the Dutch standard requiring the partner to discuss all patients with the centre; VC is an extra MDTM for the network	University Medical Center Groningen: MDt: ENT-, MF-surgeons, radiotherapist	Medical Centre Leeuwarden: MDt: ENT-, MF-surgeons, radiotherapist	HW: centre: 3 beamers; 5 camera inputs; 4 PCs of which 1 dedicated for PACS; remote partner: 1 PC showing data and imaging SW: 'Webex', optical fibre* bandwidth 2 Mbps Room: U-shaped table*
MDTM-Collaborate					

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
Hunter et al. (1999)	Web-based Patient: decreased unnecessary evacuations with cost savings HC: increased knowledge of clinical pathways for evacuation; stream-lined referral process with access to scarce facilities; served as an educational tool	HC: hindered logistics of fixed day and time 1) the day of the week (100%), or 2) the time of day (97%), or 3) low volume of interesting case presentations (100%)	Hawaii, Triple Army Medical Center: MDt: surgeon, oncologist, radiotherapist; MDd: pathologist, radiologist; Sd: psychologist, specialist nurse; Other: staff	Guam, Okinawa, Misawa, Korea, Camp Lejeune, Yokota, Yokosuka: MDt: surgeon; MDd: pathologist, radiologist; Sd: specialist nurse; Other: staff	HW: VC system, film digitizer, archive, telepathology system, web server for radiology images, workstation, conferencing telephone, digital projectors SW: net meeting desktop VC system
	ISDN HC: promoted collaboration; participants could see each other; fewer administrative tasks to get information displayed at the remote partner	HC: hindered logistics of fixed day and time 1) day of the week (95%), or 2) time of day (85%), or 3) low volume of interesting cases discussed (81%)	NC, David Grant Medical Center: MDt: surgeon, radiotherapist, oncologist; MDd: pathologist, radiologist; Sd: specialist nurse, social worker, technician; Other: staff	McClellan Air force base, Lemoore Naval: MDt: surgeon; MDd: radiologist; Sd: specialist nurse; Other: staff	HW: microscope, film digitizer, web server, PCs, conferencing telephone; camera, microphones SW: ISDN, bandwidth 384 Kbps, bridge support, PictureTel concord base codec; DICOM Faults: when network congestion telephone conferencing is used
Olver et al. (2000)	Patient: satisfied with reduced time away from home; less travel for patients HC: better understanding treatment possibilities; better treatment planning; isolated MDs felt better supported; tertiary centre reported better communication with partners; less travel for MDs; enhanced peer review; served as an educational tool	Patient: no physical examination of patient; less confidentiality (privacy) HC: not knowing each other or not knowing abilities of MDs at each site; increased workload of MDs; no reimbursement of VC	Adelaide Royal: MDt: oncologists, radiotherapist, palliative care clinicians; Sd: nurses; Other: staff	Royal Darwin Hospital: MDt: physicians, surgeons	HW: centre: camera; cameras mounted above light box; microscope for radiology and pathology; remote partner: portable VC unit Room: centre: 30-seat theatre Faults: image quality Support: logistics of displaying patient data
Davison et al. (2004)	Patient: reduced waiting time from diagnosis to treatment; increased clinical trial accrual HC: format made case presentations more concise and complete; increased availability of thoracic surgeon opinion on recent guidelines; three weeks of surgeon travel time saved	HC: upload digital CT images had to be planned and conducted before the meeting by centre and partner	Southend District Hospital: MDt: chest medicine physician, oncologist, MDd: radiologist; Sd: specialist nurse, technician	London Chest Hospital: MDt: thoracic surgeon; MDd: radiologist	HW: Tandberg VC Vision 800; centre: Radworks CT viewing station; partner: Sony CCD camera; DXC950 above light-box SW: 3 ISDN-lines, bandwidth 384 Kbps Support: technician was necessary to adjust camera, sound and radiographs (enabling medical staff to concentrate on clinical issues)

Authors (pub year)	Benefits VC	Drawbacks VC	Cancer centre participants	Remote partner participants	VC Platform used
Kunkler et al. (2006)	HC: increased size and composition of the group with less experienced, younger staff in VC vs FtF; less travel for specialists	HC: during VC there is less knowledge available from experienced MDs, possibly due to logistic changes to the MDTM and difference in attendance	Edinburgh Breast Unit: MDt: surgeons, oncologist; MDd: radiologists; Sd: specialist nurses; Other: staff	Dumfries and Galloway Royal Infirmary: MDt: surgeons; MDd: pathologist, radiologist; Sd: specialist nurses	**HW: Tandberg 2500 VC codec, twin digital projectors, networked PC, microscope and X-ray viewing system SW: ISDN-lines, NHS IP networks Room: U-form tables in room; Faults: 5x no VC due to technical difficulties Support: improved access to required physical resources for VC vs FtF, but varied across locations
Kunkler et al. (2007)	Patient: VC and FtF have similar clinical effectiveness in quality of decision making HC: more core staff involved in the oncology centre VC vs FtF; less travel for specialists; better guideline compliance	HC: slightly fewer cases by VC due to technical problems	Edinburgh Breast Unit: MDt: surgeons, oncologists	Queen Margaret Hospital, Dunfermline / Fife: MDt: surgeons; MDd: pathologist, radiologist; Sd: specialist nurses	
Stevens et al. (2012)	Patient: VC helped to decrease health disparities between urban and rural populations (improved access)	Patient: median time from diagnose to start treatment was longer (not significant)	Auckland District Health Board, VC-MDTM: MDt: surgeons, oncologists	Counties Manukau District Health Board, VC-MDTM: MDt: respiratory physicians; MDd: radiologist	*Not reported*
Murad et al. (2014)	Patient: impact on outcome through coordinated care HC: refinement of treatment through discussion; specialists at both sites have developed closer professional ties and aligned common practices; guidelines better followed for chemotherapy before and after surgery; served as an educational tool	HC: workload for oncological surgery increased threefold	NORI Hospital, Islamabad: MDt: oncologist.	Holy Family Hospital, Rawalspindi: MDt: surgeons; MDd: radiologists and pathologists	HW: Polycom VSX 7000 VTC camera, 42-inch liquid crystal display monitor SW: VC link using DSL connectivity
Novoa et al. (2016)	Patient: less travel for patients; increased frequency of thoracic surgery for new patients HC: reduction in time for MD to see patients; reduction in duplicate tests; faster and more accurate diagnostic / treatment plans	HC: too many patients to discuss during VC, but not all outpatients for thoracic surgery should be discussed in VC	Healthcare Complex of the University of León*: MDt: thoracic surgeons	Thoracic Surgery of University Hospital, Salamanca*: MDt: pulmonologists, oncologists, radiotherapists	***HW: computer with microphone and webcam SW: corporate application to access each other's' computer desktop
			Healthcare Complex of the University of León*: MDt: thoracic surgeons, radiotherapists	Hospital Nuestra Señora de Sonsoles de Ávila*: MDt: pulmonologists, oncologists	

SUPPLEMENT 7: Mapping of disciplines present during videoconferencing

Overview of the terms for healthcare professionals found in the different studies and how they were grouped by the authors in Supplement 6 of this review.

Legend people mentioned present at VC MDTM

* The terms ENT-physician and ENT-surgeon are seen as equivalents because, for ENT, the disciplines are the same. In comparison, neurosurgeons and neurologists have different disciplines.

Abbreviations: ENT = Ear -Nose -Throat; MF = Maxillofacial; HPB = Hepatobiliary; VC = Videoconferencing; MDTM = Multidisciplinary Team Meeting.

Code	*Term used in original paper*	*Equivalent group term (Suppl. 6)*
Medical Doctor therapeutic (MDt)		
MDt	general surgeon	surgeon
MDt	plastic surgeon	surgeon
MDt	thoracic surgeon	surgeon
MDt	breast surgeon	surgeon
MDt	thoracic surgeon	surgeon
MDt	transplantation surgeon	surgeon
MDt	surgical oncologist +/- HPB	surgeon
MDt	ENT-surgeon	*ENT-surgeon
MDt	MF-surgeon	MF-surgeon
MDt	medical oncologist	oncologist
MDt	clinical oncologist	oncologist
MDt	gastroenterologist	gastroenterologist
MDt	hepatologist	hepatologist
MDt	treating physician	physician
MDt	general physician	physician
MDt	ENT-clinician	*ENT-physician
MDt	radiation oncologist	radiotherapist
MDt	pulmonologist	pulmonologist
MDt	respiratory physician	pulmonologist
MDt	internist	internist
MDt	Palliative Care (PC) clinician	PC physician
MDt	consultant chest medicine	thoracic physician
MDt	oncologic rehabilitation physician	rehabilitation physician
Medical Doctor diagnostic (MDd)		
MDd	radiologist	radiologist
MDd	diagnostic radiologist	radiologist
MDd	interventional radiologist	radiologist
MDd	pathologist	pathologist

Code	*Term used in original paper*	*Equivalent group term (Suppl. 6)*
MDd	nuclear medicine physician	nuclear medicine physician
MDd	medical physicist (supporting Nuclear Medicine)	medical physicist
Supportive Discipline (Sd)		
Sd	Macmillan cancer nurses oncology	specialist nurse
Sd	clinical nurse specialists in breast and colorectal cancer	specialist nurse
Sd	oncology nurse	specialist nurse
Sd	chemotherapy specialist nurses	specialist nurse
Sd	breast care nurses	specialist nurse
Sd	surgical nurse	specialist nurse
Sd	lung cancer clinical nurse specialist	specialist nurse
Sd	palliative care nurse	specialist nurse
Sd	nurse	nurse
Sd	extended practitioners (nurse practitioner / physician assistant)	specialist nurse
Sd	clinical trial nurses	research nurse
Sd	psychologist	psychologist
Sd	mammography technologist	technologist
Sd	oncology art therapist	art therapist
Sd	radiographer	radiographer
Sd	respiratory therapist	respiratory therapist
Sd	dietician	dietician
Sd	speech & language therapist	speech & language therapist
Sd	junior medical staff	medical staff
Sd	staff physician	medical staff
Sd	social worker	social worker
Sd	medical dosimetrist	medical dosimetrist
Sd	genetic counsellor	genetic counsellor
Sd	nurse navigator	case manager
Sd	case manager	case manager
Other		
Other	research staff	research staff
Other	allied health staff	staff
Other	audit staff	staff
Other	other MDTM participants	staff
Other	project director	staff
Other	systems network manager	staff
Other	systems manager	staff
Other	dedicated coordinator	staff

Code	*Term used in original paper*	*Equivalent group term (Suppl. 6)*
Other	meeting coordinator	staff
Other	medical secretaries	medical administration
Other	administration	medical administration
Other	meeting coordinator	medical administration
Other	cancer registrar	medical administration
Other	cancer network coordinator	medical administration
Other	cancer centre personnel	medical administration
Other	technician	technician
Other	mammography technologist	technician
Other	trainees	students
Other	students	students


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CHAPTER 5

Does multidisciplinary videoconferencing between a head-and-neck cancer centre and its partner hospital add value to their patient care and decision-making? A mixed method evaluation

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ABSTRACT

Objectives

Given the difficulties in diagnosing and treating head-and-neck cancer, care is centralized in the Netherlands in eight head-and-neck cancer centres and six satellite regional hospitals as preferred partners. A requirement is that all patients of the partner should be discussed in a multidisciplinary team meeting (MDT) with the head-and-neck centre as part of a Dutch health policy rule. In this mixed method study, we evaluate the value that the video-conferenced MDT adds to the MDTs in the care pathway, quantitative regarding recommendations given and qualitative in terms of benefits for the teams and the patient.

Design

A sequential mixed method study.

Setting

One oncology centre and its partner in the Northern part of the Netherlands.

Participants

Head-and-neck cancer specialists presenting patient cases during video-conferenced MDT over a period of six months. Semi-structured interviews held with six medical specialists, three from the centre and three from the partner.

Primary and secondary outcome measures

Percentage of cases in which recommendations were given on diagnostic and/or therapeutic plans during video-conferenced MDT.

Results

In eight of the 336 patient cases presented (2%), specialists offered recommendations to the collaborating team (3 given from centre to partner and 5 from partner to centre). Recommendations mainly consisted of alternative diagnostic modalities or treatment plans for a specific patient. Interviews revealed that specialists perceive added value in discussing complex cases because the other team offered a fresh perspective by hearing the case 'as new'. The teams recognize the importance of keeping their medical viewpoints aligned, but the requirement (that the partner should discuss all patients) was seen as outdated.

Conclusions

The added value of the video-conferenced MDT is small considering patient care, but the specialists recognized that it is important to keep their medical viewpoints aligned and that their patients benefit from the discussions on complex cases.

Keywords

Videoconferencing (MeSH term), head-and-neck cancer, collaborating teams, multidisciplinary team meetings (MDT), added value, mixed method study

Strengths and limitations of this study

- The study evaluates in depth the video-conferenced MDT between the centre and the partner in the head-and-neck oncology care pathway and refocuses on benefits and drawbacks (strength).
- Participating specialists from different specialisms and locations were interviewed and identified benefits and drawbacks of the videoconference meetings (strength).
- The researcher's presence during video conferenced MDT may have influenced the communication between the centre and the partner, also called 'Hawthorne effect' (limitation).
- Only one of the six centres and its preferred partner in the Netherlands was studied (limitation).

INTRODUCTION

Most tumours in the head or neck region (nasal cavity, paranasal sinuses, lips, mouth, salivary glands, throat or larynx and complex skin malignancies) are fast growing tumours[1]. This implies that a long interval between the moment of referral and the start of the primary treatment (surgery, radiotherapy and/or chemotherapy) can lead to tumour progression with less survival chance[2]. Because of complexity of diagnostic procedures and therapeutic modalities and low volume of patients, head-and-neck cancer care is centralized in multidisciplinary head-and-neck cancer centres[3]. In 1984, the Dutch Head & Neck Society (DHNS) was founded as a scientific organization. Later the DHNS became involved in the nationwide organization of head-and-neck cancer care. As a result, since 1993, head-and-neck cancer patients in the Netherlands are treated in eight head-and-neck cancer centres recognized by the DHNS; six centres have preferred partners[4]. Within each head-and-neck cancer centre, multidisciplinary meetings according to national evidence-based guidelines are mandatory to provide the best diagnostic work up and treatment for patients, and to sustain the quality of care in the oncology centres[5, 6, 7, 8]. Criteria for qualifying as centre are: having the specialisms with expertise to treat the tumour, having the necessary diagnostic and therapeutic facilities and treating at least 200 new patients each year. Partners fulfil the same criteria, but should treat at least 80 new patients.

In 1997, after an informal collaboration period of 4 years, the Medical Centre Leeuwarden became the formal preferred partner of the Head-and-Neck Cancer Centre of the University Medical Centre Groningen[9], further referred to as the "partner" and the "centre". The collaboration of a centre with its partner is based upon trust and sustainable agreements on governance aspects, evidence based multidisciplinary decision-making and use of facilities[10, 11, 12]. The collaboration consists of weekly multidisciplinary team meetings (MDTs) between centre and partner to discuss diagnostic and therapeutic plans. The efficiency of the MDTs is important for decision-making and care pathway management. The centre's MDT regarding diagnostics and treatment involves more than 9 disciplines (details presented elsewhere)[13]. The teams of centre and partner meet face-to-face three times a year, where governance, guidelines and research projects are discussed.

The DHNS and the Dutch Health Care Inspectorate (DHCI) require that all new patients of the partner are discussed in a weekly MDT with the centre[14]. This DHCI requirement can be seen as quality control over the partner clinic. Specialists from centre and partner, from the departments of oral and maxillofacial surgery (OMS), ear, nose and throat (ENT) and radiotherapy (RT) participate. This weekly MDT is additional to a local MDT in the hospital where the patient is first seen and will be treated. Initially, these collaborative multidisciplinary weekly meetings were in the centre: three specialists travelled to the oncology centre (2 hours traveling time and 2 hours MDT). When videoconferencing became available, it became the preferred method for this communication[15, 16]. The video-conferenced MDT is scheduled after the local MDT. During the videoconferencing, the partner presents all patient cases, including available imaging, and proposed diagnostic and therapeutic plan. The centre presents complex cases or cases interesting to discuss. Both sides are free to offer recommendations. The team presenting the patient case is responsible for documenting changes when a recommendation is implemented.

Recommendations from both teams to the decision-making regarding diagnostic and therapeutic plans may add value to the quality of patient care[17, 18]. We decided to evaluate

the video-conferenced MDT as part of the collaboration agreements because it was time consuming and there was a wish to refocus on benefits and drawbacks.

Research Question

Aim of this study was to analyse the value of video-conferenced MDT in the treatment of head-and-neck cancer patients in the care pathways, resulting in two questions.

1. How often are recommendations given on diagnostic and/or therapeutic plans by the teams during video-conferenced MDT?
2. What benefits and drawbacks of the videoconference are perceived by the specialists in the teams?

DESIGN

This mixed method study[19, 20, 21] had a quantitative part followed by a qualitative part. The primary outcome of the weekly video-conferenced MDT was the percentage of cases in which recommendations on diagnostic and/or treatment plans were given. The secondary outcome were the benefits or drawbacks of the MDT video conference perceived / experienced by the participating specialists. In the study period, the teams acted conform the DHCI requirement that all patients of the partner should be presented in a multidisciplinary meeting with the centre.

Videoconferencing equipment used

The video-conferenced MDT was held in dedicated multidisciplinary meeting rooms, where screens can be operated with two to four computers with monitors. While the patient data is presented on the first screen, teams can see each other on the second screen. The videoconferencing is operated via the 'Webex'-application and a camera. Both locations call into a special safe 'chat room'.

Centre: dedicated 20-seat VC room with three screens - beamers (software / provider Kinly; bandwidth 2 Mbps) and five camera inputs. Four computer stations, one dedicated for Radiology showing PACS Imaging.

Partner: dedicated 10-seat VC room with one screen with possibility to see patient data and the other team; one computer log-on to patient dossiers showing data and imaging.

Patient data

Data of all patients presented by one of the teams during the video-conferenced MDT videoconferences between September 2016 and February 2017 were included. The tumour localization, histology and tumour stage were registered for all patients that were presented.

Patient involvement in study design

Patients were not involved in the study because the main purpose of the study was to evaluate the added value of the DHCI requirement in a weekly video-conferenced MDT.

Quantitative part

Sample size calculation recommendations

In a 4-week pilot study of 4 sessions including 46 cases, carried out 9 months before study start, we found that in approximately 20% of cases a recommendation was given. To estimate this percentage with a 10% precision (95 % confidence interval: 15.5 % to 25.4 %) would require 250 cases. On average, 15 cases were discussed at each weekly video-conferenced MDT. We estimated that six months would be sufficient to acquire the necessary 250 cases. The pilot study was also used to operationalize the primary outcome measure.

Recommendation registration

Recommendations were registered with the relevant data from electronic and written medical records on a clinical registration form by LvH during the videoconference. Each recommendation was assessed by the two teams with respect to change impact (minor or major, Table 1a) on the diagnostic and/or therapeutic plan, case complexity, use of national multidisciplinary guidelines for the diagnostic and/or treatment plan, and comorbidity of the patient (Table 1b). LvH registered the given recommendation with the relevant data; JdV and JR verified the registrations. During the videoconferencing sessions, field notes were taken by LvH.

Table 1a. Definitions of change impact and case complexity: operational definitions of major and minor changes in diagnostic or treatment plan

	diagnostic plan	treatment plan	remarks
minor	additional more-detailed MRI or CT-thorax of the area already imaged	logistic change	
major	additional MRI or CT-thorax in a different area from the area already imaged	change in modality: adding or deleting a therapeutic modality; surgery radiotherapy or chemotherapy	
criterion	addition of diagnostic plan in a different area than already investigated	adding or deleting a treatment modality from the treatment plan in the proposed or in a different area	after the major/minor decision is made, the decision registered in the research form will be verified by both specialists (giver and receiver)

Table 1b. Definitions of change impact and case complexity: operational definition of case complexity

	modality	guideline	comorbidity
not complex	unimodal treatment	diagnosis and treatment follows guideline	no comorbidity
complex	multimodal treatment	diagnosis and/or treatment does not follow guideline	comorbidity
remark	• unimodal: surgical procedure chemotherapy primary radiotherapy • multimodal: reconstruction surgery chemo- or bio-radiotherapy	which guidelines are followed	

Statistical analysis

Differences in age, gender, tumour localization and tumour histology (ICD(O))[22], and tumour stage between cases presented by the centre and those presented by the partner were analysed using t-test for independent samples, Chi-Squared test, and Chi- Squared test exact procedure if requirements for the Chi-Square test were not met. Statistical analyses were performed using SPSS 23.0 for Windows software. In all analyses, statistical significance was set at the 5% level.

Qualitative part

Interviews

Semi-structured interviews were conducted with six medical specialists that attended the meetings most frequently, one from the OMS-, ENT- and RT-department of each team, to explore the added value of the video-conferenced MDT. The field notes taken by the researcher during the video-conferenced MDT were used to develop the questions for the semi-structured interviews. After receiving verbal informed consent from the specialists, the semi-structured interviews started with providing information about the recommendations given. Thereafter it continued with the open question 'What do you think is the value of the videoconference between the head-and-neck cancer centre and their preferred partner?'. LvH then guided the interview using a short topic list including 'added value' and 'perceived possibilities for change or improvement in the video-conferenced MDT' (Table 2). The different topics were introduced in a flexible way, and the interviews took the form of natural conversations.

Table 2. Interview Guide

Topics	Questions
Added value videoconferencing	What do you think is the added value of the video-conferenced MDT between the head-and-neck cancer centre (centre) and their preferred partner (partner)? Could you mention strong points of the video-conferenced MDT? Could you give examples? Could you name points for improvement? Could you mention examples?
Role of specialism in videoconference	What do you think the role of a specialist is in the video-conferenced MDT between centre and partner? The consultation is required by the Dutch Head and Neck Society and the Dutch Health Care Inspectorate, how usefulness do you think it is? Would you advise stopping the consultation if it was not mandatory?
Results interpretation	Have you given recommendations to the centre/partner? Have you received recommendations from the centre/partner? Could you indicate what the difference is between peer consultation and giving a recommendation? What do you think would be an ideal video-conferenced MDT? Could you explain your answer? What do you think could be adjusted in the video-conferenced MDT to make the consultation more effective and more efficient?

Interviews lasted between 25 and 40 minutes, were audio recorded and transcripts of the interviews were made. The participants were asked to review the transcripts and extracted quotes, related to perceived added value, possible improvements and the role of a specialist in the video-conferenced MDT.

Thematic analysis

Quotes were anonymized and coded for their relevance to possible benefits or drawbacks for the collaboration between the teams and for patient care. The first stage of this inductive analysis of the interviews involved two authors, JR and JdV, in an initial open coding procedure that resulted in a list of codes corresponding closely to the text fragments extracted from the six interviews. The codes were placed in a coding tree using a thematic analysis approach with main themes recommendations, added value, collaboration and planning[23, 24]. Codes were judged as being a benefit or a drawback. Any disagreements during the coding were discussed between the coders and the researcher[25]. After the preliminary results were collated, for credibility a member check was performed with participants.[26] The Clinical Research Office performed a planned quality check on data management.

RESULTS

Quantitative analysis

From September 2016 to February 2017, 82 patients were presented by the centre and 177 by the partner in 18 weekly video-conferenced MDTs (Table 3). In this period of 22 weeks, three meetings were cancelled due to a 'medical complication meeting', a technical problem to connect and a holiday recess. Further, the researcher could not attend one session.

Table 3. Patients and their tumour characteristics, as presented during videoconference meetings

Number of patients (total n=259)	***Centre (n=82)***		***Partner (n=177)***		***Statistics*, p value**
(n=number of available data)	***mean***	***SD***	***mean***	***SD***	
Age (Mean, SD)	67.8	15.2	66.7	16.1	*(t-test)* .533
Gender (n=259)	*n*	*%*	*n*	*%*	*(Chi^2)* .394
Female	27	10	68	26	
Tumour localization (n=206*)	*n*	*%*	*n*	*%*	*(Chi^2-exact)* < .001
Lip (C00)	3	3	4	2	
Oral cavity	21	23	29	12	
Tongue (C01, C02)	6	-	11	-	
Gums (C03)	5	-	7	-	
Floor of mouth (C04)	4	-	4	-	
Oral cavity, unspecified (C05, C06, C14)	6	-	7	-	
Major salivary glands (C07, C08)	2	2	7	3	
Oropharynx (C09,C10)	7	8	6	2	
Nasopharynx (C11)	0	0	0	0	
Nasal Cavity (C30)	2	2	3	1	
Hypopharynx (C12, C13)	5	5	5	2	
Sinus (C31)	3	3	3	1	
Larynx (C32)	10	11	15	6	
Bronchus and Lung (C34)	0	0	5	2	
Hematologic and reticuloendothelial systems (C42)	0	0	11	5	
Skin (C44)	14	15	35	14	
Lymph nodes (C77)	2	2	1	0	
Unknown (C80)	3	3	0	0	
Miscellaneous (C20, 33, 41, 49, 50, 64, 73)	3	3	7	3	
Unknown (C80)	3	3	0	0	
Morphology or cell type (n=259)	*n*	*%*	*n*	*%*	*(Chi^2)* < .001
Squamous cell carcinoma (SCC)	57	72	78	44	
Basic cell carcinoma (BCC)	3	4	6	3	
Melanoma	0	0	11	6	
Miscellaneous malignant	7	9	9	5	
Benign	2	2	18	10	
Infection – premalignant abnormalities	2	2	12	7	
Miscellaneous	11	13	43	24	
T-stage (n=159)**	*n*	*%*	*n*	*%*	*(Chi^2)* < .001
T1	13	14	42	17	
T2	20	22	20	8	
T3	8	9	9	4	
T4	25	27	14	6	
Tx	7	8	1	1	

In total 336 cases presented: 93 by centre and 243 by partner.
*= only tumour localization if tumour diagnosed; **= only TNM-code if firstly diagnosed, so there are more patients in which 'localization' is known (i.e. for relapse or tumour residue or metastases).

Most of the centre's patients (71 out of 82 – 86%) were presented only once, nine were presented twice (11 %), one patient was discussed three times and another four times. Whereas 111 patients were presented only once (63%) by the partner. Generally patients of the partner where presented twice or three times: the first time their diagnostic plan, the second time the therapeutic plan and sometimes surgical results the third time (55 out of 177 – 31%). Only one patient was discussed four times; five patients on the partner's list were not discussed at the first opportunity because imaging was not complete.

The partner presented significantly ($p < .001$) more cases with infections that were initially suspected malignancy, T1-stage patients and non-complex cases. Tumour localization and histology differed also significantly between centre and partner (Table 3). In 61% of the 18 videoconferences both teams were complete; the centre team was not complete in 22% (n=4) and, in 17% (n=3), the partner team was not complete. On those occasions one of the other specialisms would present the cases, for example OMS for ENT. The centre's ENT department was represented in most meetings by an ENT-specialist training to be a head-and-neck oncology surgeon. The centre presented on average 5.2 (SD 2.4) cases per videoconference, the partner presented on average 13.5 (SD 3.9) cases.

Recommendations given

Recommendations were given in eight of the 336 cases presented (2%; 95% confidence interval: 1 to 5%) relating to eight of the 259 patients (3%; 95% confidence interval: 1 to 6%).

Of these recommendations, five were major and three minor (Table 4). Four recommendations concerned diagnostic plans, and four treatment plans. On three of the eight occasions when a recommendation was given, the centre's team was incomplete with one of the three specialisms absent. Seven of the eight recommendations were given by OMS specialists, and five of the eight were related to ENT patients. Seven of the eight instances occurred on a patient's first presentation and the other one during a second presentation although, in this case, the imaging had not been complete the first time. In general, recommendations were given related to the more complex cases, but not necessarily patients with comorbidity or those with more advanced tumours. About 70% of case were 'formalities' or 'routine patients', meaning patients that fitting the guidelines (well-defined tumours with limited regional metastases and without comorbidity).

Qualitative analysis – specialist interviews

During May 2017 six interviews were held. From the transcripts of the six interviews, 107 quotes were registered. During the coding procedure, items were placed in a coding tree with relevance to the primary research question (recommendations given) and the secondary research question (perceived benefits and drawbacks) by the researcher in consultation with the coders. For each major theme, minor themes were derived from the researcher's field notes. In total 282 scores were given (Table 5). In several instances the quotes were scored differently although the inter-coder agreement was acceptable given the possible 37 codes to choose from.

Benefits were more frequently mentioned by specialists of the partner, and the drawbacks more frequently by specialists of the centre. But the majority of codes had a positive connotation for the video-conferenced MDT (Table 5).

Table 4. Recommendation and its specifics

No	*Recommen-dation*	*Who*	*To whom*	*Team complete?*	*Recommen-dation (short)*	*Change impact, diagnosis or treatment phase*	*Patient status (ICD-code, TNM-classification, histology; case complexity, guideline used and comorbidity)*					
							ICD	*TNM*	*histology*	*com-plex?*	*guide-line?*	*comor-bid?*
1	2016G10-1 28-09-2016	OMS partner	ENT centre	yes	give patient choice of expectative treatment	major, treatment	C44	T2N0M0	SCC	yes	no	yes
2	2016L14-1 28-09-2016	OMS centre	OMS partner	yes	ultrasound guided biopsy	minor, diagnosis	-	-	maligne lympho-ma	no	yes	no
3	2016G32-1 26-10-2016	OMS partner	OMS centre	centre not	use methotrexate to identify malignancy	minor, treatment	C00	T1N0M0	SCC	yes	yes	no
4	2016G39-1 23-11-2016	OMS partner	ENT centre	yes	change surgery approach to retain functionality	major, treatment	C00	T2N0M0	adenoid cystic carcinoma	yes	no	no
5	2016G40-1 23-11-2016	OMS partner	ENT centre	yes	try PDT	major, treatment	C01	T4aN0M0	SCC	yes	no	no
6	2016G51-1 14-12-2016	OMS partner	ENT centre	centre not	consult Ophthalmo-logy	major, diagnosis	C44	T2N0M0	BCC eye corner	yes	no	yes
7	2016L90-2 14-12-2016	OMS centre	ENT partner	centre not	new biopsy	major, diagnosis	C31	T3NxM0	Melan.	yes	yes	yes
8	2017L123-1 04-01-2017	RT centre	OMS partner	yes	add MRI	minor, diagnosis	C07	T1N0M0	SCC	yes	yes	no

BCC = Basal cell carcinoma, Melan. = Melanoma; MRI = Magnetic Resonance Imaging; PDT = Photo Dynamic Therapy, SCC = Squamous cell carcinoma

Table 5. Coding tree evaluation video-conferenced MDT

Coding tree			Pos?	Code	Code description	Partner	Centre	Total
Videoconferencing	Recom-menda-tion	Nuance	+	22	video-conferenced MDT is mostly 'inter-collegial consultation'	3	3	6
			+	14	recommendations are nuances, not a totally different medical procedure or diagnostic/ treatment plan for a specific patient	7	10	17
		Follow-up traceable?	+	6	suggestions are taken from others	1	2	3
			+	20	there is no patient-level evaluation on the implementation of medical procedures agreed, question of trust	3	2	5
			-	34	sometimes decisions are already taken in relation to continuity of treatment	1	1	2
		Aligning	+	1	fine-tuning or aligning medical procedures	10	10	20
			+	9	continue routine cases discussion to prevent deviation from medical procedures	2	2	4
		Knowledge	0	32	besides videoconferencing also bilateral consultation via telephone	4	1	5
			+	37	keep 'know how' with routine cases	1	2	3
	Added Value?	Video-confe-renced MDT	+	8	added value for complex cases vs. routine cases	21	24	45
			-	15	little added value	8	1	9
			0	27	discuss radio-therapeutic scheme	2	2	4
			-	29	non-complex cases or 'formalities' are communicated because it is mandatory, no added value	7	1	8
			+	30	recommendation given to own discipline	5	1	6
		Team completeness	+	4	presence of all three disciplines is essential	3	4	7
			+	11	expertise (good) of physician is important	5	3	8
			0	23	add presence of medical oncology discipline as expertise	2	2	4

Coding tree			Pos?	Code	Code description	Partner	Centre	Total
Videoconferencing	Collabo-ration	Communi-cation	0	2	working together requires communication	8	2	10
			+	10	at both locations working methods are comparable through video-conferenced MDT	5	2	7
			-	19	initially it was good to consult, added value decreased because teams have grown towards each other	1	1	2
		Trust	+	5	respectful collaboration	3	7	10
			+	7	mutual trust	4	5	9
			+	13	important to know the partner, not only via videoconferencing; good for cohesion	8	7	15
		Expertise	-	18	centre member does not think videoconferencing necessary, because partner should be trusted as such	2	4	6
			+	26	expertise and new developments from centre to partner	2	2	4
		DHCI requirement	0	21	video-conferenced MDT between centre and partner is a national agreement or policy	2	3	5
			-	31	the national policy – to discuss all cases including routine cases – between centre and partner is perceived as out-dated	7	2	9
	Plan-ning	Logistics	-	16	stressful, considering other videoconferences	3	6	9
			0	17	integrate video-conferenced MDT in the hospital's MDT for centre and partner	5	7	12
		Preparation	-	12	improve format of patient presentation	1	1	2
			+	24	good preparation is important	5	4	9
		Commitments	+	25	starting and stopping the video-conferenced MDT on time is important	4	1	5
			0	33	possibly cancel video-conferenced MDT when nothing to discuss	1	1	2
		Equipment	+	3	technique always flawless	1	1	2
			-	35	sometimes video-conferenced MDT did not take place due to technical malfunction	1	1	2
			-	36	placement of monitor in the room hinders colleagues and hampers interaction	2	2	4
Scientific Research			0	28	bias through research setting because researcher is present as observer (Hawthorne effect)	1	1	2
Total quotes						151	131	282

This coding tree has major and minor themes that were derived from the primary research question (recommendations given), the secondary research question (added value as described in benefits and drawbacks perceived) and minor themes derived from researcher's field notes. One code was related to the research situation.
'Pos?' refers to the question: has this code a positive connotation or benefit? + = yes, 185 scores; 0 = neither positive nor negative, 42 scores; - = no, 55 scores.
The amount of codes given is given for the partner, the centre and in total. DHCI is short for Dutch Health Care Inspectorate.

Six main items were important according to the specialists (quotes in italic).

1. The videoconference adds value when discussing complex cases, through assisting in fine tuning and aligning medical procedures (code 1, 20x);

A patient is presented about which the own team had some discussion, that can be discussed with the partner. In that manner, you get a confirmation or advice to change your treatment plan. This advice can be given by the same specialism, but also by other members of the head-and-neck oncology team (ENT).

2. Communication is essential for cooperation between teams (code 2, 10x), furthermore it is important to know the partner well, not only via videoconferencing (code 13, 15x), and to interact respectfully (code 5, 10x) with mutual trust (code 7, 9x).

The most important feature of the video-conferenced MDT is to communicate with each other on substantive medical matters, to be on speaking terms, and to know each other (RT).

During the videoconferencing, we respect each other, we listen to each other and we are open to each other's additional comments. We trust each other as partners (OMS).

3. Recommendations are suggested alternatives on diagnostic modalities and treatment plans for specific patients (code 14, 17x).

The video-conferenced MDT has the character of a collegial discussion, in which in collaboration the best diagnostic or treatment plan for your patient is reached. Confirmation on your treatment plan adds value too (OMS).

4. For routine cases that fall within guideline for treatment, the videoconference meeting adds little value as for changes in medical content, it can even irritate the participants in such cases (code 15, 9x).

The video-conferenced MDT sometimes changes the treatment plan for an individual patient. The videoconference is not the meeting where new procedures or guidelines are developed (RT).

5. There is a wish to integrate the videoconference with the site multidisciplinary meeting in both hospitals, the centre and the partner (code 17, 12x).

Integration of the two local multidisciplinary meetings with the video-conferenced MDT could be valuable (ENT).

6. The DHCI requirement (discuss all the partner's cases) has no added value. It is seen as old-fashioned or out-dated (code 29, 8x).

It is better to prepare at a high level and discuss, than to present all the patients and deal with each one briefly. Mutual preparation on special request could have added value, for example a literature search on a complex osteosarcoma case (OMS).

DISCUSSION

Our results show that the added value of the weekly video-conferenced MDT between the head-and-neck cancer centre and the partner hospital was small given the few recommendations made on the initial diagnostic and/or treatment plan. Nevertheless, the specialists from both sites recognized the importance of keeping their medical viewpoints aligned through this type of communication. Whenever discussing complex cases in which a major change was recommended (in 5 of the 8 recommendations), for example to change the surgical approach to save functionality of organs or tissue, the recommended change in treatment had a large impact for that patient (Table 4).

The data from the interviews suggest that especially complex patients would benefit from inter collegial consultation via video-conferenced MDT. If the teams were not obliged to discuss so many routine cases, they could use the time saved to prepare and discuss complex cases in greater depth[27]. The specialists said that they did not want to stop the video-conferenced MDT, because they appreciate reflecting on diagnostic and treatment plans with trusted expert colleagues.

Because of an increase in patients to be presented in the meeting, we were looking for a more efficient meeting, which could be reached not discussing the 'formalities' or 'routine patients' (about 70% of patients); developing an evidence based working method would need more research. This result is supported by a large survey in the UK after 10 years of use of an MDT format, where specialists also said they wanted to change many components and refocus to spend more time on complex cases in detail[18].

The qualitative part of this study showed that medical specialists perceived added value in discussing complex cases in a collegiate consultation, because the other team offers a fresh perspective by hearing the case 'as new'. Although remarks were often about nuances, the confirmation on the chosen treatment by the other team was experienced as helpful. This view is supported in literature where medical specialists found videoconferencing useful in at least one aspect of their practice[10].

An important requirement to communicate through videoconference is that participants know each other from personal meetings, to support mutual trust and respect as the basis for cooperation. The finding that collaboration and cooperation improves when each discipline understands each other's roles and that specialties working together for a long time do not need many words to come to a decision was supported previously[17, 28].

The video-conferenced MDT can be used to introduce and discuss new developments, protocols and guidelines leading to comparable quality of care in both locations. Comprehensive cancer centre teams working together over videoconferencing with a peripheral hospital team, reviewing radiotherapy planning align their treatment plans (7% major and 21% minor changes)[16] and speed up follow-up appointments[15].

The video-conferenced MDT differs from the local MDT: complex cases are discussed with a second 'expert team' of head-and-neck oncology specialists. The patients treated by the centre and partner are similar, although diagnostics and treatment might differ slightly[29], only in case of rare tumours that need skull base surgery patients travel from partner to centre. In our study the significant differences in tumour localization, cell type and tumour stage between sites are a consequence of 'the DHCI requirement' whereas the 'centre' could decide which of its patients would make an interesting case for discussion. Consequently, the partner presents 3

to 4 times as many patients as the centre. One third of these (31%) reappeared in the subsequent videoconferences, checking extra diagnostic information, treatment plan and need for adjuvant therapy. Most of these presentations were seen as a 'formality'.

The perceived value of the video-conferenced MDT might be influenced by the expertise of specialists. The recommendations given during the evaluation period were mostly given to ENT by an OMS oncologist who had considerably more clinical experience than his opposing colleague had, and was one of the instigators of the collaboration. It could be that recommendations given were accepted more easily if given by a more experienced specialist[12]. Videoconferencing enables specialists acquiring experience with presenting complex oncology patients and with decision-making in teams[6, 17].

Limitations of this study

Contrary to our findings from the 4-week pilot study (n=46), where advice was offered in 20% of the presented cases, the actual 2% recommendations is much lower. Although it is difficult to explain this difference in amount of 'agreed recommendations', we think that the pilot served mainly as a feasibility check, that helped us to define our research questions and to operationalize the definitions. Other factors may also have played a role in the difference between the pilot and the actual study. Firstly, the long-lasting collaboration between the centre and the partner had led to a high level of alignment on diagnostic and therapeutic 'strategies' or medical viewpoints. Secondly, the participants were not blinded for the research question. Thus, awareness of being part of an experiment may have led to a drive to perform well and to present the patients with an optimal diagnostic and treatment plan (Hawthorne effect). Additionally presence of the researcher might have influenced the communication between centre and partner. Often the teams mentioned that the other team was asked to give collegial advice and therefore a suggestion was not always seen as a recommendation. This nuance could also be interpreted as a social desirable answer, possibly due to the long existing collaboration between the centre and the partner before study start. Thirdly, some patient cases were only presented as interesting to discuss. Finally, during the pilot study the advice given was not assessed for its impact.

In this study, we evaluated the added value of a video-conferenced MDT between one oncology centre and its preferred partner. In line with other studies[30, 31], this study showed that, in addition to a quantitative result (number of recommendations), it is important to reflect on the situation through an interview process (qualitative results) before starting to implement improvements. The interviews showed that specialists from both centre and partner support the idea of sustainable collaboration, but they do not support the view implicit in the DHCI requirement that the centre should act as means of quality control for the partner[32]. Our findings on video-conferenced MDTs find support elsewhere in terms of the positive results on teams working together[33-35]. Other studies have shown that more research is needed to understand the effects of video-conferenced MDT on patient outcomes, such as finance including resource usage[36, 37], what fields of specialisms could benefit from the medium[28, 38], participant satisfaction[39], throughput times[40] and self-management for patients[41].

In summary we believe that the DHCI requirement (the partner should discuss all patients with the centre) is unnecessary in the case of routine patients, since it does not add value to the quality of their treatment. It is more useful to spend time to discuss complex cases

in greater detail. We propose the following measures that will add value to the weekly video-conferenced MDT:

1. All the participating medical specialists should be granted freedom to select only complex or interesting cases that could serve to keep medical procedures aligned.
2. The partner should not be obliged to present cases seen as 'routine patients' since this does not add value.
3. The video-conferenced MDT should be organized as an integral part of the partners' MDT and not as a separate weekly meeting.
4. Accepted, mature processes should be regularly reassessed and refocused in order to enable new collaboration strategies.

Based on our findings on the added value of the multidisciplinary videoconference between the head-and-neck centre and its partner and our suggestions for improvements, we would advise the DHNS, along with healthcare policymakers, to reconsider the DHCI requirement.

In our study, we found that there are clinical and practical implications on how and when to start with videoconferencing instead of meetings with physical attendance. Videoconferencing must be seen as a supportive medium for communication within a sustainable collaboration of parties that understand each other's roles and work with guidelines or protocols.

Participants of a videoconference should:

1. Know each other, and meet face-to-face on a regular basis, which serves cohesion (management meetings on governance, guideline developments and research projects are ideal for this purpose).
2. Respect each other as 'expert / knowing' colleague and know each other's role in the multidisciplinary treatment of patients.
3. Trust each other in follow-up of changes to diagnostic and treatment plans.

In view of the above mentioned implications we would not recommend starting with videoconferencing for multidisciplinary meetings if a majority of participants do not know each other.

CONCLUSIONS

The video conferenced MDT has added value in the collaboration and in the care pathway management. When interpreting national multidisciplinary guidelines, centre and partner align their medical policies. This leads to a more efficient use of resources and work force.

Conversely, discussing non-complex cases is seen as a burden, and the DHCI requirement to discuss all the partners' cases as out-dated.

LIST OF ABBREVIATIONS

DMD	Doctor of Dental Medicine
DDS	Doctor of Dental Surgery
MDT	Multidisciplinary Team meeting
DHCI	Dutch Health Care Inspectorate
DHNS	Dutch Head & Neck Society
ENT	Ear, Nose and Throat
ICD(O)	International Classification of Diseases (of Oncology)
MeSH	Medical Subject Headings
OMS	Oral and Maxillofacial Surgery
RT	Radiotherapy
SPSS	Statistical Package for Social Sciences
UMCG	University Medical Center Groningen

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Contributors LvH was involved in the study design and concept; carried out the study; performed the statistical analysis and the analysis and interpretation of the data; and drafted the manuscript. PD, KA, JdV and JR, the supervisor, were involved in the study design and concept, analysis and interpretation of the data, and revision of the manuscript. JdV and JR were involved in the coding of the interview quotations, together with LvH. GH, JvdH, KvdL and OW were involved in the acquisition of the data and the revision of the manuscript. All authors read and approved the final manuscript.
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Author note The University Medical Center Groningen is developing patient centred care pathways for diverse patient groups including laws and regulations for quality and patient safety. LvH, JR are working in cooperation with KA to research care pathway implementation in the Comprehensive Cancer Center Groningen and to develop quality and safety indicators, i.e. process indicators that predict performance of care pathways and sustainable patient outcome.

REFERENCES

1 Waaijer A, Terhaard CH, Dehnad H, et al. Waiting times for radiotherapy: consequences of volume increase for the TCP in oropharyngeal carcinoma. *Radiother Oncol* 2003;66:271-6.

2 Ouwens M, Hermens R, Hulscher M, et al. Development of indicators for patient-centred cancer care. *Support Care Cancer* 2010;18:121-30 doi:10.1007/s00520-009-0638-y; 10.1007/s00520-009-0638-y.

3 Policy head and neck cancer care 2013 (in Dutch). Available at: http://www.nwhht.nl/organisatie/missie.

4 Halmos GB, Bras L, Siesling S, et al. Age-specific incidence and treatment patterns of head and neck cancer in the Netherlands-A cohort study. *Clin Otolaryngol* 2018;43:317-24 doi:10.1111/coa.12991 [doi].

5 Fleissig A, Jenkins V, Catt S, et al. Multidisciplinary teams in cancer care: are they effective in the UK?. *Lancet Oncol* 2006;7:935-43 doi:S1470-2045(06)70940-8 [pii].

6 Ruhstaller T, Roe H, Thurlimann B, et al. The multidisciplinary meeting: An indispensable aid to communication between different specialities. *Eur J Cancer* 2006;42:2459-62 doi:S0959-8049(06)00555-7 [pii].

7 Ouwens MM, Hermens RR, Hulscher MM, et al. Impact of an integrated care program for patients with head and neck cancer on the quality of care. *Head Neck* 2009;31:902-10 doi:10.1002/hed.21041; 10.1002/hed.21041.

8 Dutch National Cancer Control Programme. Progress Report on Cancer Control in the Netherlands, 2005-2010 (Dutch NCCP, Nationaal programma kankerbestrijding). 2010.

9 Cijfers over kanker / Figures on cancer. Available at: http://www.cijfersoverkanker.nl. Accessed May, 6, 2017.

10 Norum J, Jordhoy MS. A university oncology department and a remote palliative care unit linked together by email and videoconferencing. *J Telemed Telecare* 2006;12:92-6 doi:10.1258/135763306776084374 [doi].

11 Bydder S, Nowak A, Marion K, et al. The impact of case discussion at a multidisciplinary team meeting on the treatment and survival of patients with inoperable non-small cell lung cancer. *Intern Med J* 2009;39:838-41 doi:10.1111/j.1445-5994.2009.02019.x [doi].

12 Slavova-Azmanova NS, Johnson CE, Platell C, et al. Peer review of cancer multidisciplinary teams: is it acceptable in Australia?. *Med J Aust* 2015;202:144-7 doi:10.5694/mja14.00768 [pii].

13 van Huizen LS, Dijkstra PU, van der Laan BFAM, et al. Multidisciplinary first-day consultation accelerates diagnostic procedures and throughput times of patients in a head-and-neck cancer care pathway, a mixed method study. *BMC Health Serv Res* 2018;18:820,018-3637-1 doi:10.1186/s12913-018-3637-1 [doi].

14 SONCOS, Dutch policy on multidisciplinary standardization for oncological care (in Dutch): Soncos Normeringsrapport 7, pages 22-26. Available at: https://www.soncos.org/wp-content/uploads/2019/02/Soncos_norm-rapp2019-v7.pdf. Accessed 07/11, 2019.

15 Farris G, Sircar M, Bortinger J, et al. Extension for Community Healthcare Outcomes-Care Transitions: Enhancing Geriatric Care Transitions Through a Multidisciplinary Videoconference. *J Am Geriatr Soc* 2017;65:598-602 doi:10.1111/jgs.14690 [doi].

16 Seeber A, Mitterer M, Gunsilius E, et al. Feasibility of a multdisciplinary lung cancer videoconference between a peripheral hospital and a comprehensive cancer centre. *Oncology* 2013;84:186-90 doi:10.1159/000345314 [doi].

17 Gagliardi A, Smith A, Goel V, et al. Feasibility study of multidisciplinary oncology rounds by videoconference for surgeons in remote locales. *BMC Med Inform Decis Mak* 2003;3:7,6947-3-7. Epub 2003 Jun 19 doi:10.1186/1472-6947-3-7 [doi].

18 Meeting patients' needs. Improving the effectiveness of multidisciplinary teams meetings in cancer services. Available at: https://www.cancerresearchuk.org/sites/default/files/full_report_meeting_patients_needs_improving_the_effectiveness_ of_multidisciplinary_team_meetings_.pdf. Accessed 07/11, 2019.

19 Charmaz K. Contructing Grounded Theory. A Practical Guide through Qualitative Analysis. London: Sage Publications 2006.

20 Plochg T, Juttman RE, Klazinga NS, et al. Handbook health research (Handboek gezondheidszorgonderzoek). Houten: Bohn Stafleu van Loghum 2007.

21 O'Brien BC, Harris IB, Beckman TJ, et al. Standards for reporting qualitative research: a synthesis of recommendations. *Acad Med* 2014;89:1245-51 doi:10.1097/ACM.0000000000000388 [doi].

22 Vlaams Kankerregistratienetwerk. International Classification of Diseases for Oncology, third edition, updates (in Dutch): Vlaams Kankerregistratienetwerk 2011:240.

23 Creswell J, Plano Clark V. Designing and conducting mixed methods research. Los Angeles: Sage 2011.

24 Tong A, Sainsbury P, Craig J. Consolidated criteria for reporting qualitative research (COREQ): a 32-item checklist for interviews and focus groups. *Int J Qual Health Care* 2007;19:349-57 doi:mzm042 [pii].

25 Gioia DA, Gorley KG, Hamilton AL. Seeking Quality Rigor in Inductive Research: Notes on the Gioia Methodology. *Organizational Research Methods* 2012;16:15,16-31 doi:10.1177/1094428112452151.

26 Birt L, Scott S, Cavers D, et al. Member Checking: A Tool to Enhance Trustworthiness or Merely a Nod to Validation?. *Qual Health Res* 2016 doi:1049732316654870 [pii].

27 Xylinas E, Roupret M, Kluth L, et al. Collaborative research networks as a platform for virtual multidisciplinary, international approach to managing difficult clinical cases: an example from the Upper Tract Urothelial Carcinoma Collaboration. *Eur Urol* 2012;62:943-5 doi:10.1016/j.eururo.2012.08.022 [doi].

28 Stevens G, Loh J, Kolbe J, et al. Comparison of recommendations for radiotherapy from two contemporaneous thoracic multidisciplinary meeting formats: co-located and video conference. *Intern Med J* 2012;42:1213-8 doi:10.1111/j.1445-5994.2012.02817.x [doi].

29 de Ridder M, Balm AJM, Baatenburg de Jong RJ, et al. Variation in head and neck cancer care in the Netherlands: A retrospective cohort evaluation of incidence, treatment and outcome. *Eur J Surg Oncol* 2017;43:1494-502 doi:S0748-7983(17)30364-5 [pii].

30 Helck A, Matzko M, Trumm CG, et al. Interdisciplinary expert consultation via a teleradiology platform--influence on therapeutic decision-making and patient referral rates to an academic tertiary care center. *Rofo* 2009;181:1180-4 doi:10.1055/s-0028-1109733 [doi].

31 Ottevanger N, Hilbink M, Weenk M, et al. Oncologic multidisciplinary team meetings: evaluation of quality criteria. *J Eval Clin Pract* 2013;19:1035-43 doi:10.1111/jep.12022 [doi].

32 Stoffels AR. Cooperation among medical specialists: pain or gain? 2008.

33 Axford AT, Askill C, Jones AJ. Virtual multidisciplinary teams for cancer care. *J Telemed Telecare* 2002;8 Suppl 2:3-4 doi:10.1177/1357633X020080S202 [doi].

34 Barry N, Campbell P, Reed N, et al. Implementation of videoconferencing to support a managed clinical network in Scotland: lessons learned during the first 18 months. *J Telemed Telecare* 2003;9 Suppl 2:S7-9 doi:10.1258/ 135763303322596110 [doi].

35 Qaddoumi I, Mansour A, Musharbash A, et al. Impact of telemedicine on pediatric neuro-oncology in a developing country: the Jordanian-Canadian experience. *Pediatr Blood Cancer* 2007;48:39-43 doi:10.1002/pbc.21085 [doi].

36 Sezeur A, Degramont A, Touboul E, et al. Teleconsultation before chemotherapy for recently operated on patients. *Am J Surg* 2001;182:49-51 doi:S0002-9610(01)00662-6 [pii].

37 Kunkler IH, Fielding RG, Brebner J, et al. A comprehensive approach for evaluating telemedicine-delivered multidisciplinary breast cancer meetings in southern Scotland. *J Telemed Telecare* 2005;11 Suppl 1:71-3 doi:10.1258/1357633054461804 [doi].

38 Murad MF, Ali Q, Nawaz T, et al. Teleoncology: improving patient outcome through coordinated care. *Telemed J E Health* 2014;20:381-4 doi:10.1089/tmj.2013.0100 [doi].

39 Careau E, Dussault J, Vincent C. Development of interprofessional care plans for spinal cord injury clients through videoconferencing. *J Interprof Care* 2010;24:115-8 doi:10.3109/13561820902881627 [doi].

40 Fitzpatrick D, Grabarz D, Wang L, et al. How effective is a virtual consultation process in facilitating multidisciplinary decision-making for malignant epidural spinal cord compression?. *Int J Radiat Oncol Biol Phys* 2012;84:e167-72 doi:10.1016/j.ijrobp.2012.03.057 [doi].

41 Tokuda L, Lorenzo L, Theriault A, et al. The utilization of video-conference shared medical appointments in rural diabetes care. *Int J Med Inform* 2016;93:34-41 doi:10.1016/j.ijmedinf.2016.05.007 [doi].


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CHAPTER 6

General discussion

6

In this thesis, reorganisational interventions of multidisciplinary oncological care pathways at the University Medical Center Groningen (UMCG) and the added value of videoconferencing (VC) in oncology care have been evaluated. In this final chapter, the main findings will be summarised. The contributions will be discussed from three angles: the organisation of multidisciplinary oncological care pathways, the delivery of integrated care and the use of VC technology. Thereafter, methodological considerations related to the research will be discussed. Finalising this PhD project, I then take the opportunity to reflect on my roles as both a researcher in the field of quality improvement in the medical domain and as a senior consultant in quality and patient safety. Finally, the implications of the current studies for future research and recommendations for daily practice will be discussed.

6.1 Main findings

In Chapter 2, the multidisciplinary first-day clinic (MFDC) in the head-and-neck cancer care pathway (low volume – high complexity), introduced in 2007, was evaluated using quantitative and qualitative techniques. Shortly after the introduction of the MFDC, the process indicators of 'time needed to complete diagnostic procedures', 'time to start first treatment' and 'the number of hospital visits' had improved, and compliance with the national standard on 'starting treatment within 30 days' increased from 52% to 83%. In the long-term follow-up checks (in 2010 and 2013), most of these positive effects had reduced due to the introduction of new treatment modalities for which more time was needed for preparation and planning[1, 2]. Nevertheless, the effect of the MFDC remained positive in terms of the time needed to complete diagnostic procedures. In interviews, the specialists reflected they were not aware of the recent increase in throughput times because they lacked a 'real-time' dashboard.

In Chapter 3, a reorganisation of the multidisciplinary team meetings of the three UMCG Gastro-Intestinal Oncology (GIO) care pathways (hepatobiliary, esophagus-stomach and colorectal – all high volume - low-to-high complexity) that aimed to make the care pathways more patient-centred and reduce throughput times were evaluated in a mixed methods study. The effects of the reorganisation differed among the three care pathways. After the reorganisation, the time needed to formulate a treatment plan increased in the hepatobiliary care pathway, but the time to start treatment decreased. Further, the number of hospital visits between triage and treatment plan increased, and more multidisciplinary team meetings (MDTMs) were needed to come to a treatment plan. In the esophagus-stomach care pathway, the number of hospital visits needed to formulate a treatment plan decreased after the reorganisation. In the colorectal pathway there was also a trend towards a decrease in the number of hospital visits. After the reorganisation, in all three care pathways the percentage of patients starting their treatment within the 63-day Dutch national standard increased: from 60% to 88% (hepatobiliary), from 96% to 100% (esophagus-stomach) and from 85% to 93% (colorectal). In interviews, stakeholders of the three care pathways reflected that the reorganisation had led to full attendance by specialisms in the MDTMs. As a consequence, discussions about treatment modalities had improved with greater attention given to patients' wishes. The improved attendance also had a positive effect on interpersonal relations between the healthcare professionals. It was felt that the MDTMs could be further improved by participants being better prepared, but it proved difficult to schedule time for preparation.

Stakeholders explained that the limited improvement in starting treatments on time was in part due to a lack of diagnostic capacity. It was suggested that a dashboard with real-time throughput times would be helpful in monitoring diagnostic and start treatment times.

In Chapter 4 a scoping review on collaborating teams using videoconferencing (VC) in oncology care is presented. Six types of collaboration were identified in 50 included studies:

1. Expert MDTM-National: expert specialists providing expertise and experience on rare tumours within their own country (17 studies);
2. Expert MDTM-International: expert specialists providing expertise and experience on rare tumours internationally (5 studies);
3. Expert Consultation: physicians caring for complex patients seeking consultation with experts (11 studies);
4. Consultation Specialist – Nurse: nurses consulting with palliative treatment specialists in specialised palliative care units or hospices (4 studies);
5. Multidisciplinary team (MDT)-Equal: involving fairly equal MDTs that use each other to gain a 'fresh look' and optimise diagnostic and treatment plans for complex cases (5 studies); and
6. MDTM-Collaborate: MDTs collaborating in a larger MDTM (8 studies).

For patients, the benefits of VC collaboration included less travelling for diagnosis, better coordination of care both within and also between the institutions involved, improved access to scarce facilities and treatment within their own community. Benefits for healthcare professionals were optimised treatment plans through multidisciplinary discussion of complex cases, an ability to inform all healthcare professionals involved with the same patient simultaneously, enhanced care coordination, less travel and continued medical education for those working in oncology. Drawbacks identified by healthcare professionals were that VC added to their regular workload in preparing for discussions and increased administrative preparation. VC equipment costs and the lack of reimbursement were implementation barriers.

In Chapter 5 the weekly video-conferenced MDTMs, between the Head and Neck Cancer Centre of the UMCG and their preferred partner in the Medical Center Leeuwarden was evaluated, over a period of six months using a technique based on participating observations and interviews. In the MDTMs evaluated, only 8 recommendations (5 major, 3 minor) were given by the teams on the 336 cases presented (related to 259 patients). Four recommendations were related to diagnostic plans and 4 to treatment plans. Although the number of recommendations was low, in the interviews the participating specialists mentioned benefits of VC-MDTM: the other team offered a fresh perspective when discussing complex cases, the discussions provided education for oncology trainees and the discussions kept medical viewpoints aligned. The specialists would prefer to spend more time discussing complex patients that would benefit from the discussions and not discuss patients who clearly fit the current guidelines and are fairly routine cases. Here, the national requirement, that the partnering organisation should discuss all patients with the centre, was perceived as no longer appropriate by the specialists.

6.2 Relevance for theory

6.2.1 Organisation of multidisciplinary oncological care pathways

Although care pathways have for several decades been used as a model for multidisciplinary care, a definition of care pathways was only formulated in 2007[3]. In 2009, the use of care pathways was evaluated in a cross-sectional multicentre study[4]. Care pathways were associated with better coordinated care and a better monitored follow-up[2]. In 2012 a Cochrane systematic review[5] concluded that care pathways can be effective in ensuring that patients receive relevant clinical interventions and/or assessments in a timely manner, particularly when following predictable trajectories (high volume, low complexity). In less clear trajectories with more variables (low-to-high volume, high complexity) care pathways were less effective, but still reduced the number of complications and improved documentation without increasing length of hospital stay or costs. Within oncology, a recent systematic review (2020) showed that care pathways are effective in reducing the length of hospital stays when used to manage patient-centred care[6]. Various strategies were developed for the implementation of care pathways aiming to provide integrated care and closer adherence to guidelines[7]. However, due to differences in the implementation strategies for care pathways, strong conclusions could not be drawn concerning outcomes[6]. Feedback during implementation and follow-up activities seemed to be important for the implemented care pathways to improve sustainability[8]. For healthcare professionals, care pathways increased motivation and professional autonomy[7].

In general, evaluating the efficiency of care pathways within a cancer centre is complex because of differences in care pathway processes, like diagnostic and treatment due to the differences in the biological behaviour of tumours. In addition, the different groups of healthcare professionals working together in these care pathway processes relate differently in terms of shared goals, shared knowledge and mutual respect[9-12]. Thus, when evaluating care pathways, the structure, process and outcome indicators should be chosen carefully[13, 14]. In Chapters 2 and 3, four care pathways were evaluated following a reorganisation. The differences in behaviour of healthcare professionals among the four care pathways related to shared goals, shared knowledge and mutual respect were illustrated with quotes from the interviews.

Also in the two retrospective, pre-post studies, process indicators were evaluated, followed by reflective interviews. In both studies, the indicators were tailored to the goal of the reorganization while addressing the medical registration, logistics management and quality improvement domains. As proxies for efficiency, the number of hospital visits and the number of MDTMs were chosen, and for timeliness, throughput times were chosen[15-17]. In oncology, throughput times are particularly relevant because of possible upstaging of tumours if throughput times are long[18-21]. In addition, from the patient's perspective, long throughput times increase uncertainty and impact on anxiety[22].

6.2.2 Delivery of integrated care

Stakeholders such as healthcare providers, health insurance companies and patient organisations[23-26] have a longstanding interest in integrated care approaches for organising complex care. The interests of healthcare providers focus mainly on quality[27], of health insurance companies on greater efficiency[26] and continuity of care[23], and of patients on more holistic and more personalised care[23]. Cancer care is multidisciplinary and often complex.

This multidisciplinary character makes it necessary to focus on integrating care delivery, relying on careful coordination between multiple healthcare professionals and organisations[28, 29]. Technological developments and new treatment possibilities within the disciplines have led to 'super' specialisations that require even more in-depth knowledge and expertise[30, 31]. Integrated care plans, including patient needs and wishes, contribute to patient-centredness and enable care to be coordinated during the 'patient journey' in a continuum of care from referral to following up on treatment[32].

Information technology is essential for information exchange between all those involved in treatment, including general practitioners, specialists, patients and their families[6]. This information exchange contributes to the success of integrated care[33, 34]. This thesis shows that it is feasible using only simple means to evaluate organisational interventions (i.e., reorganisations) with tailored, real-time indicators that can be placed on a dashboard for monitoring performance. Reflective interviews provided a better understanding of outcomes, and increased the awareness of healthcare professionals of the benefits and drawbacks of an intervention and the opportunities for further quality improvement. This thesis contributes to the literature through its approach to evaluating, over time, the sustainable impact of tailored organisational interventions.

Coordination of care within a region

A recent development in Dutch cancer care is that some parts of an oncological treatment plan may be performed in another hospital. In such cases, coordination of and collaboration between healthcare professionals and expert facilities are key to providing safe and optimal quality care[35]. The outcomes of care depend on healthcare professionals who take account of a patient's wishes and needs, and the capabilities and needs of their colleagues. It is especially these forms of cooperation that can benefit from the adoption of performance measures such as process indicators[36]. On this basis, the implementation and evaluation of care pathways should focus on the coordination of care in and between institutions within a region, supported by a real-time dashboard[36, 37, 38]. The interviews reported in this thesis provide an insight into the complex dynamics of oncology care pathways and the functioning of their MDTMs. If team members trust each other, they can then focus on the best treatment for the patient[39]. The healthcare professionals said that preparing for the MDTM, administering the decisions on discussed diagnostic and treatment plans and enacting decisions were all time consuming. The Achilles heel of the MDTM approach would seem to be the absence from meetings of some disciplines necessary to reach the best decision for the patient (Chapters 2, 3 and 5).

MDTMs in planning care within a region

To coordinate and plan regional oncology care, MDTMs are being held in and between hospitals in a region[35, 40-45]. Given that, nowadays, MDTs have a leading role in cancer care delivery, MDTMs should be held at least weekly to avoid delays in diagnosis[46-48]. MDTMs for secondary and tertiary care can be more effective if priorities are set for the cases that have to be discussed, distinguishing between complex and routine cases[49-51]. Support provided by information technology, such as VC, easy access to guidelines[52] and planning information improves the care processes and patient outcomes[53]. As in every MDTM, the respectful interaction between team members and commitment are essential in a regional MDTM.

Mutual respect is a core value for successful cooperation and is determined by the personality of the members of the group. If team members trust each other, they can then focus on the best treatment for the patient[39]. This requirement is in line with Gittell's concept of 'relational coordination'[54], which is based on high quality communication supported by shared goals, shared knowledge and mutual respect, coached by good leadership. Relational coordination has been shown to be an important determinant of patient outcomes, such as satisfaction with care providers and their overall visit, and of healthcare professional outcomes including job satisfaction, work engagement and prevention of burnout[12].

In general, it is complex patients with advanced diseases that benefit most from MDTM discussions, also described as the 'Flying Dutchman phenomenon' of being blown from one site-specific MDTM to another until finally reaching a safe haven[55], with patients getting the best possible treatment plan through a multidisciplinary approach in a tertiary centre[55-58]. This thesis showed that new treatment options require more intensive discussion and coordination between professionals, and this is reflected in an increase in throughput times and the number of hospital visits from triage to treatment plan in some care pathways. As a result (Chapters 3), more time was planned for preparing for GIO MDTMs.

6.2.3 Use of VC technology

Videoconferencing has been widely used in oncology for more than 20 years for discussions on treatment plans and education[59-62]. Apart from its benefits, VC has also drawbacks such as leading to more formalised and regimented relationships between specialists[39], the requirement for all disciplines to be present during VC-MDTMs and an increased workload due to having to summarise patient cases before a VC-MDTM[63, 64]. In a scoping review (Chapter 4), six different types of VC collaboration were found. Two of them were focussed on collaboration over treatment plan decisions between teams in regional oncology networks. The 'MDT-Equal' type (MDTs that had broadly equal expertise and know-how in treating a specific type of patient) was analysed in detail to understand the discussions on diagnostic and treatment plans, and the decisions made during a VC-MDTM (Chapter 5). The benefits and drawbacks identified in this study can help other teams in effectively implementing VC in their regional oncology network meetings.

Several conditions need to be met for the optimal performance of VC-MDTMs. First, there should be good relations and good communication between participants in care delivery, i.e., good relational coordination[12, 54]. Additionally, all the necessary disciplines should be present during VC because the quality and number of recommendations given depend on the completeness of teams and experience of the specialists (Chapter 5). The number of recommendations increased when one of the disciplines of an MDT was less experienced than the specialists in the other team. Useful discussions about complex patients was found to be the greatest benefit of the VC-MDTM between the cancer centre and its partner. These discussions were related to guideline interpretation, clinical treatment possibilities and clinical experience, and were used for shared decision-making. For instance, possibilities for a surgical approach and for radiation therapy that maintained the functionality of lips and nose were considered. Specialists reported the Dutch national requirement that 'all patients of a partner organisation should be discussed with the centre' was no longer relevant and, instead, only complex patients should be selected and discussed.

Currently, due to the COVID-19 pandemic, the use of VC has increased enormously in the field of medicine. Given that physical attendance is less easy to arrange, VC enables multidisciplinary discussions on treatment plans that would otherwise have been difficult[65, 66].

6.2.4 What is the added value of this thesis?

This thesis provides insight into the complex dynamics of oncology care pathways and the functioning of MDTMs. It shows that it is feasible to evaluate organisational interventions in a head and neck care pathway and in three gastrointestinal care pathways with tailored, real-time indicators (performance data) that should be placed on a dashboard for monitoring performance. However, these data only partly reflect the performance of a care pathway and the value of MDTMs.

Holding reflective interviews provided a deeper understanding and increased the awareness of professionals about the benefits and drawbacks of the reorganisations and the opportunities for quality improvement. Further, the interviews drew out the complexity of the care pathways and the complexity of the collaboration within multidisciplinary meetings. An added value of this thesis is that it shows the importance of combining quantitative and qualitative research (semi-structured interviews with stakeholders and participating observations) to evaluate organisational interventions in care pathways.

This thesis showed that, in oncology care, videoconferencing is currently applied for six distinct types of collaboration, demonstrating the added value of VC for regional oncology networks. The conditions for successful use of VC are described and can be used as a guide for other MDTMs.

6.3 Methodological considerations

Choice for process indicators

The ultimate patient-relevant indicators for an oncological care pathway are survival, quality of life and patient-reported outcome measures (PROMs). A problem of studying survival is the need of a follow-up period of at least five years, often beyond the length of a research project. A drawback of a retrospective evaluation of care pathways is the limited choice of process indicators for which data are available in patient records. 'Referral time', 'time to diagnose' and 'time to treatment'[67-70] were chosen as process indicators and proved useful for the research in this thesis[71, 72]. Not only for this thesis but also as information that can be valuable for case management, for instance if it was provided using a real-time dashboard.

To acquire insight into the reasons for the outliers in terms of throughput times or the number of MDTMs in which patients were discussed, the professionals involved in the care pathways were interviewed. These interviews showed that it was the complexity of the cases or the availability of diagnostic or therapeutic capacity that increased the number of MDTMs or throughput times. Therefore, the number of hospital visits (Chapter 2) and the number of MDTMs (Chapter 3) were used as patient-centred indicators based on the assumption that patients would prefer fewer hospital visits. A real-time dashboard could provide insight into the number of MDTMs and throughput times for each patient. Accurate and up-to-date documentation of the process indicators and outliers can enable early detection and quick improvements to the care pathway.

Due to the lengthy intervals (2 to 6 years) between the reorganisations of the pathways and their evaluations reported here, patient-reported outcomes and their experiences were not included in the studies because recall bias would likely be an issue. Additionally, selection bias would also be an issue because the more complex patients might have died before the evaluation, leading to a sample weighted towards less severe cases. In the separate evaluation of the VC-MDTM between UMCG and MCL, patient experiences were not investigated since the focus of the research was specialist team performance in terms of decision-making.

Cost reduction was not considered as an efficiency indicator in our studies because there was no simple and reliable insight into departmental costs or those of care pathways. Instead, the number of hospital visits and the number of MDTMs were used as proxies for efficiency. For cancer care, throughput times could be standardised and retrieved from the electronic medical record (EMR) and compared with national and international guidelines. However, similar guidelines are not available for management efficiency. Besides that, cost effectiveness studies are preferably prospective. Nevertheless, it seems reasonable to assume that a reduction in hospital visits and the time interval before treatment starts, improved MDTM coordination and videoconferencing will all improve the quality of care and reduce costs.

At the time of the study, it was not possible to retrieve throughput times for oncology care pathways with a standard report from the EMR. Data had to be retrieved manually from electronic and written medical records. This method was time consuming due to differences in registration processes between specialisms. In this thesis , one researcher retrieved all the data so that they were consistently recorded on research forms. One contribution of this research is to highlight the benefits and encourage healthcare professionals and data specialists to retrieve throughput times through a real-time dashboard to make it easier to monitor the efficiency of care pathways.

Sample size

In the MFDC study (Chapter 2) an initial sample of 50 patients (25 before and 25 after the introduction of the MFDC in the head-and-neck pathway) was chosen to estimate the effects of the reorganisation and, if necessary, to estimate the required larger sample size. This sample size proved sufficient to show significant short-term effects of the reorganisation. However, in the longer term, only the reduction in the time needed to complete diagnostic procedures was sustained. This sample size (2 x 25) was too small to show significant reductions in throughput times for the GIO care pathways. Future research could use the outcomes of these studies (Chapters 2 and 3) to calculate required sample sizes.

The differences in the effects of these reorganisations might be due to differences between the head-and-neck pathway and the GIO care pathways. The head-and-neck care pathway is a well-functioning collaboration stretching back more than 20 years while the GIO care pathways are considerably newer and, moreover, the biological behaviour of head-and-neck tumours differs to that of GIO tumours. In addition, although not investigated in this thesis, cultures and basic values, as well as relational coordination in the care pathways may be different[9, 21, 48, 73].

Period of data retrieval

Data on patients discussed in the MDTMs that took place in the period from four months before to four months after the reorganisations (Chapters 2 and 3), were not included in the studies. This selection was applied because, once a reorganisation is announced, changes may occur in the selection of patients to be discussed and participant behaviour. Further, immediately after a reorganisation it is likely that procedures will not run as smoothly as planned and additional changes will be made. Moreover, efficiency in the procedures adopted may increase. Thus, to reduce potential selection bias and anticipation bias, data on patients in the period leading up to the reorganisations were not included. Similarly, to reduce learning effects, data on patients immediately following the reorganisations were also not included. In identifying the pre-reorganisation sample, inclusion started four months before the reorganisation and then worked back until the required sample size was obtained. Similarly, for the post-reorganisation sample, inclusion started four months after the reorganisation and proceeded forward in time until the required sample was obtained. The periods for inclusion covered differed between the GIO care pathways for the various patient categories. For the colorectal care pathway, the total period for inclusion was relatively short compared to the hepatobiliary and oesophagus-stomach care pathways. This difference probably reflects differences in tumour incidence. From the interviews it became clear that, by the end of 2015, small additional changes had been added to the management of care pathways beyond the original reorganisation, and these changes may have influenced throughput times and the number of MDTMs. It was impossible to distinguish the effects of the initial reorganisation from these additional changes.

Mixed methods design: quantitative and qualitative data

Initially, only quantitative data were gathered to evaluate the MFDC (multidisciplinary first-day clinic). However, during the initial data analyses, the presence of outliers became apparent. To understand these outliers and to explore the personal experiences of the participating specialists, interviews were added to the study design. These interviews further enabled reflections on the benefits, drawbacks and opportunities for improvement. To further enrich the data, case managers who coordinated the patient journey through the care pathway (Chapter 3, GIO MDTM) were interviewed also. Patients and imaging/laboratory personnel were not interviewed because the focus of the studies was on the perceptions of MDT members regarding possibilities for quality improvement through MDTMs.

6.4 Reflections on the dual role of quality consultant and researcher

Looking back, this PhD project was crucial for my personal development because the role of consultant in quality and patient safety intertwined with the role of researcher in the field of the organisation of oncology care. During the 10 years of this PhD research, I have seen innovations in the field of quality improvement and in consultancy methods. My insights into the various methods that are relevant for research into the implementation of care pathways for integrated care have grown, and acquired a new basic value. Initially, in my role as quality consultant, I was predominantly led by the structure of the organisation and quality improvement tools. During this PhD research, I realised that insight into the dynamics of a care pathway is also important. Following the patient journey[32] and being a participant on the multidisciplinary tumour board gave that insight and changed my basic value to

seeing the patient and the benefits for quality management. With this insight it became possible to provide tailored feedback on the multidisciplinary collaboration, with valuable improvement opportunities for the management of care pathways. As part of this approach, three knowledge domains came together in this thesis: medical registrations, logistics and information management, and quality improvement.

Tools for quality improvement came from areas outside the healthcare field, such as the aviation, automotive and military industries. These tools include safety and risk-checklists, quality management systems (QMSs) and lean six sigma projects to reduce costs. Specific healthcare certification came available in 2012 with ISO 9001 for healthcare services.

The UMCG implemented 'ISO 9001 Healthcare'[74] and this resulted in certification for care, education and research processes across the entire medical centre in 2015. The quality objectives used to define the goals of the UMCG organisation are similar to those of the Institute of Medicine[75] and the World Health Organization[76] including objectives related to efficiency and timeliness. Along with the ISO standards, the 'Plan-Do-Check-Act' improvement cycle, process management and responsibilities were established at all levels of the UMCG. The commitment of the board of directors and management teams is important for implementation throughout the organisation of clinical governance and the improvement cycle (top-down: what needs to be done). Even more important for effective implementation is the commitment of all personnel involved, healthcare professionals, leading clinicians of multidisciplinary care pathways, case managers, nurses and supporting staff of the organisation[77] (bottom-up: how things are done). The commitment of healthcare professionals in the implementation process is essential, the advantage of their participation in quality management for the benefit of their own patients must be clear[78]. Therefore, the connection between the QMS and the workplace, where the patient is seen and treated, should be described in terms of roles, responsibilities, guidelines, processes and procedures, and measured with unambiguously defined performance indicators. This thesis shows that, in the assessment and redesign of care pathways, process indicators can be defined and validly used to measure performance provided they are tailored to the clinical process[10, 17]. Furthermore these indicators can be used to evaluate added value for patients and healthcare professionals working in the care pathway.

The position of a quality consultant and her/his relationship with healthcare professionals needs to be clear. The quality consultant can only give useful advice if she/he and the healthcare professionals have a good working relationship. There should be a good understanding of the care pathway dynamics, shared commitment and mutual trust to enable valuable quality improvement opportunities to be identified. Coaching can then be given to the clinical lead and the healthcare professionals during the implementation process c. In the UMCG, multidisciplinary care pathways involve cooperation between different specialist disciplines and departments, coached by clinical leads. Departments are organised in divisions that are managed by the Board of Directors (Figure 1). The problem of financing activities spread across different departments and divisions in care pathways became clear when trying to implement quality improvements. Budgets and staff are tied to a department and have to be allocated to a care pathway. Sometimes this structure leads to conflicts of interest with efficiency and timeliness being viewed from two different perspectives[78, 79]. The perspective of the department, including costs and income, can differ from that of the care pathway aiming at high quality care (patient-centredness, efficiency and timeliness).

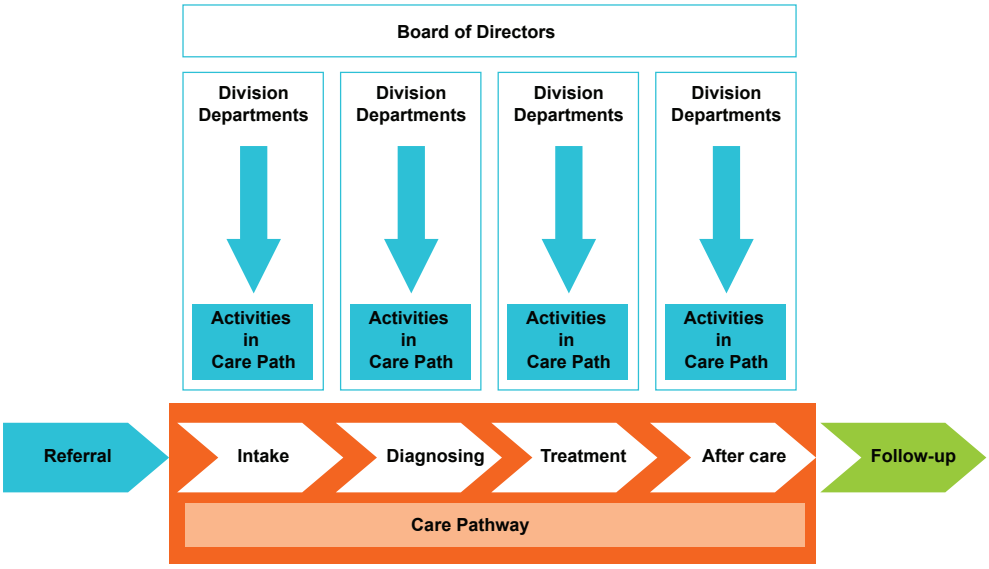

Figure 1. Care Pathway within the UMCG, organised with personnel from various departments
This figure illustrates the patient's journey along a care pathway that is organised with healthcare professionals detached from various departments in different divisions. Diverse specialist disciplines and other professions see and treat a patient as they progress along their care pathway.
Care path: agreements on the organisation of care within a department or a specialism with protocols and procedures.
Care pathway: agreements between all the departments and specialisms involved in the complete intramural care or within the hospital from referral to follow-up.

The leading clinicians involved in the care pathways and part of multidisciplinary teams often have no mandate and means from their own department or division to manage the care pathway. To overcome the conflicting perspectives, good leadership from the clinicians, delivering care in the care pathway, and from the management of the involved departments is required. It is important that management and leading clinicians together reflect on the quality of care provided in care pathways. The performance of the care pathways and the needs of the healthcare professionals should be evaluated to benefit the learning cycle of the whole organisation.

An important tool for quality improvement is performance measurement[78, 80, 81]. In measuring performance, healthcare professionals and patient organisations use indicators such as waiting times, number of hospital visits and travel time[53, 67, 82, 83]. However, given the many stakeholders involved, an abundance of indicators (such as monitoring per disease, monitoring hospital level, etc.) have been developed over the last 20 years[78, 81, 84]. The value of some indicators is not always clear. The obligatory and sometimes questionable registration of indicators has become a burden, leaving less time for care and activities to improve care pathways[17, 85] (Figure 2). The registration process is felt by healthcare professionals as an indication of distrust in their professionalism and as inefficient. Since 2018, healthcare professionals have started to realise that: (1) fewer indicators can provide adequate insight into performance, and (2) that diverse indicators can be deduced from the effective use of registrations made at the source.[86, 87].

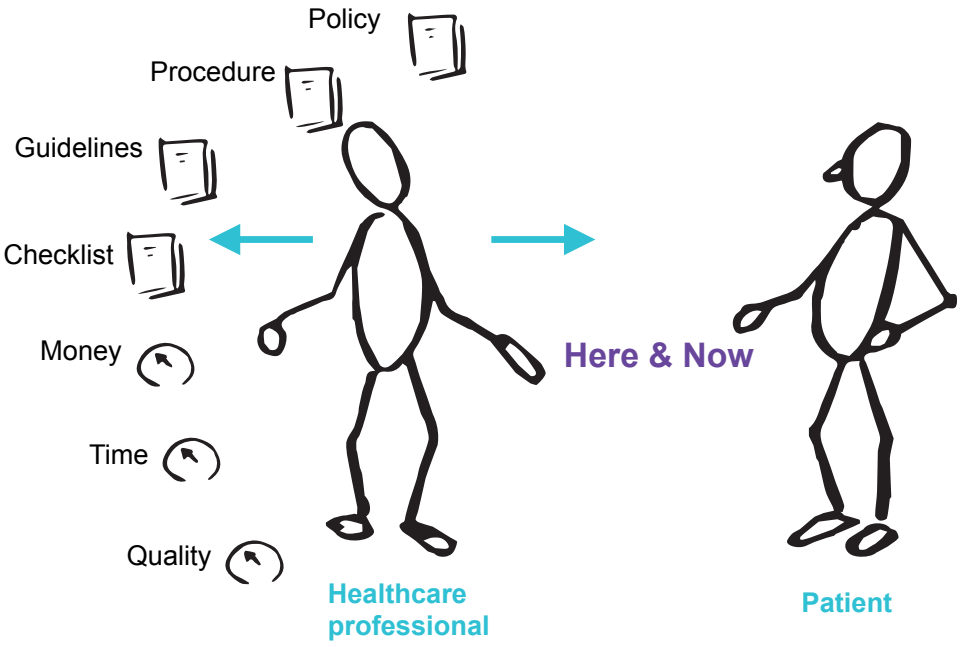

Figure 2. Illustration of the healthcare professional torn between healthcare-related activities and registering indicators for the Quality Management System (adapted with permission from Wouter Hart, Lost in Control, p. 27)[88]
Filling out checklists and following policies, guidelines and procedures takes more time than intended: the healthcare professional needs to find time to see and treat the patient.

In an academic centre for care, the registration of data for the QMS should serve three goals: (1) continuous improvement in quality of care; (2) evaluation of organisational interventions in a care pathway; and 3) publication of the evaluation outcomes. In evaluating an organisational intervention in a care pathway, different indicators should be considered depending on the development and the maturity of the management of care quality[52]. Initially, structure indicators are used to enhance implementation. Later, process and outcome indicators give insight into the performance of the care pathway. After an initial evaluation, some indicators can be dropped to then register only what is useful for managing the performance of the care pathway, thereby reducing the registration burden for healthcare professionals and quality officers. However, it is not that simple to drop registrations and indicators in an academic setting because healthcare professionals often want to use registrations for ongoing healthcare research projects. This thesis shows how valuable these registrations can be for research. This dilemma seems to be a 'Catch 22' situation. As such, the quality and information management departments should join forces to support leading clinicians and other healthcare professionals in deciding which indicators to register. The solution proposed is to adopt a single format for 'registration at the source', for example the date of decision on the diagnosis and the treatment plan, and to use the registered information to deduce various indicators in a real-time dashboard to enable early detection of a poorly performing a care pathway.

This PhD project has taught me that multidisciplinary cooperation, needed to treat patients with complex medical problems in a care pathway, cannot be evaluated using indicators alone. In clinical governance, the question should not be 'How can we show that we comply with guidelines using indicators?' but 'How can we show that we provide the patient with optimal quality care?'[89]. In multidisciplinary clinical care, process indicators can be used to evaluate efficiency and timeliness, and can be tailored to a specific care pathway. However, in the context of complex care delivery, not all patients fit the guidelines and, in such cases, it is important to tailor the treatment to the patients and their wishes. Thus, performance evaluations should also include an assessment of the needs and wishes of patients and the views of healthcare professionals to evaluate added value. Reflective interviews with all stakeholders, including patients, on the benefits and drawbacks of the care process can provide this information. The field of quality improvement in healthcare is evolving from measurement, carried out to comply with guidelines and checking boxes, towards clinical governance. Prerequisites for clinical governance are ownership by leading healthcare professionals, so that they take responsibility in their teamwork, and learning from mistakes with feedback on achieving goals linked to the quality of care[90].

To summarise, healthcare teams and experts in the quality improvement and information management domains need to collaborate in order to support clinical governance. This should be an open and symbiotic collaboration in which all the involved professionals show interest in and respect for each other's profession and expertise and are willing to invest in the relationship with the mutual goal of quality care, with clear roles and responsibilities based on relational coordination[54]. Sharing data on the quality of care by healthcare professionals, quality improvement experts, data analysts and researchers can provide insight into the performance of a care pathway[90-92]. When these domains share data and insights regarding quality improvement[93], all stakeholders can benefit.

The quality consultant should be a value-based, data-driven, reflective expert or practitioner who supports continuous quality improvement while taking into account the goals of the organisation and the goals of the care pathway or unit they are committed to. As such this role fits well with the role of a researcher as it is motivating and the two roles inspire each other.

6.5 Future research and recommendations

6.5.1 Suggestions for further research

Since healthcare professionals indicated that they missed a 'real-time' dashboard, future research could focus on the value and adoption of such a dashboard for the early detection of an increase in throughput time or increase in the number of hospital visits or MDTMs. At the level of the tumour board, further research could focus on developing indicators that enable effective care pathway management and evaluate the influence of such indicators on the management of the care pathway.

In future research evaluating the reorganisation of care pathways, it should be ensured that an adequate sample size is used to analyse the effects of an intervention. Participating observations before and after a reorganisation could be included to analyse the effects of announcing a reorganisation on the behaviour of professionals (any anticipation bias) and to identify when learning effects tail off.

Indicators could be included in research to measure and assess the quality of 'shared decision-making' and patients' satisfaction with this. Outcomes based on patient-reported experience measures (PREM) and qualitative data from interviews could offer guidance on how to improve the process of shared decision-making.

Patient-reported outcome measures (PROM) should be included in future research on the evaluation of care pathways and their management or reorganisations. Here, semi-structured interviews would add depth to the data found.

Future research could also apply the methods developed in this thesis to evaluate care pathways for other life-threatening chronic diseases.

6.5.2 Recommendations for the organisation of multidisciplinary care pathways

The various studies in this thesis show the importance of adequately organising multidisciplinary oncological care pathways and regionally integrated care to focus on the patient journey and enhanced quality care. Although the organisation of a care pathway is predominantly determined by the type of disease (the biological behaviour of the tumour) some general recommendations can be given for an adequate organisational process.

Tumour board level

1. Have dedicated policy meetings, in which the organisational aspects of the care pathway are discussed in relation to new regulations and scientific developments, to which all stakeholders are invited including specialists, case managers, nurses, and patient representatives.
2. Develop a regional policy plan for a specific period based on recent and accurate performance data, and reflect on possibilities to improve the care pathway such as by implementing new guidelines or enabling new collaboration strategies.
3. Facilitate informal contact among MDTM members to promote interaction and commitment and to enhance good meeting behaviour such as listening and asking questions respectfully during discussions. This respect will help colleagues interact with each other about desirable and undesirable behaviours. The above can be supported through a good MDTM environment (e.g. by using a U-form table in meeting rooms) and use of VC.
4. Set up a real-time dashboard to monitor relevant real-time indicators, such as 'throughput time differences from standard' or 'hospital visits', and evaluate the performance for each care pathway and patient group.

MDTM level

1. Ensure that all specialist disciplines attend the MDTM, possibly through VC, to improve the quality of treatment plans for complex cases.
2. Give medical specialists the freedom to present only selected complex or interesting cases that induce discussions in the MDTM and serve to keep medical procedures aligned.

3. Provide clarity on everybody's individual role, before, during and after the meeting to optimise time management during the MDTM.
4. A chair should show leadership and motivate the team (build a team spirit), taking responsibility for directing the discussion in the meetings and summarising to produce a conclusion, and also to help formulate a treatment plan according to the guidelines format.
5. Provide all MDTM participants with dedicated time to prepare for the meeting as this will increase meeting efficiency and the quality of the treatment plan.
6. Ensure that medical and psychosocial information is available during MDTMs to enhance decision making.
7. Include patient wishes in the treatment plan, for example by planning the MDTM for elderly patients before the treatment MDTM.
8. Ensure that updated guidelines are available.
9. Trust each other to follow up recommended changes to diagnostic and treatment plans.

Videoconferencing platform

1. Participants in a videoconference should know each other and meet face-to-face on a regular basis to boost cohesion.
2. The VC platform should include at least two cameras and microphones for each participating team and a bandwidth that exceeds 2 Megabits per second. Using a U-form seating plan so that participants face each other will enable them to observe body language.
3. The VC platform should have the ability to show, at the same time, on screens at each location, both participants for optimal personal interaction and real-time data (such as imaging, histology and required test results) to verify diagnoses, tumour stage and treatment options).

6.6 Conclusions

This thesis showed that organisational interventions of multidisciplinary oncological boards can be evaluated using tailored, real-time performance indicators for both low volume - high-complexity and high volume - low-to-high complexity care pathways. However, effects of these interventions differed between oncology care pathways.

Evaluations should include both quantitative and qualitative research methods. Reflective interviews provide a deeper understanding of data and increase professionals' awareness of the benefits and drawbacks of reorganisations and the opportunities they offer for quality improvement. Multidisciplinary oncological teams should pay attention to not only the state-of-the-art of care for the individual patient but also at the organisation of the care pathway.

The presence of all the involved disciplines is essential to come to the best decision for an individual patient. Real-time data on performance, particularly on efficiency and timeliness, can help healthcare professionals reflect on quality improvements that could be made to their care pathway. To further improve the performance of care pathways, clinical integration (e.g., decision-making shared with the patient), professional integration (e.g., collaboration in MDTMs) and organisational integration (e.g., a regional policy) are needed.

It should be considered to discuss only complex cases in an MDTM, because the increased knowledge in multidisciplinary teams, the availability of evidence based guidelines and the increase of number of patients.

Videoconferencing can enable patients to access scarce facilities and receive better coordinated care. VC improves efficiency through better communication with all the relevant healthcare professionals and subsequently improves the quality of treatment plans. Drawbacks of VC were that it added to their regular workload, increased administrative preparation. Costs of VC equipment and lack of reimbursement could be implementation barriers.

REFERENCES

1 Christianen ME, van der Schaaf A, van der Laan HP, et al. Swallowing sparing intensity modulated radiotherapy (SW-IMRT) in head and neck cancer: Clinical validation according to the model-based approach. *Radiother Oncol* 2016;118:298-303 doi:10.1016/j.radonc.2015.11.009 [doi].

2 Schepers RH, Kraeima J, Vissink A, et al. Accuracy of secondary maxillofacial reconstruction with prefabricated fibula grafts using 3D planning and guided reconstruction. *J Craniomaxillofac Surg* 2016;44:392-9 doi:10.1016/j.jcms.2015.12.008 [doi].

3 Vanhaecht K, De Witte K, Sermeus W. The impact of Clinical Pathways on the organisation of care processes. *KU Leuven* 2007:1-170.

4 Vanhaecht K, De Witte K, Panella M, et al. Do pathways lead to better organized care processes?. *J Eval Clin Pract* 2009;15:782-8 doi:10.1111/j.1365-2753.2008.01068.x; 10.1111/j.1365-2753.2008.01068.x.

5 Rotter T, Kinsman L, James E, et al. The effects of clinical pathways on professional practice, patient outcomes, length of stay, and hospital costs: Cochrane systematic review and meta-analysis. *Eval Health Prof* 2012;35:3-27 doi:10.1177/0163278711407313 [doi].

6 van Hoeve JC, Vernooij RWM, Fiander M, et al. Effects of oncological care pathways in primary and secondary care on patient, professional and health systems outcomes: a systematic review and meta-analysis. *Syst Rev* 2020;9:246,020-01498-0 doi:10.1186/s13643-020-01498-0 [doi].

7 Seys D, Bruyneel L, Deneckere S, et al. Better organized care via care pathways: A multicenter study. *PLoS One* 2017;12:e0180398 doi:10.1371/journal.pone.0180398 [doi].

8 van Zelm R, Coeckelberghs E, Aeyels D, et al. Qualitative Evaluation of the Implementation of a Care Pathway for Colorectal Cancer Surgery. *Qual Health Res* 2021;31:241-53 doi:10.1177/1049732320965188 [doi].

9 Allen D, Gillen E, Rixson L. Systematic review of the effectiveness of integrated care pathways: what works, for whom, in which circumstances?. *Int J Evid Based Healthc* 2009;7:61-74 doi:10.1111/j.1744-1609.2009.00127.x [doi].

10 Berwick D, Fox DM. "Evaluating the Quality of Medical Care": Donabedian's Classic Article 50 Years Later. *Milbank Q* 2016;94:237-41 doi:10.1111/1468-0009.12189 [doi].

11 Delilovic S, Hasson H, Ahstrom M, et al. Implementing standardized cancer patient pathways (CPPs) - a qualitative study exploring the perspectives of health care professionals. *BMC Health Serv Res* 2019;19:577,019-4413-6 doi:10.1186/s12913-019-4413-6 [doi].

12 Gittell JH, Logan C, Cronenwett J, et al. Impact of relational coordination on staff and patient outcomes in outpatient surgical clinics. *Health Care Manage Rev* 2020;45:12-20 doi:10.1097/HMR.0000000000000192 [doi].

13 Robinson TE, Janssen A, Harnett P, et al. Embedding continuous quality improvement processes in multidisciplinary teams in cancer care: exploring the boundaries between quality and implementation science. *Aust Health Rev* 2017;41:291-6 doi:10.1071/AH16052 [doi].

14 Prang KH, Canaway R, Bismark M, et al. The impact of public performance reporting on cancer elective surgery waiting times: a data linkage study. *BMC Health Serv Res* 2021;21:129,021-06132-w doi:10.1186/s12913-021-06132-w [doi].

15 Berwick DM, Nolan TW, Whittington J. The triple aim: care, health, and cost. *Health Aff (Millwood)* 2008;27:759-69 doi:10.1377/hlthaff.27.3.759 [doi].

16 Sikka R, Morath JM, Leape L. The Quadruple Aim: care, health, cost and meaning in work. *BMJ Qual Saf* 2015;24:608-10 doi:10.1136/bmjqs-2015-004160 [doi].

17 Meyer GS, Nelson EC, Pryor DB, et al. More quality measures versus measuring what matters: a call for balance and parsimony. *BMJ Qual Saf* 2012;21:964-8 doi:10.1136/bmjqs-2012-001081 [doi].

18 Wyatt RM, Beddoe AH, Dale RG. The effects of delays in radiotherapy treatment on tumour control. *Phys Med Biol* 2003;48:139-55.

19 Waaijer A, Terhaard CH, Dehnad H, et al. Waiting times for radiotherapy: consequences of volume increase for the TCP in oropharyngeal carcinoma. *Radiother Oncol* 2003;66:271-6.

20 Huang J, Barbera L, Brouwers M, et al. Does delay in starting treatment affect the outcomes of radiotherapy? A systematic review. *J Clin Oncol* 2003;21:555-63.

21 van Harten MC, Hoebers FJ, Kross KW, et al. Determinants of treatment waiting times for head and neck cancer in the Netherlands and their relation to survival. *Oral Oncol* 2015;51:272-8 doi:10.1016/j.oraloncology.2014.12.003 [doi].

22 Chen AY, Callender D, Mansyur C, et al. The impact of clinical pathways on the practice of head and neck oncologic surgery: the University of Texas M. D. Anderson Cancer Center Experience. *Arch Otolaryngol Head Neck Surg* 2000;126:322-6 doi:10.1001/archotol.126.3.322 [doi].

23 Kodner DL, Spreeuwenberg C. Integrated care: meaning, logic, applications, and implications--a discussion paper. *Int J Integr Care* 2002;2:e12 doi:10.5334/ijic.67 [doi].

24 Minkman MM, Vermeulen RP, Ahaus KT, et al. The implementation of integrated care: the empirical validation of the Development Model for Integrated care. *BMC Health Serv Res* 2011;11:177,6963-11-177 doi:10.1186/1472-6963-11-177 [doi].

25 Minkman MMN. The current state of integrated care: an overview. *Journal of Integrated Care Pathways* 2012;6:346-58.

26 Leutz W, Ford T, Leung M, et al. Medicare managed care and frail elders: lessons from social HMOs. *Care Manag J* 2003;4:161-9 doi:10.1891/cmaj.4.3.161.57518 [doi].

27 O'Kane M, Corrigan J, Foote SM, et al. Crossroads in quality. *Health Aff (Millwood)* 2008;27:749-58 doi:10.1377/hlthaff.27.3.749 [doi].

28 Goodwin N. Understanding Integrated Care. *Int J Integr Care* 2016;16:6 doi:10.5334/ijic.2530 [doi].

29 Kodner DL. All together now: a conceptual exploration of integrated care. *Healthc Q* 2009;13 Spec No:6-15 doi:10.12927/hcq.2009.21091 [doi].

30 Lyngso AM, Godtfredsen NS, Host D, et al. Instruments to assess integrated care: a systematic review. *Int J Integr Care* 2014;14:e027.

31 Novo A, Knezevic B, Omerbegovic B, et al. Measures to Improve Integration of Healthcare in Federation of Bosnia and Herzegovina. *Mater Sociomed* 2019;31:71-4 doi:10.5455/msm.2019.31.71-74 [doi].

32 Khan AI, Arthurs E, Gradin S, et al. Integrated Care Planning for Cancer Patients: A Scoping Review. *Int J Integr Care* 2017;17:5 doi:10.5334/ijic.2543 [doi].

33 Gonzalez-Ortiz LG, Calciolari S, Goodwin N, et al. The Core Dimensions of Integrated Care: A Literature Review to Support the Development of a Comprehensive Framework for Implementing Integrated Care. *Int J Integr Care* 2018;18:10 doi:10.5334/ijic.4198 [doi].

34 Goodwin N. Tomorrow's World: Is Digital Health the Disruptive Innovation that will Drive the Adoption of Integrated Care Systems?. *Int J Integr Care* 2018;18:14 doi:10.5334/ijic.4638 [doi].

35 European Partnership Action Against Cancer consensus group, Borras JM, Albreht T, et al. Policy statement on multidisciplinary cancer care. *Eur J Cancer* 2014;50:475-80 doi:10.1016/j.ejca.2013.11.012 [doi].

36 Ouwens M, Hulscher M, Hermens R, et al. Implementation of integrated care for patients with cancer: a systematic review of interventions and effects. *Int J Qual Health Care* 2009;21:137-44 doi:10.1093/intqhc/mzn061; 10.1093/intqhc/mzn061.

37 Weggelaar-Jansen AMJWM, Broekharst DSE, de Bruijne M. Developing a hospital-wide quality and safety dashboard: a qualitative research study. *BMJ Qual Saf* 2018;27:1000-7 doi:10.1136/bmjqs-2018-007784 [doi].

38 Elshehaly M, Randell R, Brehmer M, et al. QualDash: Adaptable Generation of Visualisation Dashboards for Healthcare Quality Improvement. *IEEE Trans Vis Comput Graph* 2021;27:689-99 doi:10.1109/TVCG.2020.3030424 [doi].

39 Delaney G, Jacob S, Iedema R, et al. Comparison of face-to-face and videoconferenced multidisciplinary clinical meetings. *Australas Radiol* 2004;48:487-92 doi:ARA1349 [pii].

40 Wright FC, De Vito C, Langer B, et al. Multidisciplinary cancer conferences: a systematic review and development of practice standards. *Eur J Cancer* 2007;43:1002-10 doi:S0959-8049(07)00070-6 [pii].

41 Fennell ML, Das IP, Clauser S, et al. The organization of multidisciplinary care teams: modeling internal and external influences on cancer care quality. *J Natl Cancer Inst Monogr* 2010;2010:72-80 doi:10.1093/jncimonographs/lgq010 [doi].

42 Prades J, Remue E, van Hoof E, et al. Is it worth reorganising cancer services on the basis of multidisciplinary teams (MDTs)? A systematic review of the objectives and organisation of MDTs and their impact on patient outcomes. *Health Policy* 2015;119:464-74 doi:10.1016/j.healthpol.2014.09.006 [doi].

43 Pillay B, Wootten AC, Crowe H, et al. The impact of multidisciplinary team meetings on patient assessment, management and outcomes in oncology settings: A systematic review of the literature. *Cancer Treat Rev* 2016;42:56-72 doi:10.1016/j.ctrv.2015.11.007 [doi].

44 Soukup T, Lamb BW, Arora S, et al. Successful strategies in implementing a multidisciplinary team working in the care of patients with cancer: an overview and synthesis of the available literature. *J Multidiscip Healthc* 2018;11:49-61 doi:10.2147/JMDH.S117945 [doi].

45 Specchia ML, Frisicale EM, Carini E, et al. The impact of tumor board on cancer care: evidence from an umbrella review. *BMC Health Serv Res* 2020;20:73,020-4930-3 doi:10.1186/s12913-020-4930-3 [doi].

46 Brice SN, Harper P, Crosby T, et al. Factors influencing the delivery of cancer pathways: a summary of the literature. *J Health Organ Manag* 2021;35:121-39 doi:10.1108/JHOM-05-2020-0192 [doi].

47 Redaniel MT, Ridd M, Martin RM, et al. Rapid diagnostic pathways for suspected colorectal cancer: views of primary and secondary care clinicians on challenges and their potential solutions. *BMJ Open* 2015;5:e008577,2015-008577 doi:10.1136/bmjopen-2015-008577 [doi].

48 Lopez-Cedrun JL, Otero-Rico A, Vazquez-Mahia I, et al. Association between hospital interval and survival in patients with oral cancer: A waiting time paradox. *PLoS One* 2019;14:e0224067 doi:10.1371/journal.pone.0224067 [doi].

49 Lamb BW, Jalil RT, Sevdalis N, et al. Strategies to improve the efficiency and utility of multidisciplinary team meetings in urology cancer care: a survey study. *BMC Health Serv Res* 2014;14:377,6963-14-377 doi:10.1186/1472-6963-14-377 [doi].

50 Meeting patients' needs. Improving the effectiveness of multidisciplinary teams meetings in cancer services. Available at: https://www.cancerresearchuk.org/sites/default/files/full_report_meeting_patients_needs_improving_the_effectiveness_of_multidisciplinary_team_meetings_.pdf. Accessed 07/11, 2019.

51 Prades J, Morando V, Tozzi VD, et al. Managing cancer care through service delivery networks: The role of professional collaboration in two European cancer networks. *Health Serv Manage Res* 2018;31:120-9 doi:10.1177 /0951484817745219 [doi].

52 Piggott T, Langendam M, Parmelli E, et al. Bringing two worlds closer together: a critical analysis of an integrated approach to guideline development and quality assurance schemes. *BMC Health Serv Res* 2021;21:172,020-05819-w doi:10.1186/s12913-020-05819-w [doi].

53 Dowding D, Randell R, Gardner P, et al. Dashboards for improving patient care: review of the literature. *Int J Med Inform* 2015;84:87-100 doi:10.1016/j.ijmedinf.2014.10.001 [doi].

54 Gittell JH, Beswick J, Goldmann D, et al. Teamwork methods for accountable care: relational coordination and TeamSTEPPS(R). *Health Care Manage Rev* 2015;40:116-25 doi:10.1097/HMR.0000000000000021 [doi].

55 Munro AJ. Multidisciplinary Team Meetings in Cancer Care: An Idea Whose Time has Gone?. *Clin Oncol (R Coll Radiol)* 2015;27:728-31 doi:10.1016/j.clon.2015.08.008 [doi].

56 Munro A, Brown M, Niblock P, et al. Do Multidisciplinary Team (MDT) processes influence survival in patients with colorectal cancer? A population-based experience. *BMC Cancer* 2015;15:686,015-1683-1 doi:10.1186/s12885-015-1683-1 [doi].

57 Segelman J, Singnomklao T, Hellborg H, et al. Differences in multidisciplinary team assessment and treatment between patients with stage IV colon and rectal cancer. *Colorectal Dis* 2009;11:768-74 doi:10.1111/j.1463-1318.2008.01648.x [doi].

58 Chinai N, Bintcliffe F, Armstrong EM, et al. Does every patient need to be discussed at a multidisciplinary team meeting?. *Clin Radiol* 2013;68:780-4 doi:10.1016/j.crad.2013.02.011 [doi].

59 Donnem T, Ervik B, Magnussen K, et al. Bridging the distance: a prospective tele-oncology study in Northern Norway. *Support Care Cancer* 2012;20:2097-103 doi:10.1007/s00520-011-1319-1 [doi].

60 Thomas IM, Duncan JL. Improving cancer teaching through videoconferenced multidisciplinary team meetings. *Med Educ* 2013;47:1133-4 doi:10.1111/medu.12346 [doi].

61 Dharmarajan H, Anderson JL, Kim S, et al. Transition to a virtual multidisciplinary tumor board during the COVID-19 pandemic: University of Pittsburgh experience. *Head Neck* 2020;42:1310-6 doi:10.1002/hed.26195 [doi].

62 Kitamura C, Zurawel-Balaura L, Wong RK. How effective is video consultation in clinical oncology? A systematic review. *Curr Oncol* 2010;17:17-27 doi:10.3747/co.v17i3.513 [doi].

63 Olver IN, Selva-Nayagam S. Evaluation of a telemedicine link between Darwin and Adelaide to facilitate cancer management. *Telemedicine J* 2000;6:213-8.

64 Murad MF, Ali Q, Nawaz T, et al. Teleoncology: improving patient outcome through coordinated care. *Telemed J E Health* 2014;20:381-4 doi:10.1089/tmj.2013.0100 [doi].

65 Elkaddoum R, Haddad FG, Eid R, et al. In reply to the Letter to the Editor on: telemedicine for cancer patients during COVID-19 pandemic: between threats and opportunities. *Future Oncol* 2020 doi:10.2217/fon-2020-0985 [doi].

66 Chisci E, de Donato G, Fargion A, et al. One-year experience of a regional service model of teleconsultation for planning and treatment of complex thoracoabdominal aortic disease. *J Vasc Surg* 2018;67:974-83 doi:S0741-5214(17)32522-3 [pii].

67 Ouwens M, Hermens R, Hulscher M, et al. Development of indicators for patient-centred cancer care. *Support Care Cancer* 2010;18:121-30 doi:10.1007/s00520-009-0638-y; 10.1007/s00520-009-0638-y.

68 Gort M, Broekhuis M, Regts G. How teams use indicators for quality improvement - a multiple-case study on the use of multiple indicators in multidisciplinary breast cancer teams. *Soc Sci Med* 2013;96:69-77 doi:10.1016/j.socscimed.2013.06.001 [doi].

69 Wollersheim H, Hermens R, Hulscher M, et al. Clinical indicators: development and applications. *Neth J Med* 2007;65:15-22.

70 Litvak E, Buerhaus PI, Davidoff F, et al. Managing unnecessary variability in patient demand to reduce nursing stress and improve patient safety. *Jt Comm J Qual Patient Saf* 2005;31:330-8.

71 Gagliardi AR, Simunovic M, Langer B, et al. Development of quality indicators for colorectal cancer surgery, using a 3-step modified Delphi approach. *Can J Surg* 2005;48:441-52.

72 Dikken JL, Stiekema J, van de Velde CJ, et al. Quality of care indicators for the surgical treatment of gastric cancer: a systematic review. *Ann Surg Oncol* 2013;20:381-98 doi:10.1245/s10434-012-2574-1 [doi].

73 Roemeling O, Ahaus K, van Zanten F, et al. How improving access times had unforeseen consequences: a case study in a Dutch hospital. *BMJ Open* 2019;9:e031244,2019-031244 doi:10.1136/bmjopen-2019-031244 [doi].

74 Netherlands Standardisation Institute (NEN). NEN-EN 15224 Quality Management System Healthcare (Kwaliteitsmanagementsystemen voor zorg en welzijn). 2017:1-87.

75 Institute of Medicine. Crossing the Quality Chasm: A New Health System for the 21st Century. Washington, DC: The National Academies Press 2001:1.

76 Kelley E, Hurst J, eds. Health Care Quality Indicators Project. Conceptual Framework Paper. Geneva: WHO Publications 2006:1-36.

77 Prado JCP, Fernández-González AJ, García-Lorenzo A. Quality management and personnel participation: Improvement teams, a solution for ISO 9000 system maintenance problems in small to medium-sized enterprises. *Human Factors and Ergonomics in Manufacturing & Service Industries* 2004;14:221-37.

78 Wagner C, Groene O, Thompson CA, et al. DUQuE quality management measures: associations between quality management at hospital and pathway levels. *Int J Qual Health Care* 2014;26 Suppl 1:66-73 doi:10.1093/intqhc/mzu020 [doi].

79 Ohrling M, Tolf S, Solberg-Carlsson K, et al. That's how it should work: the perceptions of a senior management on the value of decentralisation in a service delivery organisation. *J Health Organ Manag* 2021;ahead-of-print:10.1108/JHOM,12-2020-0474 doi:10.1108/JHOM-12-2020-0474 [doi].

80 Shaw CD, Groene O, Botje D, et al. The effect of certification and accreditation on quality management in 4 clinical services in 73 European hospitals. *Int J Qual Health Care* 2014;26 Suppl 1:100-7 doi:10.1093/intqhc/mzu023 [doi].

81 Botje D, Ten Asbroek G, Plochg T, et al. Are performance indicators used for hospital quality management: a qualitative interview study amongst health professionals and quality managers in The Netherlands. *BMC Health Serv Res* 2016;16:574 doi:10.1186/s12913-016-1826-3 [doi].

82 Beswick DM, Vashi A, Song Y, et al. Consultation via telemedicine and access to operative care for patients with head and neck cancer in a Veterans Health Administration population. *Head Neck* 2016;38:925-9 doi:10.1002/hed.24386 [doi].

83 SONCOS Normeringsrapport 7, pagina's 22-26 [Standardization report 7, pages 22-26]. Available at: https://www.soncos.org/wp-content/uploads/2019/02/Soncos_norm-rapp2019-v7.pdf. Accessed 07/11, 2019.

84 Rademakers J, Delnoij D, de Boer D. Structure, process or outcome: which contributes most to patients' overall assessment of healthcare quality?. *BMJ Qual Saf* 2011;20:326-31 doi:10.1136/bmjqs.2010.042358 [doi].

85 Berwick DM. Era 3 for Medicine and Health Care. *JAMA* 2016;315:1329-30 doi:10.1001/jama.2016.1509 [doi].

86 VWS. Outcome oriented care (Uitkomst gerichte zorg) 2018-2022. 2018.

87 Alvarado N, McVey L, Greenhalgh J, et al. Exploring variation in the use of feedback from national clinical audits: a realist investigation. *BMC Health Serv Res* 2020;20:859,020-05661-0 doi:10.1186/s12913-020-05661-0 [doi].

88 Hart W, Buiting M. Lost in Control. Refocus on purpose (Dutch: Verdraaide organisaties. Terug naar de bedoeling). Amsterdam: Boom 2018:159.

89 Beattie M, Shepherd A, Howieson B. Do the Institute of Medicine's (IOM's) dimensions of quality capture the current meaning of quality in health care? – An integrative review. *Journal of Research in Nursing* 2013;18:288-304.

90 Schein EH, Schein PA. A New Era for Culture, Change, and Leadership. Conversation between Edgar and Peter Schein. *MIT Sloan Management Review* 2019;Summer.

91 Janssen A, Robinson T, Brunner M, et al. Multidisciplinary teams and ICT: a qualitative study exploring the use of technology and its impact on multidisciplinary team meetings. *BMC Health Serv Res* 2018;18:444,018-3242-3 doi:10.1186/s12913-018-3242-3 [doi].

92 Janssen A, Donnelly C, Elder E, et al. Electronic medical record implementation in tertiary care: factors influencing adoption of an electronic medical record in a cancer centre. *BMC Health Serv Res* 2021;21:23,020-06015-6 doi:10.1186/s12913-020-06015-6 [doi].

93 Veenstra GL, Ahaus K, Welker GA, et al. Rethinking clinical governance: healthcare professionals' views: a Delphi study. *BMJ Open* 2017;7:e012591,2016-012591 doi:10.1136/bmjopen-2016-012591 [doi].


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APPENDICES

A

SUMMARY

Introduction

Multidisciplinary care pathways are disease-centred collaborations among doctors and other healthcare professionals that apply standardised processes and procedures to treat groups of patients with a specific type of disease. Multidisciplinary care pathways are currently the standard approach to organising diagnostic procedures and treatment in cancer care. Multidisciplinary processes can improve the treatment plan of the patients, but might delay the start of cancer treatment. Therefore, it is essential that cancer care is coordinated and organised in structural multidisciplinary teams (MDTs). In addition to specific oncology departments such as Medical Oncology and Radiotherapy, oncology sections, or sub-departments, have been created within organ specialisms such as Gynaecology, Urology, ENT, Oral, Maxillofacial and Facial Surgery. Staff and budgets are linked to these departments and not to the care pathway or MDTs. As such, care pathways and MDTs can only exist if there are cooperation agreements with the participating departments. MDTs aim to provide the best care for their own cancer patients and those being treated elsewhere in the regional oncology network.

Nevertheless, the effects of adopting multidisciplinary oncological care pathways on the quality of care is unclear. In MDT meetings, information and communication technology (ICT) such as videoconferencing (VC) is used but it is unclear in what way VC is applied in oncological care pathways and how it contributes to the quality of oncological care.

In *Chapter 1*, the two main aims of this thesis are described: the evaluation of organisational interventions in multidisciplinary cancer care pathways in the University Medical Center Groningen (UMCG) and of the added value of VC in cancer care. Four of the UMCG's cancer care pathways have been evaluated through mixed-method studies with both quantitative and qualitative approaches.

Introduction of a multidisciplinary first-day consultation for head-and-neck tumours

Not only are head-and-neck tumours fast growing, they are also complex to diagnose and to treat. A multidisciplinary first-day consultation (MFDC) was introduced to reach a preliminary diagnosis and staging, and to prepare a diagnostic and treatment plan, in order to reduce throughput times. In *Chapter 2*, a mixed methods study is described that evaluated the effects of the MFDC on throughput times, the number of patient hospital visits and compliance with the Dutch standard requiring treatment to start within 30 calendar days.

Data regarding the process indicators, days needed for referral, days needed for diagnostic procedures, days to start first treatment and number of hospital visits were retrieved from the medical records and analysed for periods before and after implementation of the MFDC (before implementation: 2007; after: 2008, 2010 and 2013). Semi-structured interviews were held with medical specialists to enhance understanding of the outliers found within the data.

After the introduction of the MFDC in 2008, days needed to complete diagnostic procedures and to start the first treatment was reduced by 9.2 to 11.4 days and 10.4 to 22.2 days respectively, the number of hospital visits was reduced with 1.5 to 3.6 visits. The percentage

of new patients treated within the standard 30 calendar days after intake increased from 52% to 83%. The reduction in number of days needed for diagnostic procedures remained low. In the 2010 and 2013 data rounds, the days needed to start treatment had increased again. The semi-structured interviews revealed that this increase could be attributed to 1) new treatment modalities, 2) patients needing more time to carefully consider their treatment options and/or 3) professionals needing longer preparation time to organise more complex treatment due to earlier communication regarding the diagnostic procedures to be performed. The introduction of the MFDC had a positive effect on the days needed for diagnostic procedures. This study showed that the extra efforts required of the healthcare professionals participating in this MFDC (seeing the patient together during intake) were justified.

Reorganisation of the Gastro-Intestinal Oncology Multidisciplinary Consultation

The multidisciplinary team meetings (MDTMs) of the UMCG's Gastro-Intestinal Oncology (GIO) discipline were reorganised in 2015. In *Chapter 3*, a mixed methods study is described that evaluated the effects of this reorganisation on three care pathways: hepatobiliary, esophagus-stomach and colorectal. Process indicators such as throughput times were retrieved from the medical files, and stakeholders were interviewed regarding the benefits and drawbacks of the reorganisation and current functioning of the MDTM.

For the hepatobiliary care pathway, the time to reach a treatment plan increased, but the time to start treatment reduced significantly. In the esophagus-stomach care pathway, the number of hospital visits needed to formulate a treatment plan decreased after the reorganisation. The colorectal pathway showed a decreasing trend in the number of hospital visits. After the reorganisation, the percentage of patients in all three care pathways starting their treatment within the 63-day Dutch national standard increased: from 60% to 88% (hepatobiliary), from 96% to 100% (esophagus-stomach) and from 85% to 93% (colorectal).

In interviews, stakeholders of the three care pathways reflected that the reorganisation had led to the full attendance of all necessary specialisms in the MDTMs. As a consequence, discussions about treatment modalities had improved, with greater attention given to patients' wishes. The improved attendance also had a positive effect on interpersonal relations between the healthcare professionals. It was felt that the MDTMs could be further improved if participants were better prepared, but participants had difficulties in scheduling time to prepare for meetings. Stakeholders explained that the limited improvement in starting treatment on time was partly due to a lack of diagnostic capacity. It was suggested that allocating time slots would be helpful for planning purposes, and that a dashboard with real-time throughput times would be helpful in monitoring diagnostic and start treatment times.

Scoping review: video-conferencing

In *Chapter 4*, a scoping review is described that presents an overview of VC in oncology care and summarises its benefits and drawbacks regarding decision-making and care coordination. MEDLINE, Embase, CINAHL and the Cochrane Library were searched from their inception through to October 2020 for studies that included VC as a means to discuss treatment plans and to coordinate care in oncology networks among teams at different sites. Two reviewers extracted data and carried out thematic analyses. Six types of VC usage in teams collaboration

in oncology care were distinguished : 1) Expert MDTM-National: where expert specialists provided expertise and experience on rare tumours within their own country (17 studies); 2) Expert MDTM-International: expert specialists providing expertise and experience on rare tumours internationally (5 studies); 3) Expert Consultation: physicians caring for complex patients seeking consultation with experts (11 studies); 4) Consultation Specialist – Nurse: nurses consulting with palliative treatment specialists in specialised palliative care units or hospices (4 studies); 5) Multidisciplinary team (MDT)-Equal: involving fairly equal MDTs that use each other to gain a 'fresh look' and optimise diagnostic and treatment plans for complex cases (5 studies); and 6) MDTM-Collaborate: MDTs collaborating in a larger MDTM (8 studies).

The benefits for patients were less travel required for a diagnosis, better coordination of care, better access to scarce facilities and treatment in their own community. Benefits for healthcare professionals involved optimised treatment plans through multidisciplinary discussion of complex cases, the ability to inform all healthcare professionals simultaneously on developments in the care of individual patients, enhanced care coordination, less travel and continued medical education. A drawback for professionals was that VC added to their regular workload in preparing for discussions and increased administrative preparation.

Evaluation of video-conferenced multidisciplinary team meetings between a cancer centre and partner

The care of head-and-neck cancer patients is centralised in the Netherlands in eight head-and-neck cancer centres plus six satellite regional hospitals viewed as preferred partners. In a multidisciplinary team meeting (MDTM), all the patients of a partnering organisation are discussed with its associated head-and-neck centre in line with a Dutch health policy rule. *Chapter 5* describes a mixed methods study that evaluated VC-MDTMs in one such relationship between the UMCG (centre) and the Medical Center Leeuwarden (partner).

These VC-MDTMs were observed across six months. The number and subject of any recommendations made were recorded. Further, semi-structured interviews were held with six head-and-neck cancer specialists (three each from the centre and the partner) to reflect on the benefits and drawbacks of the video-conferenced MDTMs.

In only 8 of the 336 cases presented (2%), were recommendations given, 3 from the centre to the partner and 5 from the partner to the centre. Recommendations mainly consisted of alternative diagnostic modalities or treatment plans for a specific patient. The interviews revealed that specialists perceived that there was added value in discussing complex cases because the other team offered a fresh perspective by hearing the case 'as new'. The teams also recognised added value in keeping their medical viewpoints aligned. However, the requirement to discuss all the partner's patients was felt to be out-dated due to the trust built up in the cooperation and the coordinated medical treatment policy. It was felt that simple routine cases, which fully fitted current guidelines, could be treated according to existing protocols and did not need to be discussed. The specialists considered their time would be better spent in more extensively discussing complex patient cases that would benefit from such a discussion with the partner.

Discussion, conclusions and future research

In the general discussion (*Chapter 6*), the results of this thesis are summarised and discussed. An added value of this thesis is that, in addition to quantitative research techniques, qualitative research techniques were applied that provided insight into the underlying mechanisms behind the outcomes. A limitation is that the reorganisations of the care pathways were evaluated retrospectively, using data that were not always recorded uniformly by healthcare professionals. This dissertation showed that organisational changes such as the introduction of an MFDC for head-and-neck cancer and the reorganisation of the GIO MDTM did reduce throughput times. The reorganisation of the MDTM also had an effect on the coordination of care within the region. The care professionals' reflections on the data shed light on further improvement opportunities and practical recommendations, which have since been implemented in the care pathways.

In the work leading up to this thesis, I combined the roles of researcher and quality consultant, which led to the following reflection: 'The quality consultant should be a value-based, data-driven, reflective expert who supports continuous quality improvements while taking into account the goals of the organisation and the goals of the care pathway or care unit they are committed to. As such, this role fits well with that of a researcher as it is motivating and the two roles are mutually inspiring.

Future research should focus on evaluating the effects and impact of real-time dashboard information, regarding the status of diagnostic procedures and waiting times, on the care pathways. In addition, it is argued that in the evaluation of care pathways more attention should be paid to gaining reliable insight into the true costs of care.

SAMENVATTING

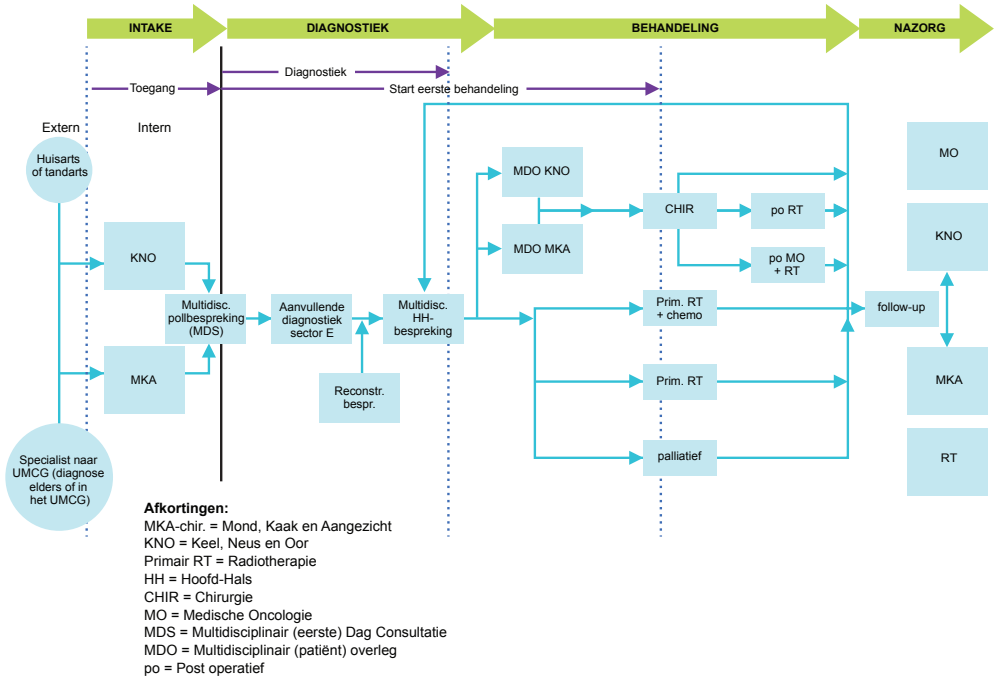
Inleiding

Multidisciplinaire zorgtrajecten zijn ziektebeeld gerichte samenwerkingsverbanden van artsen en andere zorgprofessionals die gebruikmaken van gestandaardiseerde processen en procedures. In de jaren 70 werd duidelijk dat voor zowel diagnostiek als behandeling van kanker, de kennis en kunde van meerdere specialismen noodzakelijk is. Het een en ander was de aanleiding om kankerzorg in multidisciplinaire zorgtrajecten te organiseren. Maar multidisciplinaire processen kosten tijd wat de start van de kankerbehandeling kan vertragen. Coördinatie en organisatie van de oncologische zorgtrajecten zijn daarom essentieel. Ad hoc en meer structurele overleggen van multidisciplinaire teams (MDT's) ontstonden om de inbreng van de verschillende specialismen te coördineren en de behandeling op tijd te laten plaats vinden.

Naast specifieke oncologische afdelingen zoals Medische Oncologie en Radiotherapie, ontstonden binnen orgaanspecialismen als Gynaecologie, Urologie, KNO, Mondziekten Kaak- en Aangezichtschirurgie oncologische secties of onderafdelingen. Later werden erkende aanvullende oncologische opleidingen ontwikkeld in de vorm van fellowships. Personeel en budget zijn gekoppeld aan deze afdelingen en niet aan het zorgtraject of MDT's. Zorgtrajecten en MDT's kunnen alleen bestaan indien er goede afspraken zijn over de samenwerking met de participerende afdelingen (zie figuur 1 voor het voorbeeld van het zorgtraject Hoofd-Hals Oncologie). Deze samenwerking betreft gezamenlijke poliklinische spreekuren, multidisciplinair overleggen (MDO's) ten behoeve van eigen patiënten, maar ook van regionale oncologische zorg en van gezamenlijke operaties van patiënten uitvoeren.

Voor de coördinatie van een zorgtraject, lijken ontwikkelingen op het gebied van informatie- en communicatietechnologie (ICT) zoals het elektronisch patiëntendossier, videobellen of video-confereren (VC), behulpzaam. Het is echter onduidelijk wat de effecten van multidisciplinaire oncologische zorgtrajecten is op de kwaliteit van de oncologische zorg. Daarnaast is onduidelijk hoe ICT in het bijzonder VC wordt toegepast binnen oncologische zorg en op welke wijze het bijdraagt aan de kwaliteit van de oncologische zorg.

De doelen van dit proefschrift, beschreven in *hoofdstuk 1* zijn het evalueren van organisatorische interventies in 4 multidisciplinaire oncologische zorgtrajecten in het Universitair Medisch Centrum Groningen (UMCG) en van het gebruik van VC in de oncologische zorg. De oncologische zorgtrajecten werden geëvalueerd met een combinatie van kwantitatieve en kwalitatieve onderzoeksmethoden, zogenoemde 'mixed methods' studies. De kwantitatieve methode had tot doel het verzamelen van getallen en met de kwalitatieve methoden werd gezocht naar verklaringen voor uitschieters via bijvoorbeeld interviews.



Figuur 1. Illustratie informatiestroom in zorgtraject hoofd-hals oncologie in het UMCG

Zorgpad: een beschrijving van afspraken over de organisatie van de zorg binnen een afdeling of specialisme (in processen, protocollen en procedures).

Zorgtraject: een beschrijving van afspraken tussen alle afdelingen en specialismen die betrokken zijn bij de intramurale zorg van een bepaald soort kankerbehandeling (vanaf verwijzing gedurende intake tot en met nazorg).

A

Invoering van een multidisciplinair eerste dag-spreekuur voor hoofd-halstumoren

De behandeling van hoofd-halstumoren is een voorbeeld van multidisciplinaire, 'laag volume - hoge complexiteit' zorgtrajecten, die in gespecialiseerde centra worden verleend. Hoofd-halstumoren zijn snelgroeiende tumoren waarbij het snel starten van de behandeling bepalend is voor de prognose. De Nederlandse norm is om binnen 30 kalenderdagen na het eerste consult in het UMCG de behandeling te starten. Om de doorlooptijd van patiënten met hoofd-hals kanker in het zorgtraject te verkorten, werd een multidisciplinair (eerste) dag-spreekuur (MDS) ingevoerd. In *hoofdstuk 2* is een mixed methods-studie beschreven waarin de effecten van het MDS op doorlooptijden en aantal ziekenhuisbezoeken van patiënten werden geëvalueerd.

Gegevens betreffende de procesindicatoren, dagen nodig voor verwijzing, dagen nodig voor diagnostische procedures, dagen tot de start van de eerste behandeling en aantal ziekenhuisbezoeken, werden uit de medische dossiers gehaald. Deze gegevens werden voor en na het instellen van het MDS geanalyseerd. Om meer inzicht te krijgen in de uitschieters (extreme waarden) werden semigestructureerde interviews gehouden met medisch specialisten.

Na de introductie van het MDS in 2008 waren de dagen die nodig zijn voor diagnostische procedures verminderd met 9,2 dagen tot 11,4 dagen en het starten van de eerste behandeling

met 10,4 dagen tot 22,2 dagen; het aantal ziekenhuisbezoeken was met 1,5 verminderd tot 3,6 bezoeken. Het percentage nieuwe patiënten dat binnen de Nederlandse norm van 80% binnen 30 kalenderdagen na eerste consult werd behandeld, steeg van 52% naar 83%. De vermindering van het aantal dagen dat nodig was voor diagnostische procedures bleef laag, ook in de latere evaluaties. Het aantal dagen dat nodig was om met de behandeling te starten, nam in 2010 en 2013 weer toe. Uit semigestructureerde interviews bleek dat deze toename kon worden toegeschreven aan 1) nieuwe behandelmethodes, 2) patiënten die meer tijd nodig hadden om hun behandelopties goed te overwegen of 3) professionals die meer voorbereidingstijd nodig hadden voor complexere behandelingen door vroegtijdig overleg over diagnostische procedures. De extra inspanningen van deelnemende zorgprofessionals om de patiënt samen te zien tijdens het MDS, droeg bij aan de efficiëntie van het zorgtraject.

Reorganisatie van het gastro-intestinaal oncologisch multidisciplinair overleg

De behandeling van gastro-intestinale tumoren is een voorbeeld van multidisciplinaire 'hoog volume - lage tot hoge complexiteit' zorgtrajecten, die in regionale ziekenhuizen wordt verleend. In het Gastro-Intestinaal Oncologisch (GIO) MDO worden complexe cases en de complexe behandeling in het UMCG als gespecialiseerde centrum (tertiair en quaternaire zorg) besproken. In 2015 werd het GIO MDO van het UMCG gereorganiseerd. In *hoofdstuk 3* wordt een mixed methods-studie beschreven waarin de effecten van deze reorganisatie zijn geëvalueerd voor drie zorgtrajecten namelijk voor hepatobiliaire tumoren, voor slokdarm-maag tumoren en voor colorectale tumoren. Voor het kwantitatieve deel werden gegevens betreffende procesindicatoren zoals doorlooptijden voor en na de reorganisatie, uit de medische dossiers gehaald en geanalyseerd. Voor het kwalitatieve deel van het onderzoek werden bij het zorgtraject betrokken professionals geïnterviewd over de voor- en nadelen van de reorganisatie en het huidige functioneren van het GIO MDO.

Voor het hepatobiliaire zorgtraject nam de tijd om te komen tot het behandelplan toe, maar de tijd om met de behandeling te starten nam af. In het slokdarm-maag zorgtraject was het aantal ziekenhuisbezoeken dat nodig was om een behandelplan op te stellen na de reorganisatie afgenomen. In het colorectale traject was er een trend naar een afname van het aantal ziekenhuisbezoeken. Na de reorganisatie was het percentage patiënten dat met behandeling startte binnen de Nederlandse 63-dagen norm voor gastro-intestinale tumoren, gestegen van 60% naar 88% (hepatobiliair), van 96% naar 100% (slokdarm-maag) en van 85 % tot 93% (colorectaal).

De zorgprofessionals gaven aan dat door de reorganisatie de aanwezigheid van alle benodigde specialismen in het MDO was verbeterd. Het gevolg hiervan was dat de discussies over behandelopties verbeterden met meer aandacht voor de wensen van patiënten. Ook was er een positief effect op de relaties tussen de zorgverleners. Men was van mening dat het MDO verder zouden kunnen worden verbeterd indien de deelnemers beter waren voorbereid. Vanwege andere verplichtingen was het moeilijk om tijd voor voorbereiding te plannen. Zorgprofessionals gaven tevens aan dat de beperkte verbetering van het op tijd starten van behandelingen, mede te wijten was aan een gebrek aan diagnostische capaciteit. Er werd gesuggereerd dat 'time slots' daarbij zouden kunnen helpen. Tenslotte werd aangegeven dat men behoefte had aan een dashboard, waarmee real-time doorlooptijden kunnen worden gevolgd voor het gehele zorgtraject, om het diagnostisch proces en het op tijd starten van de behandeling te bewaken.

Scoping review video-confereren

In *hoofdstuk 4* wordt een literatuur overzicht ('scoping review') gegeven van video-confereren (VC) in de oncologische zorg. De voor- en nadelen van VC met betrekking tot besluitvorming en zorgcoördinatie zoals in de literatuur onderzocht en beschreven werden samengevat. De databases MEDLINE, Embase, CINAHL en Cochrane Library werden vanaf hun ontstaan tot oktober 2020 doorzocht. Er werd gezocht naar studies die rapporteren over het gebruik van VC voor het bespreken van behandelplannen en het coördineren van zorg in oncologische netwerken tussen (multidisciplinaire) teams op verschillende locaties.

Twee onderzoekers extraheerden data en analyseerden de gevonden studies op overkoepelende thema's. Zes soorten samenwerking werden onderscheiden: 1) Expert MDO-Nationaal: specialisten die expertise en ervaring delen op het gebied van zeldzame tumoren, in een nationale samenwerking (17 studies); 2) Expert MDO-Internationaal: deskundige specialisten die expertise en ervaring delen op het gebied van zeldzame tumoren, in een internationale samenwerking (5 studies); 3) Raadpleging van deskundigen: specialisten die complexe patiënten behandelen en deskundigen raadplegen (11 studies); 4) Consultatie specialist-Verpleegkundige: verpleegkundigen, in gespecialiseerde palliatieve zorgafdelingen of hospices, die overleggen met specialisten in palliatieve zorg (4 studies); 5) MDT-Gelijk: gelijkwaardige MDT's die elkaar gebruiken om in een VC-MDO een frisse blik te krijgen op patiënten casus en om diagnostische en behandelplannen voor complexe gevallen te optimaliseren (5 studies); en 6) MDO-Samenwerking: MDT's die samenwerken om zo een groter MDO te vormen (8 studies).

Voordelen van VC voor de patiënt waren minder reizen voor diagnostisch onderzoek, betere coördinatie van zorg, betere toegang tot schaarse voorzieningen en behandeling in de eigen regio. Voordelen voor zorgmedewerkers waren optimalisatie van behandelplannen door multidisciplinaire discussies van complexe cases, tegelijkertijd informeren van zorgmedewerkers over ontwikkelingen in de zorg voor individuele patiënten, verbeterde zorgcoördinatie en minder reizen. Naast de voordelen voor de patiënten, draagt VC bij aan continue scholing van zorgprofessionals. Nadelen van VC waren de verhoogde werkdruk door de langere voorbereidingstijd om de discussies te kunnen voeren en door administratieve taken bij deze voorbereiding.

Evaluatie van video-confereren multidisciplinair overleg tussen oncologisch centrum en partner

Gezien de complexiteit van het diagnosticeren, de behandeling en het lage volume van hoofd-hals kanker, is deze zorg in Nederland gecentraliseerd in 8 hoofd-hals oncologische centra. Deze centra hebben samenwerking met 6 regionale ziekenhuizen als voorkeurspartners. Voorwaarde voor de samenwerking tussen centrum en partner is dat alle patiënten van de partner in een MDO met het hoofd-hals kankercentrum worden besproken. In *hoofdstuk 5* wordt een mixed methods-studie beschreven waarin het MDO met behulp van VC tussen het UMCG (centrum) en het Medisch Centrum Leeuwarden (partner) is geëvalueerd.

Dit VC-MDO werd gedurende 6 maanden geobserveerd. Het aantal en het onderwerp van de aanbevelingen werden geregistreerd. Semigestructureerde interviews werden gehouden met 6 hoofd-hals oncologische specialisten, drie van het centrum en drie van de partner om voor- en nadelen van VC-MDO in kaart te brengen.

In 8 van de 336 voorgelegde casussen (2%), werden aanbevelingen gegeven, 3 van centrum aan partner en 5 van partner aan centrum. Aanbevelingen bestonden voornamelijk uit alternatieve diagnostische of behandelopties voor een specifieke patiënt. Uit interviews bleek dat specialisten ondanks het geringe aantal aanbevelingen, vooral toegevoegde waarde zagen bij het bespreken van complexe cases, omdat het andere team met een frisse blik naar de casus keek. Daarnaast bleek dat VC-MDO zorgde voor afstemmen van medisch beleid. De eis dat de partner alle patiënten zou moeten bespreken, werd door het vertrouwen in de samenwerking en het afgestemd medisch behandelbeleid als achterhaald beschouwd. Eenvoudige, routinematige patiënten-cases, die volledig passen in de huidige richtlijnen en protocollair behandeld kunnen worden, hoeven niet meer besproken te worden aldus de geïnterviewde specialisten. De specialisten zouden liever meer tijd besteden aan het bespreken van complexe patiënten-cases die baat hebben bij bespreking met de partner.

Discussie, conclusies en toekomstig onderzoek

In de algemene discussie *(hoofdstuk 6)* worden de resultaten van dit proefschrift kort samengevat en bediscussieerd. De meerwaarde van dit proefschrift is dat naast kwantitatieve ook kwalitatieve onderzoekstechnieken werden toegepast, waardoor meer inzicht werd verkregen in de onderliggende mechanismen van de uitkomsten. Een beperking was dat de reorganisaties van de zorgtrajecten retrospectief werden geëvalueerd, waarbij gegevens niet altijd uniform waren geregistreerd door zorgprofessionals. Dit proefschrift liet zien dat reorganisaties zoals de invoering van een MDS voor hoofd-hals kanker en de reorganisatie van het GIO MDO in retrospectieve evaluatie afname van doorlooptijden geeft. De reorganisatie van het MDO had ook effect op de coördinatie van de zorg binnen de regio. De reflectie van de zorgprofessionals op de data leverde verbetermogelijkheden en praktische aanbevelingen op, die inmiddels zijn geïmplementeerd in de zorgtrajecten.

Het scoping review identificeerde zes verschillende vormen van VC in de oncologische zorg, met elk een duidelijk toepassingsgebied. De toepassingen varieerden van ad hoc overleg over een complexe casus tot regulier multidisciplinair overleg.

De gecombineerde rol van onderzoeker en adviseur kwaliteit leidde tot de volgende reflectie: 'De adviseur kwaliteit is een op waarden gebaseerde, data gedreven, reflectieve deskundige, die continue kwaliteitsverbetering bevordert. Het gaat daarbij om de doelen van de organisatie en de doelen van het zorgtraject of de zorgeenheid waar zij / hij zich voor inzet.' Deze rol laat zich goed combineren met de rol van onderzoeker, omdat het motiverend is en de twee rollen elkaar wederzijds inspireren.

In toekomstig onderzoek zou de meerwaarde van real-time dashboardinformatie betreffende de status van diagnostische procedures en de wachttijden op impact van de zorgtrajecten onderzocht moeten worden. Daarnaast is bij de evaluatie van zorgtrajecten meer aandacht gevraagd voor inzichten in de werkelijk gemaakte kosten van de zorg.

DANKWOORD

In de afgelopen 10 jaar heb ik met veel anderen gewerkt aan het tot stand komen van dit proefschrift. Het was een reis met bijzondere tussenstations, waarbij ik hulp heb gehad van veel verschillende mensen. De mensen aan wie ik veel te danken heb en die het leven leuk maken of allebei, wil ik graag noemen.

Zonder betrokken promotores, geen promotietraject

Prof. dr. J.L.N. Roodenburg, beste Jan, je hebt een gave om de potentie van iemand te zien en het talent tot ontplooiing te brengen met jouw aandacht. Jouw vertrouwen in mij, het samen opzetten van het onderzoek, jouw geduld en pragmatische aanpak hebben ervoor gezorgd dat ik mijn onderzoek succesvol heb kunnen afronden en de artikelen in gewaardeerde tijdschriften heb kunnen publiceren. Onze samenwerking liep van het project zorgtraject Hoofd-Hals Oncologie over in ondersteuning van bestuur van het zorgtraject en promotieonderzoek. Wekelijks overleg stelde ik zeer op prijs, waarbij we het UMCG en de ontwikkelingen bespraken en de gevolgen voor onze functie. Dank voor de ondersteuning bij het volhouden tot de eindstreep.

Prof. dr. P.U. Dijkstra, beste Pieter, na ons eerste overleg zag je een bijzondere eigenschap in mij: vlinderen. Je bedoelde dat ik naar veel verschillende onderwerpen kan associëren, waarna ik weer op aarde moet komen om mijn ideeën op te schrijven. Jij was daarbij een geweldige hulp: van 'Wat wilde je opschrijven?' naar 'Bedoelde je dat echt?', tot 'Ik zou het net even anders op schrijven.'. Ik heb geleerd dat weg laten het beter maakt. Gecomprimeerd en precies schrijven heb ik geleerd van jou.

Prof. dr. C.B.T. Ahaus, beste Kees, ons eerste schrijfcontact was het jubileumboek van Nucleaire Geneeskunde en Moleculaire Beeldvorming. We vonden elkaar in het enthousiast willen beschrijven wat we in Groningen goed doen. In de laatste fase van het schrijven van de artikelen had je een *kritische* kwaliteitsblik met waardegedreven input op mijn manuscript gericht op theoretische onderbouwing.

Een promotietraject is net een zorgtraject, voortdurend in ontwikkeling. De samenwerking tussen jullie als promotores en mij als promovendus was inspirerend. Het is dan ook jammer dat deze vorm van samenwerken stopt.

Zonder leescommissie, geen promotie

Hartelijk dank aan alle leden van de leescommissie voor het lezen, beoordelen en geven van feedback op mijn manuscript: **prof. dr. Marian Mourits**, **prof. dr. Jaap Tulleken** en **prof. dr. Thijs Merkx**.

Zonder tijd, geen onderzoek

Dank aan de Raad van Bestuur van het UMCG voor het financieren van mijn onderzoektijd.

Vanaf september 2012 kon ik een dag per week besteden aan het onderzoek met toestemming van **drs. Greetje Vos**, directeur MZKV en **drs. Jan Noord,** Hoofd Kwaliteit. Beste Jan en Greetje, het was voor mijn ontwikkeling van groot belang dat jullie mij de kans gaven dit naast mijn baan als sr. Adviseur Kwaliteit en Patiëntveiligheid te doen. Er was op deze manier ook tijd om me te verdiepen in literatuur over Zorgtrajecten naast de drukte van het adviseurschap. Graag wil ik jullie ook bedanken voor de mogelijkheid om mijn gespaarde

overuren te besteden in 2019 aan een sabbatical. Daardoor kon ik mij volledig richten op het verzamelen van gegevens en het doen van interviews voor de evaluatie van de reorganisatie van het gastro-intestinale multidisciplinaire (medisch) overleg. Daarnaast wil ik jullie vooral bedanken voor de belangstelling en de morele ondersteuning gedurende dit traject.

Gedurende mijn onderzoek heb ik een 0-aanstelling bij de afdeling Mondziekten, Kaak- en Aangezichtschirurgie gehad. Al die jaren ben ik als lid in de MKA gemeenschap opgenomen, ben ik gesteund en gefaciliteerd bij het uitvoeren van mijn onderzoek. Het was bijzonder om in de afdeling MKA-chirurgie mee te doen aan o.a. de kliniekdagen. Ik ben blij dat ik gezien heb hoe de cultuur in een afdeling ervoor kan zorgen dat je aandacht hebt voor de behoeften van patiënten en dat je elkaar draagt in mindere tijden. Het afdelingshoofd, **Prof. Fred Spijkervet** dank ik voor deze 'veilige klinische haven', waar vanuit ik dit onderzoek kon doen.

Zonder deskundige co-auteurs, geen publicaties

Graag wil ik alle co-auteurs bedanken voor hun bijdragen aan mijn publicaties.

Dr. Harry Reintsema, fijn dat je me uitlegde hoe het Centrum voor Bijzondere Tandheelkunde werkt en bijdraagt aan het zorgtraject Hoofd-Hals Oncologie. Ook je bespiegeling over het al dan niet publiceren in een kwartiel 2 of 3-tijdschrift afhankelijk van het vakgebied waren opbeurend.

Dr. Henk Bijl, dank voor de uitleg over de bijdrage van de radiotherapeut aan het zorgtraject en de discussie over het oplopen van het aantal ziekenhuisbezoeken door de gewijzigde aanpak van het plannen bij Radiotherapie.

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Zonder data, geen onderzoek

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Zonder lotgenoten, geen doorzettingsvermogen

Het behoren tot een 'community' van (buiten)promovendi is belangrijk voor mij geweest tijdens het promotietraject. In verschillende fasen van mijn onderzoek kon ik informatie delen over mijn onderzoek en oefenen met presentaties in de Epidemiology Research Meeting, onderzoek bijeenkomsten van de werkgroep Hoofd-Hals Oncologie, van de MKA-chirurgie, en die van het Kenniscentrum voor Kwaliteit en Veiligheid. De PhD-dagen van het Cancer Research Centre Groningen waren in dit kader ook waardevol.

Zonder kritische collega's, geen zelfreflectie

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Lidia, Groningen, 2022

CURRICULUM VITAE

Lidia van Huizen (1961) was born in Hengelo, the Netherlands. After completing her secondary education at the Ichthus College in Enschede in 1980, she studied Biology at the University of Groningen and graduated in 1988. In that year she started to work as a first-grade teacher at a secondary school in Almelo.

From 1988 to 2000 she worked in various organisations as a manager and quality consultant. Initially, working at Ophtec BV, an intra-ocular lens manufacturer, in 1988 she set up a quality system for the production of lenses. Subsequently, after completing a post academic course in Quality Management & Engineering (Utrecht University of Applied Sciences), she started working as a quality manager at Cordis Europe in 1991. After Cordis was taken over by Johnson & Johnson, she seized the opportunity to set up the quality management activities as director of Quality Assurance and Regulatory Affairs of a new plant for cardiac catheters and stents in Switzerland. After returning to the Netherlands, she worked for RIVM as head of quality and regulatory affairs for the vaccine development and production sector. These roles provided considerable experience in training healthcare professionals in quality and patient safety. She gained expertise in developing quality standards, working on the ISO 9001 Healthcare standard.

In 2000, she started working in the University Hospital in Groningen (Academisch Ziekenhuis Groningen) and in 2009 started working for Kerteza, a worldwide consultancy and training institute for healthcare organizations. Seeing an opportunity for personal growth, she enrolled as a PhD student at the department of Oral and Maxillofacial Surgery in 2012 with funding from the Board of Directors of the University Medical Center Groningen (UMCG). Prof. dr. Jan Roodenburg, oncological maxillofacial surgeon and chair of the head-and-neck oncology care pathway at the UMCG, became her first promotor. Prof. dr. Pieter Dijkstra, physical therapist, manual therapist, epidemiologist and researcher in the field of rehabilitation and in head and neck oncology, was asked to give advice on methodology. Prof. dr. Kees Ahaus, chair of the Quality and Patient Safety research group of the UMCG and researcher in Health Services Management & Organisation, joined her supervisory group offering advice on Quality and Patient Safety. Lidia's goal was to evaluate the development of care pathways in oncology. She has focused on change management and indicators that could help manage care pathways in oncology networks. The method of measuring quality of care and reflecting on the results to support sustainable quality improvement fits her like a glove.

Lidia has combined her PhD study with consultancy work over the last 10 years. She now works as a senior consultant on quality and patient safety, aiming to contribute to keeping the UMCG on the road to integrated quality excellence. Lidia is married to Hans Beldhuis and has with him two daughters, Iris (1994) and Hester (1997).

LIST OF PUBLICATIONS

Lidia S. van Huizen, Pieter U. Dijkstra, Sjoukje van der Werf, Kees Ahaus, Jan L.N. Roodenburg
Benefits and drawbacks of videoconferencing for collaborating multidisciplinary teams in regional oncology networks: a scoping review.
BMJ Open 2021;11:e050139. doi: 10.1136/bmjopen-2021-050139
http://dx.doi.org/10.1136/bmjopen-2021-050139

Lidia S. van Huizen, Pieter U. Dijkstra, Patrick H.J. Hemmer, Boudewijn van Etten, Carlijn I. Buis, Linde Olsder, Frederike G.I. van Vilsteren, Kees (C.) T.B. Ahaus, Jan L.N. Roodenburg
Reorganizing the multidisciplinary team meetings in a tertiary centre for gastro-intestinal oncology adds value to the internal and regional care pathways. A mixed method evaluation.
International journal of integrated care. 2021;21(1):8.
http://doi.org/10.5334/ijic.5526

Lidia S. van Huizen, Pieter U. Dijkstra, Gyorgy B. Halmos, Johanna G.M. van den Hoek, Klaas T. van der Laan, Oda B. Wijers, Kees Ahaus, Jan G.A.M. Visscher, Jan Roodenburg
Does multidisciplinary videoconferencing between a head-and-neck cancer centre and its partner hospital add value to their patient care and decision-making? A mixed-method evaluation.
BMJ Open 2019;9:e028609.
http://doi.org/10.1136/bmjopen-2018-028609

Lidia S. van Huizen, Pieter U. Dijkstra, Bernard F.A.M. van der Laan, Harry Reintsema, Kees T.B. Ahaus, Hendrik P. Bijl, Jan L.N. Roodenburg
Multidisciplinary first-day consultation accelerates diagnostic procedures and throughput times of patients in a head-and-neck cancer care pathway, a mixed method study.
BMC Health Serv Res 18, 820 (2018).
http://doi.org/10.1186/s12913-018-3637-1

Lidia S. van Huizen, C.T.B. (Kees) Ahaus
Quality in Nuclear Medicine: The Road to Quality Excellence. A Case Study of the Application of GMP, ISO 9001 and the EFQM Excellence Model in a Nuclear Medicine Department.
In A.W.J.M. Glaudemans et al. (eds.), Quality in Nuclear Medicine,
Springer International Publishing Switzerland 2017
http://doi.org/10.1007/978-3-319-33531-5_1

A. van der Star, **L.S. van Huizen**, Fr.C.A. Jaspers
Kwaliteit en Veiligheid: samen werkt beter
Kwaliteit in Zorg, september 2008

L.S. van Huizen, C.A.M. Hazenberg, A. van der Star
ISO9001 in de zorg gecombineerd met CCKL in een laboratorium van het UMCG. Kwaliteit zonder bureaucratie bestaat niet.
Kwaliteit in Beeld, februari 2006

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