An evaluation of Colorectal Cancer multidisciplinary team meetings

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ABSTRACT

The management of Colorectal Cancer has evolved, and in many parts of the world is provided by multidisciplinary teams (MDTs). In the UK all patients with colorectal cancer have their management discussed at MDTs. This thesis presents a series of mixed method studies aimed at developing and utilising methods to evaluate and assess the functioning of Colorectal Cancer MDTs.

The introduction presents an overview of Colorectal Cancer and the role of MDTs. Chapter 2 presents a systematic review and meta-analysis of studies on Colorectal Cancer MDTs. Chapter 3 explores the views of core members of Colorectal Cancer MDTs on potential assessment tools. Chapter 4 concludes this section with an analysis of the costs involved with these teams.

In Chapter 5 I describe the development and validation of an observational tool for evaluation of Colorectal Cancer MDTs, followed by an evaluation of the relationships between decision making within the team and the various aspects of the tool described in Chapter 6. Chapter 7 presents the feasibility of reliably using this tool for video based assessments of Colorectal Cancer MDTs.

I conclude this thesis with a general discussion – focussing on relevant findings, clinical implications of my work and directions for future research.
DECLARATION OF ORIGINALITY

The work presented in this thesis is my own and all else has been appropriately referenced.

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Sujay M Shah
THESIS RELATED OUTPUTS

Publications

- Decision making in Colorectal Cancer Tumor Board meetings: Results of a prospective observational assessment
  Surgical Endoscopy. 2014 Oct; 28(10):2783-8

- Cancer Patients’ Perspectives on Multidisciplinary Team working: An Exploratory Focus Group Study
  B. Lamb, R. Jalil, S. Shah, K. Brown, P. Allchorne, C. Vincent, J. Green, N. Sevdalis

- What are the recommendations to ensure a Successful Multidisciplinary Team in Rectal Cancer?
  S. Shah, P. Mathur, R. Glynne-Jones
  In V. Valentini et al: Multidisciplinary Management of Rectal Cancer (2012)

Abstracts

- Predicting the decision making ability of colorectal cancer multi-disciplinary teams: Results of an observational study.
  International Journal of Surgery, 2014, 12 (pp S33)

  International Journal of Surgery, 2014, 12 (pp S32)

- Predicting the decision making ability of Colorectal Cancer Multidisciplinary teams.
  Colorectal Disease, 2014, 16 (pp 86)
- A multi-centre study evaluating performance of multidisciplinary teams: Urology versus the top cancer killers
  Eur Urol Suppl 2014; 13; e878

- A systematic evaluation of the performance of multi-disciplinary team meetings: How does colorectal surgery compare to the top cancer killers?
  S. Arora, S. Sarkar, T. Soukup, B.W. Lamb, J Green, S. Shah, N. Sevdalis, A. Darzi,
  Colorectal Disease. 2014, 16 (pp 45)

- Variability in the quality of decision-making processes in urology multidisciplinary teams compared to other cancer specialties.
  BJU International. 2014, 113 (pp 27-28)

- A multi-centre study evaluating performance of multidisciplinary teams: Urology vs the top cancer killers.
  European Urology, 2014, 13 (1) (pp e878-e878a)

- User defined opinions of outcome measures for Colorectal Cancer Multidisciplinary team meetings
  Colorectal Disease, 2013, 15 (s3) 37

- Systematic review and meta-analysis of the effectiveness of Colorectal Cancer tumour boards
  Surgical Endoscopy 2013, 27, S251-S287

- Systematic evaluation of decision making in Colorectal Cancer tumour board meetings: Development and validation of a Quality assessment tool
  Surgical Endoscopy, 2013, 27, S251-S287
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  *ASIT (Association of Surgeons in Training) Annual Meeting*, April 2014

• Evaluating Colorectal Cancer Multi-disciplinary team meetings: Development and validation of a Quality assessment tool
  *ASIT (Association of Surgeons in Training) Annual Meeting*, April 2014

• Evaluating CRC MDTs: Development of a Novel Scoring System
  *3rd Biennial ECTA meeting, Singapore*, Nov 2013

• User defined opinions of outcome measures for Colorectal Cancer Multidisciplinary team meetings
  *ESCP (European Society of Coloproctology) Annual Meeting*, Sept 2013

• Colorectal cancer MDTs: Are we as good as we think we are?

• Systematic review and meta-analysis of the effectiveness of Colorectal Cancer tumour boards
  *SAGES (Society of American Gastrointestinal and Endoscopic Surgeons) Annual Meeting*, April 2013

• Systematic evaluation of decision making in Colorectal Cancer tumour board meetings:
  Development and validation of a Quality assessment tool
SAGES (Society of American Gastrointestinal and Endoscopic Surgeons) Annual Meeting, April 2013

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- Colorectal cancer MDTs: Are we as good as we think we are?
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CHAPTER 1: INTRODUCTION

1.1 Introduction

As the National Health Service (NHS) approaches the end of its seventh decade in existence, there are numerous challenges facing this established body. One of the central principles on which the NHS was founded was to provide healthcare to all, with financing coming from the public purse (1).

With increasingly limited resources and a rising population (2) – both in number and in age - there is immeasurable pressure on a system that many speculate is close to breaking point. Nowhere is this truer than with cancer services in the NHS. Whilst the overall provision of cancer services has changed drastically, the pressures remain similar – and, with an aging population, are projected to intensify.

In this chapter I will outline the origins and the current state of cancer services in England. I will then summarise the evidence for the use of multidisciplinary teams and their origins. I will then focus specifically on colorectal cancer, highlighting the reasons for this. Finally, I will outline the aims and objectives of this thesis.

1.2 Cancer care in England

The provision of care for patients with cancer has undergone significant changes since the inception of the National Health Service. Perhaps the most significant event in recent history was the publication in 1995 of the Calman-Hine report – formally known as the “Policy framework for commissioning cancer services – a report by the Expert Advisory Group to the chief medical officers of England and Wales” (3). This landmark report led to a significant reconfiguration of infrastructure and personnel with the aim of delivering improved cancer care. The sections that follow outline the key elements of the report, as well as the changes made to the structure of healthcare as a result of this report.
1.2.1 Cancer services: pre-1995

Cancer services in England have evolved. Prior to the mid-1990s, much of the care was provided by individual clinicians, with the onus on the individual clinician to arrange appropriate treatment – with or without involving clinicians from other related specialties. Whilst the overall organisation of the NHS meant that the responsibility for commissioning and provision of services was held locally, there were concerns regarding the uniformity of care. To many, this meant that access to specific treatments and medications were ‘rationed’ by the physical location of patients. However, a more subtle effect of this was the variation in access to specialist care for specific diseases. These two factors meant that patients were referred to individual clinicians locally, and received treatments depending on the available expertise, often without referral or discussion with other, related specialties; with the possibility that they were not receiving the best, most appropriate care for their conditions (4).

If local services were matched however, this may not have been seen as such an issue – as patients preferred to be treated locally if they were receiving appropriate treatments (4). However, statistics showed that there was significant variability in the types and volumes of specific treatments available between clinicians (5) and between hospitals (6). Furthermore, there was evidence of variations in clinical outcomes across England (7, 8). Although not available at the time, more recent evidence has highlighted the relationship between hospital volume and clinical outcomes (9, 10). The evidence provided by the European cancer registry based study of survival and care of cancer patients (11) showed that generally, outcomes were worse in the United Kingdom for most types of cancers compared with those countries that had a more centralized, specialized approach to cancer treatments.

Within cancer services in England, the changes in breast cancer care provided further evidence of the possible benefits specialisation could bring (12). The contrast between the improvements seen in the organisation and delivery of services for patients diagnosed through the screening programme – established in 1987 – and those diagnosed following symptoms was evident to those in the specialty, and brought to the attention of specialists in cancer care in all areas by the British Breast Group in 1994 (13).
1.2.2 The Calman-Hine report: 1995

At the time of the developments described above, the Chief Medical Officers of England and Wales were Professor Sir Kenneth Calman and Dame Deirdre Hine respectively. In developing their cancer policy, they established the expert advisory group on cancer with the aim of reviewing and assessing current evidence on best practice for cancer care.

Following the reports of the group, the landmark government document, ‘A policy framework for commissioning cancer services – a report by the Expert Advisory Group to the chief medical officers of England and Wales’ (3) was produced in 1995. The detailed report identified seven key principles to govern the provision of cancer care:

- Access to uniform high-quality care in the community or hospital
- Early identification of cancer and availability of national screening programmes
- Patients to be given clear information at all stages
- Services to be patient centred
- Centrality of primary care and effective communications
- Psychosocial aspects of care are important
- Cancer registration and monitoring of treatment and outcomes are essential

Whilst the recommendations of the report were many and far-reaching, the overall message was one of changes in structures and processes to ensure the effective delivery of cancer services to all patients. The policy proposed a change in model from one of generalists treating patients, to the development of a specialist cancer service for the treatment of all patients.

The policy set out the importance of specialist clinicians in cancer care leading the management of cancer patients, with close working between related specialties in the form of multidisciplinary teams. The organisational arrangements proposed the development of cancer units, cancer centres and cancer networks (3).

Cancer units were local hospitals with speciality-specific departments to provide the surrounding population with all aspects of cancer care for those cancers and specialties that were common, and had sufficient numbers. More complex cases, rarer cancers or those with poor outcomes would be referred by local cancer units to regional (or in some cases national) cancer centres – usually within
the same cancer network. This would allow for specialist treatments by a team of clinicians that had sufficient exposure to the cancer type to make and carry out appropriate care recommendations.

1.2.3 After The Calman-Hine report: 1995 onwards
Whilst the Calman-Hine report set out general recommendations on the delivery of cancer services in England, the policy was light on detail (3). The aim was to set out a framework, upon which future cancer services would be based. The policy was followed a year later by a more detailed circular (14). Following this, the publication of a series of reports, beginning with breast cancer outlined more detailed aspects of the proposed development of cancer services. These ‘Improving Outcomes Guidance’ documents were produced for different tumour types (15-18) and had a significant impact on the layout of cancer services. Further Government policy, in the form of the first National Cancer Plan (19) in 2000 built on previous work and set out clearer objectives, with specific numbers and financial costs attached to it. In 2000, cancer networks were introduced to provide comprehensive cancer services for a specific geographical area. Their remit was far reaching, but involved provision, co-ordination and support for cancer services for the members of the network.

Whilst overall outcomes in cancer services have improved since the Calman-Hine report (1995) and the National Cancer plan (2000), there have been further Government policy documents aimed at improving cancer services. I will not go into further details of all these separately, but I conclude this section by highlighting the importance of multidisciplinary teams in cancer care - an underlying theme in all these documents was the key role that the multidisciplinary team played in cancer care.

1.3 Multidisciplinary teams in cancer care
A multidisciplinary team has been defined as a group of people of different healthcare disciplines, who meet together at a given time (whether physically in one place, or by video or teleconferencing) to discuss a particular patient and who are each able to contribute independently to the diagnostic and treatment decisions about the patient (20).

The idea behind multidisciplinary teams is perhaps best summarised by the following quote by Atul Gawande in The New Yorker:

“But you can’t hold all the information in your head any longer, and you can’t master all the skills. No one person can work up a patient’s back pain, run the immunoassay, do the physical therapy,
protocol the MRI, and direct the treatment of the unexpected cancer found growing in the spine. I don’t even know what it means to “protocol” the MRI” (21).

Although referring to healthcare in general, this notion epitomises the rationale behind multidisciplinary care for cancer patients, and highlights the importance of a team of specialists treating cancer patients. Differences in tumour types and tumour stages affect the types of treatments offered to patients. As cancer treatments become more complex, there has been a decline in the number of cases that are treated by a sole general clinician – indeed a number of different clinicians, from various specialties, provide care to cancer patients.

### 1.3.1 Multidisciplinary teams in England

One of the key recommendations of the Calman-Hine report was the introduction of multidisciplinary teams into cancer care (3). However, whilst the Calman-Hine report proposed the implementation of multidisciplinary teams in the management of cancer, it is important to note that evidence of the benefits of multidisciplinary teams in cancer care had already begun to appear in the literature (4, 22); indeed some of this evidence formed part of the reasoning behind the report.

Multidisciplinary care in cancer services is now a mandatory aspect of service delivery, and all hospitals in England delivering cancer care have specific multidisciplinary teams. Indeed, multidisciplinary teams form a core part of the service for specialties outside of cancer management (23, 24). In the United Kingdom, a cancer multidisciplinary team is made up of surgeons, physicians, clinical and medical oncologists, radiologists, pathologists, specialist nurses, and palliative care specialists and may also include researchers, dieticians, radiographers, social workers and other allied healthcare professionals.

Most teams meet on a weekly basis at a set venue, and patients with cancer are discussed at the meeting at various stages of their management, and recommendations made regarding ongoing care. All patients with cancer must have their care led by a multidisciplinary team. Guidance on the structure, organisation and functioning of multidisciplinary teams in the UK was provided by the National Cancer Action Team (NCAT) (25), with a regular evaluation of the Cancer pathway, including the MDT being undertaken in the form of Peer Review (26).
1.3.2 Multidisciplinary teams around the world

Globally, multidisciplinary teams are increasingly becoming the model of care for patients with cancer (27-30), with varying levels of integration into the national policies of different countries (31-33).

The emergence of cancer multidisciplinary teams (or tumour boards as they are known in some settings) as a forum for patient management discussions allows individual clinicians from different specialties to come together and discuss the diagnosis, staging and treatment plans of patients with cancer. In the United States, The National Cancer Institute defines a tumor board review as “a treatment planning approach in which a number of doctors who are experts in different specialties (disciplines) review and discuss the medical condition and treatment options of a patient” (34). They go on further to propose the members of a cancer tumor board to include a medical oncologist (who provides cancer treatment with drugs), a surgical oncologist (who provides cancer treatment with surgery), and a radiation oncologist (who provides cancer treatment with radiation).

The principle behind tumor boards is that combined decision making, with the presence of different clinicians, ensures that patients receive the most appropriate care for their disease and stage. Whilst tumour boards have been an integral part of surgical care in various hospitals, particularly in the USA, their structure and purpose have changed with time. Table 1.1 summarises the key differences between traditional tumor boards (predominantly in the USA) and more modern multidisciplinary teams, based on the principles of multidisciplinary care from around the world.

Whilst the idea of multidisciplinary team working has now been endorsed in cancer care systems throughout much of Europe, their prevalence is much lower in the USA and Australasia. In Europe, multidisciplinary care forms a core component of clinical guidelines in all cancer care services, and is pivotal to many of the National Cancer Plans in Europe (33). In USA, despite being a requirement for accreditation by the American College of Surgeons’ Cancer Program Standards (35), they are not always present in hospitals that treat cancer patients.
Table 1.1: Differences between tumour boards and multidisciplinary treatment care teams

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Tumour boards</th>
<th>Multidisciplinary treatment care teams</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stage of cases</td>
<td>Newly diagnosed; complex cases</td>
<td>Newly diagnosed, complex cases, plus “repeat” cases at later stages</td>
</tr>
<tr>
<td>Approach</td>
<td>Consultative; advice provided to lead MD</td>
<td>Collaborative, consultation between all members of team</td>
</tr>
<tr>
<td>Focus</td>
<td>Treatment only</td>
<td>Treatment and patient’s quality of life (rehabilitation; psychosocial needs; long-term care)</td>
</tr>
<tr>
<td>Primary purpose</td>
<td>Education and training</td>
<td>Planning treatment and care management</td>
</tr>
<tr>
<td>Participants</td>
<td>Open to any practitioner</td>
<td>Focused on care team responsible for managing patient care for specific disease site</td>
</tr>
<tr>
<td>Timing</td>
<td>At one point in time</td>
<td>Multiple points along treatment pathway</td>
</tr>
<tr>
<td>Case review</td>
<td>Retrospective; prospective planning potential more recently</td>
<td>Prospective</td>
</tr>
<tr>
<td>Treatment decision process</td>
<td>Physician in charge</td>
<td>Consensus</td>
</tr>
</tbody>
</table>

1.3.3 Multidisciplinary teams – what does the evidence say?
The use of multidisciplinary teams in the management of cancer patients provides an interesting insight into the world of modern medicine. In a field where up to date evidence is essential before tests, treatments and pathways are used in clinical practice, multidisciplinary teams seem to have ‘snuck in under the radar’ There is almost universal approval for this strategy, which indeed some consider critical for ensuring all the involved disciplines are included in patient care, yet there was little evidence that suggested that this form of multidisciplinary care actually improved outcomes for patients (28). The ideal standard would therefore be to run a suitably powered randomized control trial to compare a matched cohort of patients managed either by individual clinicians or by a multidisciplinary team. However, in most healthcare systems, where multidisciplinary team working is now established, this would be a nearly impossible task.
Across tumour types, there are a number of recent studies, the majority longitudinal, that have looked at the impact of the introduction of multidisciplinary teams on patient care as well as on service delivery.

Studies on multidisciplinary teams have explored the impact that multidisciplinary teams have had on clinical outcomes as a means of evaluating the effectiveness and success of MDTs. There have been studies in different cancer types, including lung, colorectal and breast, looking at the impact of MDTs on clinical outcomes such as recurrence rates, disease free survival and overall survival. Whilst a number of these studies have shown an improvement in clinical outcomes in different specialties (36, 37), a recent large study from the USA (38) has not shown similar improvements in the majority of specialty multidisciplinary teams. Furthermore, a major limitation of all these studies is the inability to distinguish the introduction of multidisciplinary care from the overall improvements made in the fields of cancer care, ranging from improved diagnostics, screening, and a wider range of treatment modalities and types. Attributing the improvement in clinical outcomes solely to the introduction of tumor boards ignores the improvements made in cancer care over the same time periods. The difficulties in setting up randomized controlled trials as described above, as well as the ethical questions related to setting up such a study mean that there is unlikely to be a definitive answer available.

A further group of studies on multidisciplinary team processes have highlighted the significant resource and manpower that is associated with these meetings, however there have been few attempts to quantify this. Chinai and colleagues (39) provide a robust evaluation of the costs associated with MDT meetings at a single centre, however, acknowledge the fact that these results may not be transferrable due to the significant variations in practice reported anecdotally. Indeed, a review by Taylor and colleagues (28) highlighted the vast differences between hospitals as well as between departments within the same hospital as an example of how little guidance is available on the implementation and running of MDTs. Without appropriate guidance against which to benchmark performance, it is difficult to evaluate the success of multidisciplinary teams.
1.4 Colorectal cancer

Colorectal disease is an area of healthcare that holds a special interest for me. In particular, as a trainee surgeon, the management of colorectal cancer (also known as bowel, colon or rectal cancer) has a certain appeal due to the mix of technical skills required and the mental challenge it provides. Figure 1.1 shows the different areas in the colon and rectum that can be affected by cancer.

Figure 1.1: Large bowel – colon and rectum – potential sites of cancer

1.4.1 Importance of Colorectal Cancer

Colorectal cancer is becoming increasingly common, and continues to form a large part of the cancer burden globally (40). Colorectal cancer affects the lower part of the digestive system; approximately two-thirds of these tumours develop in the colon or large bowel and about one third are in the rectum or anus. The most common type of bowel cancer is adenocarcinoma (41).

The latest statistics available from the Office of National Statistics (2012) identify Colorectal cancer as having the 4th highest incidence amongst cancers in the United Kingdom (42). In 2010, colorectal cancer accounted for the second highest cancer mortality in the UK (43). Furthermore, the statistics show that it is on the increase - Cases of bowel cancer for men have increased from 45 per 100,000
in 1975-77 to 58 per 100,000 in 2008-10 (a rise of 29%) and for women have increased from 35 per 100,000 to 37 per 100,000 in the same timescale (a rise of 6%).

Globally, the incidence and mortality of colorectal cancer is amongst the highest of all cancers. The GLOBOCAN report of 2008 (40) estimated that there were 1.2 million new cases of colorectal cancer diagnosed globally (3rd most common incidence) and 610,000 deaths attributed to colorectal cancer (4th most common mortality).

1.4.2 Differences in presentation

Whilst definitive diagnosis of colorectal cancer is made following an endoscopic examination of the large bowel (either a flexible sigmoidoscopy or a colonoscopy) with biopsy of the suspect lesion, colorectal cancer presents in one of two main ways:

• Symptoms – these include blood or mucus in the stools, changes in bowel habit, abdominal pain, rectal pain, weight loss or symptoms of anaemia (such as tiredness)

• Screening – these are often asymptomatic individuals, but have had abnormalities identified on screening programmes. In the UK, the NHS Bowel Cancer Screening Programme (44) offers screening in the form of Faecal Occult Blood tests to all individuals aged between 60 and 69, every 2 years. More recently, a pilot programme has been initiated using flexible sigmoidoscopy between the ages of 55 and 60. Additionally there are specific screening programmes for those individuals with diseases that are thought to pre-dispose to Bowel Cancer (such as Peutz-Jeghers Syndrome).

These two groups of patients may present at various stages of disease progression, with evidence suggesting that cancers or pre-cancerous lesions are picked up earlier through screening asymptomatic individuals (45). This is likely to increase the number of patients discussed at multidisciplinary team meetings, placing increasing pressure on services. Furthermore the exact management and follow-up of patients with early cancers or pre-cancerous lesions is yet to be agreed upon, and there are likely to be differing strategies for this.
1.4.3 Differences in diagnostics

Once the diagnosis of colorectal cancer has been made (or in some cases suspected), a number of investigations are undertaken to accurately stage the disease prior to planning further management. Traditionally, in England, local staging has been carried out with CT scans (colon) and MRI scans (rectal) (46) and distant staging with CT scans. Guidelines from the UK National Institute for Health and Clinical Excellence (NICE) released in 2011 (31) concur with this and advise that the above is all that is necessary – recommendations similar to that of the previous version of the guidelines.

However, since the introduction of the initial, evidence-based guideline, several improvements have been made in imaging such as the wide-spread use of multi-spiral CT, new available MRI-contrast liver agents and the more widespread use of FDG-PET and the introduction of FDG-PET/CT. Additionally, there has been an increase in the use of trans-rectal and endo-anal ultrasound for specific local staging of low rectal cancers.

Given these advances, there are now many more options for optimal staging, which will be affected by local availability and local expertise, making appropriate decision making important. The best treatment plans depend on the most accurate information regarding the disease being available, and the choice of staging techniques is an important determinant of this.

1.4.4 Differences in management

Treatments for colorectal cancer are determined by the stage of the disease. Specific staged disease can be treated with fixed treatment plans based on sound clinical evidence. However there remain a number of areas where there is still debate regarding optimal management. A specific example is the treatment of localized T2 stage rectal cancer. There is now a growing body of proponents for the use of local techniques such as trans-anal endoscopic microsurgery (TEMS). However, there remain concerns regarding the adequacy of resection and the ongoing risk of local recurrence or distant spread. Furthermore, the delivery of such techniques is limited by the expertise of local personnel and the availability of specific equipment (47). Another example of treatment debates relate to the use of radiotherapy (either none, short course or long course) in the management of rectal cancer (48).

These management debates emphasise the fact that there remains a role for constructive discussion of
management strategies for patients with colorectal cancer. The multidisciplinary team meeting provides an avenue for such debate to take place.

1.4.5 Clinical guidelines
Previous sections have highlighted that advances in diagnostics and management strategies have challenged clinicians to keep up to date and query the recommendations from guidelines such as those from UK NICE (31). However the presence of relevant, up to date guidelines for colorectal cancer means that a standard protocol for diagnostics and management does exist. In cases where there is little debate (such as, for example, the management of T2 colon cancer with no nodal or metastatic disease) there is an argument to state that these cases do not all need to be discussed at a multidisciplinary meeting. Similar strategies exist in parts of Europe with considerable success, but it is important to note that this relies heavily on the presence of up to date guidelines that are based on sound clinical evidence.

1.4.6 Clinical trials
The previous sections have identified some of the potential diagnostic and management dilemmas clinicians’ face in the management of colorectal cancer. Currently, there are numerous trials running (200 as of 25/10/15 according to the Cancer Research UK website) (41) looking at various aspects of colorectal cancer management with a view to answering some of these dilemmas. The high number of trials means that patients that present with colorectal cancer may fit the criteria for enrolment into trials; indeed, some estimates state that approximately a quarter of patients with colorectal cancer are eligible for trials.

The multidisciplinary team meeting provides an open forum for discussion of enrolment into various trials, often led by different specialties.

1.4.7 Section summary
This section discusses some of the aspects of colorectal cancer that make the use of multidisciplinary care particularly important. As pressure on services increases with greater numbers, the specialty provides an area to examine the need for discussing all patients in multidisciplinary teams, whilst emphasizing the need for a multi-specialty approach due to the variations in diagnostic techniques and management strategies.
**Thesis Aims**

This MD(Res) Thesis aims to evaluate and assess the functioning of Colorectal MDTs and their decision making. The specific objectives are:

1. To review the evidence base on Colorectal Cancer MDTs.

2. To identify key aspects that could be utilised in evaluating Colorectal Cancer MDTs.

3. To develop an objective evaluation tool for Colorectal Cancer MDTs which can be used in different formats.

4. To identify key elements that predict decision making in Colorectal Cancer MDTs.
1.5 Chapter summary and thesis outline

This chapter gives a brief description of cancer services in England leading up to the introduction of multidisciplinary teams. It goes on to outline the reasons why I have focused on colorectal cancer multidisciplinary teams for this thesis.

In this thesis, I report a variety of qualitative and quantitative studies that will attempt to explore multidisciplinary care in colorectal cancer.

The thesis is split into 3 distinct sections. Section 1 includes the introduction, and the background behind the thesis. Section 2 is made up of Chapters 2, 3 and 4. Section 4 consists of Chapters 5, 6 and 7. The discussion in Chapter 8 completes the thesis.

Following the introductory section, in section 2, I present information regarding colorectal cancer multidisciplinary teams. Chapter 2 describes a systematic review of the available literature on colorectal cancer multidisciplinary teams. In chapter 3, I explore the views of core members of colorectal cancer multidisciplinary teams on proposed assessment tools. In Chapter 4, I report financial data on the cost of colorectal cancer multidisciplinary teams. I complete this section with a summary of the previous three chapters, and I go on to identify and expand on specific areas for assessment.

In section 3, I focus on some of the specific findings from the previous section: the ability of multidisciplinary teams to make decisions and the assessment of teamwork in multidisciplinary team meetings. In Chapter 5, I describe the development and validation of an objective assessment tool for evaluation of colorectal cancer multidisciplinary teams, and, in Chapter 6 I use the tool to evaluate the relationships between decision making and various aspects of the multidisciplinary meeting. Finally, in Chapter 7, I evaluate the feasibility of reliably using the tool for video based assessments of multidisciplinary teams.

In Chapter 8, I complete this thesis with a detailed discussion of my findings and their implications, and outline areas for future work.
CHAPTER 2: COLORECTAL CANCER MULTIDISCIPLINARY TEAMS: A SYSTEMATIC REVIEW AND META-ANALYSIS OF THE LITERATURE

2.1 Chapter overview
In this Chapter, I present a systematic review and meta-analysis of the available literature on Colorectal Cancer Multidisciplinary teams.

2.2 Introduction
The previous chapter outlined the development of cancer care in England over the past few decades. It highlighted some of the available literature on multidisciplinary teams by discussing a combination of narrative and systematic reviews on the topic. There is large body of research looking at various aspects of multidisciplinary teams. The introductory chapter further outlined the specific challenges faced in the management of colorectal cancer – a specialty where the disease burden continues to increase, whilst the options for investigation and management are wide reaching.

This chapter sets the scene for the rest of the thesis, by focusing specifically on colorectal cancer multidisciplinary teams. I undertook a systematic review of the literature on colorectal cancer, specifically looking at three aspects of the meetings. Following this, I undertook a meta-analysis of selective, appropriate data – further details are found in the sections that follow. The final section discusses proposed methods of assessment of Colorectal Cancer MDTs, based on the information available from the systematic review.

2.3 Aims
The aims of the systematic review in this chapter are to identify the available literature on Colorectal Cancer Multidisciplinary teams. My analysis specifically aims to identify studies that look at MDT processes and implementation, the impact of MDTs on pre-treatment decisions and the impact of MDTs on outcomes. Where there are multiple studies that examine a specific factor related to the MDT, I have combined this data and assessed its suitability for further analysis, undertaking a meta-analysis in three different areas.
2.4 Methods

2.4.1 Search strategy and selection criteria

I undertook systematic literature searches of Embase, Medline, PsycINFO (using Ovid SP) and the Cochrane Library. The free text search terms used were ‘colorectal’, ‘cancer’, ‘multidisciplinary’ and relevant derivatives (for a detailed search strategy please see Table 2.1). MeSH terms were identified for each database separately and incorporated into the search. Results were limited to humans, English Language and dates from 1980 to 15th October 2015. Additionally, I hand-searched the reference lists of all articles that fitted the inclusion criteria to identify any other articles for inclusion.

Articles were included in the review if they presented empirical data on management of Colorectal Cancer by a Multidisciplinary team. A distinction was made between articles relating simply to multimodality treatment of Colorectal Cancer, or those looking at a specific treatment, and these articles were excluded.

I reviewed all titles and those that did not meet the inclusion criteria were excluded. To ensure adequate article retrieval, any titles that were unclear were included for review of the abstracts. I then reviewed the remaining abstracts (n=834) for relevance and excluded those that did not meet the inclusion criteria. A second reviewer (Sevdalis) independently reviewed the abstracts for relevance to ensure adequate retrieval. Concordance between reviewers was very good, with a Cohen’s Kappa coefficient of 0.80. Discordant decisions were arbitrated by a third reviewer (Arora), and an agreement reached between all of us. I then reviewed all full text articles (n=172) and included them if they met all the inclusion criteria. Where I had any doubts about inclusion, full text articles were reviewed by Arora and following discussion a final decision regarding inclusion was made. A final number of 42 articles were included in the review. Figure 2.1 outlines the study selection process.
**Table 2.1: Search strategy**

<table>
<thead>
<tr>
<th></th>
<th>Search Term</th>
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<tbody>
<tr>
<td>1</td>
<td>colo$$.mp</td>
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<tr>
<td>2</td>
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</tr>
<tr>
<td>3</td>
<td>anus.mp</td>
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<tr>
<td>4</td>
<td>anal.mp</td>
</tr>
<tr>
<td>5</td>
<td>anorect$$.mp</td>
</tr>
<tr>
<td>6</td>
<td>caec$$.mp</td>
</tr>
<tr>
<td>7</td>
<td>colon/</td>
</tr>
<tr>
<td>8</td>
<td>rectum/</td>
</tr>
<tr>
<td>9</td>
<td>anus/</td>
</tr>
<tr>
<td>10</td>
<td>colorectal surgery/</td>
</tr>
<tr>
<td>11</td>
<td>cancer$$.mp</td>
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<td>12</td>
<td>neoplas$$.mp</td>
</tr>
<tr>
<td>13</td>
<td>tumo?r$$.mp</td>
</tr>
<tr>
<td>14</td>
<td>onco$$.mp</td>
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<tr>
<td>15</td>
<td>carcinoma$$.mp</td>
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<td>16</td>
<td>carcinoma/</td>
</tr>
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<td>17</td>
<td>neoplasms/</td>
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<td>18</td>
<td>MDT$$.mp</td>
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<tr>
<td>19</td>
<td>multidisciplinary.mp</td>
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<td>20</td>
<td>multiprofessional.mp</td>
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<td>28</td>
<td>interdisciplinary treatment approach/</td>
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<td>29</td>
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</tr>
<tr>
<td>33</td>
<td>limit 32 to human</td>
</tr>
<tr>
<td>34</td>
<td>limit 33 to English language</td>
</tr>
<tr>
<td>35</td>
<td>limit 34 to year = “1980 - Current”</td>
</tr>
<tr>
<td>36</td>
<td>remove duplicates from 35</td>
</tr>
</tbody>
</table>
Figure 2.1: Study selection flow diagram

- Systematic search
  - 6913 Titles
    - 5753 Titles reviewed
      - 4919 Titles excluded
        - 662 Abstracts excluded
          - Exclusion criteria
            - Not colorectal cancer: 43
            - Not MDT: 375
            - Specific treatment: 81
            - Not empirical data: 163
        - 132 Full text articles excluded
          - Exclusion criteria
            - Not colorectal cancer: 0
            - Not MDT: 23
            - Specific treatment: 39
            - Not empirical data: 70
    - 172 Full text articles reviewed
      - 40 Articles included
        - 2 Additional Articles included from reference searching
  - 42 Articles included in analysis
2.4.2 Data extraction and quality assessment

Data I extracted by myself from the 42 included papers for: country in which the study was undertaken, population size, patient characteristics, health-care professional characteristics, setting of the MDT, study design, study objectives and study findings. I divided the studies into three groups – the first included studies that presented data on MDT running and implementation, the second on the impact of MDT on pre-treatment decisions, and the third on the impact of MDT on outcomes. Some studies were included in more than one group.

Within each group, I placed studies that identified specific pre-treatment decisions or outcomes into different sub-groups, and those sub-groups that included three or more studies were included in a meta-analysis.

I undertook meta-analysis of three separate sub-groups that fulfilled the above criteria – use of MRI or TRUS for staging in rectal cancer, positive resection margins and 3 year overall survival rates. This was performed on advice from a meta-analysis expert (Athanasiou) and in line with recommendations from Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (49), and the Meta-analysis of Observational Studies in Epidemiology (MOOSE) (50). A random-effects model was used which assumes that there is variation among studies because this model better accounts for heterogeneity between studies, and the odds ratio (OR) was the summary statistic used.

As there was considerable variation among studies identified for meta-analysis in terms of the homogeneity of study populations pre and post the MDTs, I thought that performing a further sub-group analysis may provide more meaningful results. In order to categorize studies into those that were homogenous, and therefore, a more reliable comparison, and those that were less so, I identified five specific criteria (Table 2.2 below) and compared these in the pre and post MDT groups. I attributed one point to each criterion that was matched or zero points to each criterion that was unmatched or unspecified.

However, within each sub-group, no two studies scored more than three out of five, and therefore further sub-group analysis was not carried out. I refer to this in more detail in the discussion.
Table 2.2: Quality scoring: criteria for comparison

<table>
<thead>
<tr>
<th>Criterion</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient factors</strong></td>
<td></td>
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<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>Co-morbidity</td>
<td></td>
</tr>
<tr>
<td><strong>Tumour factors</strong></td>
<td></td>
</tr>
<tr>
<td>Tumour stage</td>
<td></td>
</tr>
<tr>
<td>Tumour location</td>
<td></td>
</tr>
<tr>
<td><strong>Operative factors</strong></td>
<td></td>
</tr>
<tr>
<td>Type of surgery (including open or laparoscopic)</td>
<td></td>
</tr>
</tbody>
</table>

2.5 Results

2.5.1 Study Characteristics

A total of 5753 articles were retrieved by the search criteria above. Application of the inclusion criteria excluded 5713 articles. 6 further articles were identified from hand-searching, and of these 2 fitted the inclusion criteria. A final list of 42\(^1\) included articles was completed, and is presented in Table 2.3.

The 42 included studies included articles published in peer reviewed journals between 2003 and 2015 inclusive. Papers were from 10 countries: UK (n=14), USA (n=7), France (n=4), Sweden (n=3), China (n=2), Australia (n=2), Canada (n=2), Italy (n=2), Netherlands (n=2) Denmark (n=1), Iran (n=1) and two multi-centre, international studies (principal authors from USA).

\(^1\) The updated systematic review carried out on 15/10/2015 also identified Shah et al - Decision-making in Colorectal Cancer Tumor Board meetings: results of a prospective observational assessment (Surg End). This has been excluded from this analysis as it was developed based on the initial review, and forms part of the content of further chapters in this thesis
### Table 2.3: Characteristics of included studies

<table>
<thead>
<tr>
<th>Author / Year / Country</th>
<th>Study design, methodology</th>
<th>Main Study Themes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Augestad K, Lindsetmo R, et al (2010), North America, Europe, Asia (53)</td>
<td>Questionnaire</td>
<td>Effect of MDT on pre-operative decision making</td>
</tr>
<tr>
<td>Brannstrom F, Bjerregaard J et al (2015), Sweden (56)</td>
<td>Retrospective review of registry data</td>
<td>Predictors of discussion at MDTs  Effect of MDT on treatment decision making</td>
</tr>
<tr>
<td>Catt S, Fallowfield L et al (2005), UK (58)</td>
<td>Questionnaire</td>
<td>Individual roles within MDTs  Psychological impact of MDT work</td>
</tr>
<tr>
<td>Chang-Zheng D, Jie L et al (2011), China (59)</td>
<td>Longitudinal study</td>
<td>Effect of MDTs on overall management of Colorectal Cancer</td>
</tr>
<tr>
<td>Author(s) and Year</td>
<td>Location</td>
<td>Study Type</td>
</tr>
<tr>
<td>--------------------</td>
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</tr>
<tr>
<td>Chinai N, Bintcliffe F et al (2013), UK (39)</td>
<td>Longitudinal study</td>
<td>Concordance of MDT recommendations</td>
</tr>
<tr>
<td>Derwinger K, Carlsson G, et al (2007); Sweden (60)</td>
<td>Longitudinal study</td>
<td>Effect of MDT on pathology reporting</td>
</tr>
<tr>
<td>Feroci F, Lenzi E et al (2012), Italy (61)</td>
<td>Questionnaire</td>
<td>MDT implementation, structure and process</td>
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<tr>
<td>Gagliardi A, Smith A et al (2003), Canada (62)</td>
<td>Scenario based discussion</td>
<td>Video-conferencing in MDTs</td>
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<tr>
<td>Genovesi D, Mazzilli L et al (2014), Italy (63)</td>
<td>Audit</td>
<td>Adherence to guidelines</td>
</tr>
<tr>
<td>Haddad P, Mir M.-R. et al (2013), Iran (64)</td>
<td>Longitudinal study</td>
<td>MDT implementation, structure and process</td>
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<tr>
<td>Hamaker M, van Rixtel B et al (2015), Netherlands (65)</td>
<td>Retrospective review of management</td>
<td>Effect of patient age on MDT decisions</td>
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<tr>
<td>Keating N, Landrum M et al (2012), USA (38)</td>
<td>Survey and retrospective review of registry data</td>
<td>Effect of MDT on overall management of and outcomes from Colorectal Cancer</td>
</tr>
<tr>
<td>Kehl K, Landrum M et al (2015), USA (67)</td>
<td>Survey and retrospective review of registry data</td>
<td>Effect of MDT on overall management of and outcomes from Colorectal Cancer</td>
</tr>
<tr>
<td>Kurtz J, Heitz D et al (2010), France (68)</td>
<td>Longitudinal study</td>
<td>Effect of MDT on adherence to guidelines MDTs in elderly patients</td>
</tr>
<tr>
<td>Reference</td>
<td>Country</td>
<td>Study Type</td>
</tr>
<tr>
<td>-----------</td>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>Lamb B, Sevdalis N et al (2012), UK (69)</td>
<td>Analysis of survey data</td>
<td>Comparison of survey responses for Colorectal Cancer and other cancer types</td>
</tr>
<tr>
<td>Levine R, Chawla B et al (2012), USA (70)</td>
<td>Longitudinal study</td>
<td>Effect of MDTs on overall management of Colorectal Cancer</td>
</tr>
<tr>
<td>Lordan J, Karanjia N et al (2008), UK (71)</td>
<td>Longitudinal study</td>
<td>Effect of team composition on referrals to MDT</td>
</tr>
<tr>
<td>MacDermid E, Hooton G et al (2008), UK (72)</td>
<td>Longitudinal study</td>
<td>Effects of MDT on overall outcomes in Colorectal Cancer</td>
</tr>
<tr>
<td>Marshall C, Balentine C et al (2011), USA (73)</td>
<td>Longitudinal study</td>
<td>Effects of MDT on overall outcomes in Colorectal Cancer</td>
</tr>
<tr>
<td>Mathoulin-Pélissier S, Bécouarn Y et al (2012), France (74)</td>
<td>Longitudinal study</td>
<td>MDT implementation</td>
</tr>
<tr>
<td>Rogers S, Ayanian J et al (2009), USA (75)</td>
<td>Survey</td>
<td>Effects of surgical volume on attendance at MDTs</td>
</tr>
<tr>
<td>Ryan J, Faragher I (2014), Australia (76)</td>
<td>Prospective study</td>
<td>Concordance of MDT recommendations</td>
</tr>
<tr>
<td>Segelman J, Singomklao T et al (2008), Sweden (77)</td>
<td>Longitudinal study</td>
<td>Effect of MDTs on overall management of Colorectal Cancer</td>
</tr>
<tr>
<td>Sharma A, Sharp D et al (2008), UK (78)</td>
<td>Questionnaire</td>
<td>MDT implementation, structure and process</td>
</tr>
<tr>
<td>Soukop M, Robinson A et al (2006), UK (80)</td>
<td>Questionnaire</td>
<td>MDT implementation, structure and process</td>
</tr>
<tr>
<td>Authors</td>
<td>Year, Country</td>
<td>Study Type</td>
</tr>
<tr>
<td>---------------------------------</td>
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</tr>
<tr>
<td>Swellengrebel H, Peters E et al</td>
<td>2011, Netherlands</td>
<td>Longitudinal study</td>
</tr>
<tr>
<td>Taylor A, Sheridan M et al</td>
<td>2004, UK</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>Taylor C, Sippitt J et al</td>
<td>2010, UK</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>Vasudevan S, Cresswell A, et al</td>
<td>2013, UK</td>
<td>Prospective study</td>
</tr>
<tr>
<td>Vaughan-Shaw P, Wheeler J et al</td>
<td>2015, UK</td>
<td>Longitudinal study</td>
</tr>
<tr>
<td>Wilcoxon H, Luxford K et al</td>
<td>2011, Australia</td>
<td>Survey</td>
</tr>
<tr>
<td>Wilks J, Liebig C et al</td>
<td>2009, USA</td>
<td>Longitudinal study</td>
</tr>
<tr>
<td>Wille-Jørgensen P, Sparre P et al</td>
<td>2013, Denmark</td>
<td>Longitudinal study</td>
</tr>
<tr>
<td>Wood J, Metcalfe C et al</td>
<td>2008, UK</td>
<td>Longitudinal study</td>
</tr>
<tr>
<td>Ye Y, Shen Z et al</td>
<td>2012, China</td>
<td>Longitudinal study</td>
</tr>
</tbody>
</table>
2.5.2 MDT Running and implementation

2.5.2.1 Organisation

Kelly et al’s questionnaire study in 2003 of colorectal cancer MDTs in the UK showed that not all colorectal cancer MDTs were fully functioning (90% up and running, 9% partially running), and only 51% met weekly. In comparison, an Australian study by Wilcoxon et al from 2011 identified only a third of hospitals had an MDT. There were no similar studies from Europe or the USA.

Significantly, approximately 62% of MDTs surveyed by Kelly et al had problems with organization of the meeting, with 32% of these not having a MDT co-ordinator. Soukop et al sent a questionnaire to all MDT co-ordinators in the UK, and identified that only 70% of respondents had a dedicated CRC MDT co-ordinator. Within this group, only 26% had the role of communicating decisions with primary care.

2.5.2.2 Team members

The attendance of core team members was variable, with surgeons and CNSs attending the most according to Kelly et al, whilst Wilcoxon et al reported that less than 1% of MDTs had core team members attending regularly. Rogers et al reported that surgeons that regularly attended MDTs were more likely to be high volume surgeons, and were more likely to collaborate with other specialties in decision making processes.

Catt et al showed that there was good role clarity amongst surgeons, oncologists, radiologists and CNSs. This study also examined overall psychiatric morbidity related to MDTs, and overall rates were lower than previously reported – however, there was considerable variation between results for the colorectal cancer teams involved – ranging between 7% and 25%. Taylor et al’s study from 2010 reported that although surgeons reported highest total job stress, they also reported highest job satisfaction.

This study also reported that all members of the MDT felt that “providing better care from working in a MDT” were predominant sources of job satisfaction – a finding echoed by the Gagliardi et al. Respondents in this study also stated that attendance at MDTs provided useful tips for practice (61%) and changed current practice (30%). Results of the study by Sharma et al showed that clinicians felt
that CRC MDTs improved quality of care, whilst having a positive impact on training and team morale.

### 2.5.2.3 Case selection

Three European studies which reported data on which patients were discussed at MDT all reported a less than a 100% rate. The reasons for this varied: Bouvier et al reported that those over the age of 75, those with colon cancer (as opposed to rectal cancer) and those with early disease were less likely to be discussed, whilst treatment in a university hospital meant that case were more likely to be discussed. Segelman et al similarly reported that patients over the age of 72 were less likely to be discussed at MDT. Swellengrebel et al reported that patients with distal tumours were more likely to be discussed at MDT than those with proximal tumours. Taylor et al’s study from 2004 reported that 95% of UK departments discussed all cases at MDT, although Chinai et al’s study proposed that even in the UK setting, not all cases needed to be discussed.

### 2.5.2.4 Decisions made – concordance and implementation

Both Ryan et al and Chinai et al compared the decisions made by MDTs with those made by individual clinicians blindly. Both these studies showed that within a subset of cases discussed, there was no deviation from the MDT decision, and proposed that certain cases did not need to go through the MDT. One study reported that not all decisions made at MDT are implemented (Wood et al), with 10% not implemented – 9 due to co-morbidity, 7 due to patient choice and 2 due to further clinical information at time of surgery.
<table>
<thead>
<tr>
<th>Reference</th>
<th>Outcomes</th>
<th>Aspects of MDTs investigated</th>
<th>Relevant results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bouvier A, Bauvin E, et al (2007); France</td>
<td>1. Whether or not MDT was held for patients 2. Specific features influencing this</td>
<td>✓</td>
<td>32.3% (Range 6.4%-76.9%) discussed at MDT use in: 1. &gt;75 years less likely OR 0.71, 0.64-0.79, p&lt;0.001 than in &gt;75 2. Public non-university hospital (OR 0.36, 0.26-0.5, P&lt;0.001) and private hospital (OR 0.40, 0.31-0.54, p&lt;0.001) less likely than in public university hospital 3. rectum more often (OR1.83, 1.48-2.25, p&lt;0.001) than in colon 4. advanced disease (37.1%) than in early disease (27.5%) (p&lt;0.001) Patients discussed at MDT were more likely to be included in therapeutic trials (OR 1.99, 1.23-3.21, p=0.005)</td>
</tr>
<tr>
<td>Catt S, Fallowfield L et al (2005), UK</td>
<td>1. Awareness of roles (IRQ) 2. GHQ-12 scores</td>
<td>✓</td>
<td>1. Good role clarity amongst surgeons, oncologists, radiologists and CNSs 2. Percentage of GHQ-12&gt;4 in CRC teams - 7, 22, 25%</td>
</tr>
<tr>
<td>Chinai N, Bintcliffe F et al (2013), UK</td>
<td>1. Cost of MDT 2. Concurrence</td>
<td>✓</td>
<td>1. Total cost of 1 colorectal MDT meeting - £162,734 2. 94% concurrence between management plan documented by each consultant prior to MDT meeting and recorded outcomes</td>
</tr>
</tbody>
</table>
1. Only 28.5% of Community hospital and 15.1% of teaching hospital surgeons attended MDTs once a week, with the highest being pathologists and oncologists in both.

2. Significant differences between how decisions were recorded between community and teaching hospitals.

3. Not all hospitals discussed all cases at MDTs – 67.4% of community hospitals and only 15.1% of teaching hospitals.

4. Surgeons felt that there were numerous perceived benefits of MDTs.

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1. CRC (2 teams) - 10/22 (45.5%) and 13/25 (52%) individual response rate (total number = 23)

2. 73.9% were, "overall, satisfied with event"

3. 30.4% said, "information revealed, not accessible elsewhere"

4. 60.8% felt discussion provided useful tips for practice

5. 69.5% felt discussion caused reflection on practice

6. 30.4% stated that current practice would change
1. 116/136 statements were similar across tumour types
2. Significant differences in opinions between colorectal cancer MDT members (percentage in brackets) and other MDT members were:
   - Good MDTs save time in periods between meetings (88%)
   - All MDT core members need to do some preparation before meeting (77%)
   - Case summaries should be circulated before meeting (50%)
   - Late additions should not be allowed unless clinically urgent (61%)
   - Patient’s case should not be discussed unless someone who has been involved in assess patient is present (68%)
   - Aspects of clinical decision making process

Multidisciplinary approach was taken:
1. 86/625 (14%) of colon cancer patients before surgery
2. 175/327 (54%) of rectal patients before surgery
3. 128/190 (67%) of rectal cancer patients before a pre-surgical treatment performed
4. 685/767 (89%) of colon cancer patients after surgery
5. 273/340 (80%) of rectal cancer patients after surgery

Compared to surgeons that attended MDTs quarterly or less frequent, surgeons that attended MDTs weekly were more likely to:

1. Be high volume surgeons (OR 1.62, CI 0.93-2.82, p = 0.09)
2. Collaborate with other specialties for decisions regarding chemotherapy (OR 1.66, CI 1.06-2.60, p = 0.02)
3. Collaborate with other specialties for decisions regarding radiotherapy (OR 1.82, CI 1.17-2.82, p = 0.008)
<table>
<thead>
<tr>
<th>Author</th>
<th>Year</th>
<th>Country</th>
<th>Study Type</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Segelman J, Singomklao T et al (2008), Sweden</td>
<td></td>
<td></td>
<td>Assessment by MDT</td>
<td>1. Patients under 72 were more likely to be discussed at MDT then those over 72 (OR 7.88, CI 5.88-10.57, p&lt;0.001)</td>
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<tr>
<td></td>
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<td>2. Surgery for metastases more common among patients discussed at MDT than those who were not (72/1041 vs 5/409, p&lt;0.001)</td>
</tr>
<tr>
<td>Sharma A, Sharp D et al (2006), UK</td>
<td></td>
<td></td>
<td>Questionnaire responses - from Colorectal Surgeons (CRS) and Colorectal Nurse Specialists (CNS)</td>
<td>1. CRC MDTs improve quality of care - 95.6% agree</td>
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<td>2. CRC MDTs have positive impact on training - 80% agree</td>
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<td>3. CRC MDTs have positive impact on morale - 78.6% agree</td>
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<td>4. CRC MDTs are cost effective - 73% agree</td>
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<td>5. CRC MDTs not a passing fad - 89% agree</td>
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<td>6. 50.4% of CRSs and 35.2% of CNSs stated that job plan did not have enough time for CRC MDTs</td>
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<td>7. Overall CNSs responses had more positive views than CRSs</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>8. CNSs significantly improve care of CRC patients - 98.9% of CRSs and 95% of CNSs agree</td>
</tr>
<tr>
<td>Soukop M, Robinson A et al (2006), UK</td>
<td></td>
<td></td>
<td>Questionnaire responses - from MDT co-ordinator</td>
<td>1.70% of responders had a dedicated MDT co-ordinator</td>
</tr>
<tr>
<td></td>
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<td>2. Presence of CRCMDTC correlated in use of pro forma for recording patient details 83% vs 44% (p&lt;0.001)</td>
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<tr>
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<td>3. CRCMDTC responsible for communicating decisions in 26%</td>
</tr>
<tr>
<td>Swellengrebel H, Peters E et al (2011), Netherlands</td>
<td></td>
<td></td>
<td>1. Staging methods</td>
<td>1. Patients with distal tumours more likely to be discussed at MDT than those with proximal (69% vs 47%, p=0.002)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2. Treatments</td>
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<td></td>
<td></td>
<td></td>
<td>3. Positive CRM</td>
<td></td>
</tr>
<tr>
<td>Taylor A, Sheridan M et al (2004), UK</td>
<td></td>
<td></td>
<td>Questionnaire responses - from radiologists</td>
<td>1. 138/142 (95%) - all cases discussed at MDT, 1 (1%) not always, 3 (2%) not discussed and 3 (2%) not stated</td>
</tr>
<tr>
<td></td>
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<td></td>
<td>2. 126/142 (89%) - nominated radiologist regularly participates in MDT</td>
</tr>
<tr>
<td>Study Authors</td>
<td>Research Design</td>
<td>Key Findings</td>
<td></td>
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<tr>
<td>Taylor C, Sippitt J et al (2010), UK</td>
<td>Questionnaire responses: 1. Changes in self-reported job stress 2. Changes in self-reported job satisfaction 3. Changes in team performance</td>
<td>✓ 1. 90% of MDT co-ordinators and CNSs were female, 90% of surgeons and 79% of radiologists were male 2. Surgeons reported highest total job stress 3. Surgeons and CNSs reported highest job satisfaction 4. Across all members - &quot;working in MDT&quot; and &quot;providing better care from working in a MDT&quot; were predominant sources of job satisfaction</td>
<td></td>
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</tr>
<tr>
<td>Wilcoxon H, Luxford K et al (2011), Australia</td>
<td>Questionnaire responses</td>
<td>✓ 1. 1/3 of hospitals surveyed reported having an MDT 2. Of those with MDT, 2/3 informed patient of MDT discussion 3. Of those with MDT, under half reported that patient consent not sought for discussing their case 4. only 2/299 had core team members regularly attending MDT meetings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wood J, Metcalfe C et al (2008), UK</td>
<td>Implementation of decisions</td>
<td>✓ 1. 20/201 (10% (CI 6.3-15.2%) decisions not implemented. 2. All these patients had more conservative treatment then original. 3. Of these, 16 due to patient factors (9 co-morbidity, 7 patient choice), 1 due to irresectable tumour at laparotomy, 1 due to unsuitability for colonoscopic local excision, 1 due to doctor changing decision as did not feel adjuvant therapy would be beneficial, and 1 with no apparent reason 4. Decisions more likely to change for colon cancers than for rectal cancers (OR 4.34, CI 0.97-15.06, p=0.024)</td>
<td></td>
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</tr>
</tbody>
</table>
2.5.3 The impact of MDTs on pre-treatment decisions

The study by Kurtz et al showed that presentation at MDT resulted in good compliance with local guidelines in patients with colorectal cancer – 91% and 83% in different groups. Although this study did not compare these to a control group prior to the introduction of the MDT, the findings were echoed by Abraham et al who showed that presentation at MDT resulted in improved adherence to recommended therapy in patients with colon cancer and rectal cancer, although the findings were not significant in colon cancer.

A number of studies showed that presentation at MDT improved both local and distant staging – both in their use as well as in the accuracy of reporting. Metaanalysis of studies reporting use of MRI or TRUS for local staging of rectal cancer patients showed that patients in the MDT group were more likely to have MRI / TRUS than those not discussed at MDT (OR 6.97, 2.92, 16.64). The proportion of patients referred for and receiving neoadjuvant oncological treatment was also greater in patients discussed at MDT – statistically significant findings reported by Levine et al, Marshall et al, Swellengrebel et al and Wilks et al.

**Figure 2.2: The impact of MDTs on the use of MRI / TRUS for staging in rectal cancer**
<table>
<thead>
<tr>
<th>Reference</th>
<th>Outcomes</th>
<th>Aspects of MDTs investigated</th>
<th>Relevant results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abraham, N. S., J. T. Gossey, et al. (2006); USA</td>
<td>Receipt of recommended treatment</td>
<td>Guidelines ✓</td>
<td>1. Colon cancer - no statistically significant difference in receipt of recommended treatment between groups presented or not presented at MDT&lt;br&gt;2. Rectal cancer - presentation at MDT more likely to result in appropriate use of recommended treatment (strict definition) (OR 3.62; CI: 1.18-11.17). This was true for both intention to treat (broad) and actual (strict) treatment</td>
</tr>
<tr>
<td>Augestad K, Lindsetmo R, et al. (2010); North America, Europe, Asia</td>
<td>Questionnaire responses</td>
<td></td>
<td>MDTs influence preoperative factors:&lt;br&gt;1. choice of staging modality - MRI used more (RR 3.62, CI 0.93-14.03, p=0.06)&lt;br&gt;2. CRM as indication for neoadjuvant treatment increased (RR 5.67, CI 1.8-17.89, p=0.003)&lt;br&gt;3. Quality of pathology report improved (RR 4.85, CI 1.34-17.46, p=0.01)&lt;br&gt;4. Use of new chemotherapy regimen if liver mets present improved (RR 6.41, CI 1.34-30.64, p=0.02)&lt;br&gt;5. 1 stage surgery when liver mets present - reduced (RR 0.25, CI 0.08-0.8, p=0.02)</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Study Details</td>
<td>Findings</td>
<td></td>
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<tr>
<td>Augestad K, Lindsetmo R, et al (2012); North America, Europe, Asia</td>
<td>Survey responses</td>
<td>Decision for one stage surgery was less likely in departments with MDTs (OR 0.24)</td>
<td></td>
</tr>
</tbody>
</table>

1. 62/259 (24%) proceeded to surgery without pre-op MDT discussion of MRI (no neoadjuvant therapy)  
2. no MDT group - 20/62 had MRI, but not discussed  
3. All patients in MDT group had MRI  

1. All complicated patients (n=516) discussed at MDT  
2. Rectal cancer: MDT group - 61/101 (60.4%) had MRI vs non-MDT - 66/162 (40.7%) - p<0.001  

1. High degree of agreement between reviewers classing decision to treat palliatively as correct (K statistic 0.577)  
2. Overall, in only 5/52 patients were all 6 reviewers in agreement that decision to treat palliatively was correct  
3. Differences in individual management strategies  

1. Colon cancer: 68.7% (no MDT) vs 69.3% (General MDT) vs 70.4% (CRC specific MDT) – p=0.83  
2. Rectal cancer: 74.6% (no MDT) vs 73.9% (General MDT) vs 74.6% (CRC specific MDT) – p=0.03
<table>
<thead>
<tr>
<th>Study</th>
<th>Title</th>
<th>Patients</th>
<th>Treatment</th>
<th>Follow-up</th>
<th>MDT Evaluation</th>
<th>Results</th>
</tr>
</thead>
</table>
| Kurtz J, Heitz D et al (2010), France | II/III rectal cancer | 65 | Adjuvant chemotherapy, 128 advocated follow-up. | 91% in chemo group were in accordance with guidelines, 83% in follow-up group. Of those not according to guidelines (22) - 7 due to comorbidities, 11 due to old age, 4 - no reason. | 1. MDT cases: what percentage patients > 70 years had treatment according to guidelines. 2. Percentage of these that actually had recommended treatment | 1. MDT cases: what percentage patients > 70 years had treatment according to guidelines. 2. Percentage of these that actually had recommended treatment |}

| Levine R, Chawla B et al (2012), USA | Pre-operative evaluation | 91% in chemo group were in accordance with guidelines, 83% in follow-up group. Of those not according to guidelines (22) - 7 due to comorbidities, 11 due to old age, 4 - no reason. | As compared to those not discussed at MDT, patients discussed at MDT had: 1. CT: abdomen - 97.5% vs 83.1% (p=0.03); chest - 95% vs 37.1% (p<0.0001) 2. CEA - 100% vs 63.8% (p<0.0001) 3. TRUS (rectal pts) - 88% vs 37.7% (p<0.0001) 4. Overall complete work-up - 85% vs 23% (p<0.0001) 5. Oncology consultation - 98.9% vs 25.4% (p<0.0001) & treatment – 62.5% vs 41.5% (p=0.02) 6. Advanced pathology testing - 29.6% vs 10.6% (p=0.0001) 7. Neoadjuvant therapy rate - 76% vs 20% (p<0.0001) | 1. Pre-operative evaluation 2. Access to multimodal therapy |}

| Marshall C, Balentine C et al (2011), USA | Overall & disease free survival | Neoadjuvant therapy (rectal) - 35% to 91% (p<0.01) | 1. Overall & disease free survival 2. R0 resections 3. Recurrence rate 4. No. of lymph nodes found | 1. Overall & disease free survival 2. R0 resections 3. Recurrence rate 4. No. of lymph nodes found |}

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CT: computed tomography, CEA: carcinoembryonic antigen, TRUS: transrectal ultrasound, MDT: multidisciplinary team.
5. No. of patients receiving neoadjuvant therapy

Palmer G, Martling A et al (2010), Sweden

1. Pre-operative staging techniques / completeness
2. Type of surgery
3. R0 Resection
4. Residual tumour / recurrence

✓ 1. 65/65 in group 1 had local staging, compared to 44/139 in group 3 (p<0.001)
2. 65/65 in group 1 had distant staging, compared to 53/139 in group 3 (p<0.001)
3. 51/65 in group 1 had pre-op treatment, compared to 48/139 in group 3 (p<0.001)

Swellengrebel H, Peters E et al (2011) Netherlands

1. Pre-operative staging techniques / completeness
2. Treatments
3. Positive CRM

✓ 1. More complete staging in MDT+ group - 94% vs 73%, p<0.001
2. Patients undergoing pre-op therapy discussed more often at MDT then those straight to TME (63% VS 19%, p<0.001)

Taylor A, Sheridan M et al (2004), UK

Questionnaire responses

1. 138/142 (95%) - all cases discussed at MDT, 1 (1%) not always, and 3 (2%) not discussed. 3 (2%) not stated
2. 126/142 (89%) - nominated radiologist regularly participates in MDT
3. 79/142 (56%) - more than 75% of patients have pre-operative MRI
<table>
<thead>
<tr>
<th>Study</th>
<th>Variables</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wilks J, Liebig C et al</td>
<td>1. No. of lymph nodes resected  2. % of patients undergoing R0 resection  3. No. of patients receiving neoadjuvant therapy</td>
<td>✓ 1. Number of patients receiving neoadjuvant therapy increased from 32% pre to 74% post (p&lt;0.0001)</td>
</tr>
<tr>
<td>(2009), USA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wille-Jørgensen P,</td>
<td>1. Preoperative staging done  2. MRI performed</td>
<td>✓ 1. Full preoperative staging done – 240/467 (pre) and 300/344 (post) (p&lt;0.001) 2. MRI performed – 100/467 (pre) and 249/344 (post) p=0.007</td>
</tr>
<tr>
<td>Sparre P et al (2012), Denmark</td>
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<tr>
<td>Ye Y, Shen Z et al (2012),</td>
<td>1. Number of lymph nodes examined  2. Pre-operative staging techniques / completeness  3. Rate of tumour recurrence</td>
<td>1. CT done in 90/297 (30.3%) in pre, vs 185/298 (55.7%) post - p&lt;0.001  2. CT TNM staging done in 37/90 (41.1%) in pre, vs 150/185 (81.3%) post - p&lt;0.001  3. Accurate CT TNM staging done in 17/37 (45.9%) in pre, vs 96/150 (64.0%) post - p=0.044</td>
</tr>
<tr>
<td>China</td>
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</table>
2.5.4 The impact of MDTs on outcomes

Two studies (Burton et al and Swellengrebel et al) reported reductions in the rates of CRM positive resections; however these findings were only statistically significant in the former study. Overall, the number of Lymph Nodes found improved in data from three studies (Derwinger et al, Marshall et al and Ye et al). Additionally, Derwinger et al demonstrated a significant increase from 27% to 67% in the number of patients who had the minimum number of 12 Lymph nodes identified. Despite differences in reporting survival – Lordan et al, Segelman et al and Ye et al reported overall survival, MacDermid et al reported 3 year survival and Chang-Zheng et al reported 5 year survival – there was an overall improvement shown following the introduction of MDTs. Metaanalysis of overall survival at 3 years showed an improvement following the introduction of MDTs – OR 1.51 (0.91, 2.52). Overall positive margins following surgery improved following introduction of MDTs, as reported by Marshall et al, Palmer et al, Wilks et al and Wille Jorgensen et al – metaanalysis showed a reduction in these rates – OR 0.35 (0.24, 0.52).

Figure 2.3: The impact of MDTs on 3 year overall survival
Figure 2.4: The impact of MDTs on reducing positive resection margins

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Treatment through MDT</th>
<th>Treatment without MDT</th>
<th>Odds Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marshall 2011</td>
<td>17</td>
<td>265</td>
<td>0.27 [0.15, 0.48]</td>
</tr>
<tr>
<td>Palmer 2010</td>
<td>21</td>
<td>44</td>
<td>0.69 [0.30, 1.61]</td>
</tr>
<tr>
<td>Wilks 2009</td>
<td>100</td>
<td>100</td>
<td>0.19 [0.07, 0.52]</td>
</tr>
<tr>
<td>Wilke-Jørgensen 2012</td>
<td>63</td>
<td>261</td>
<td>0.30 [0.27, 0.53]</td>
</tr>
</tbody>
</table>

Total (95% CI): 670 / 881 = 0.75 [0.24, 0.52]

Total events: 106 / 315

Heterogeneity: Tau^2 = 0.00; Chi^2 = 4.88, df = 3 (P = 0.18); I^2 = 39%

Test for overall effect: Z = 5.22 (P < 0.00001)
### Table 2.6: The impact of MDT on outcomes

<table>
<thead>
<tr>
<th>Reference</th>
<th>Outcomes</th>
<th>Aspects of MDTs investigated</th>
<th>Relevant results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burton S, Brown G, et al (2006); UK</td>
<td>Percentage of patients with preoperative MDT discussion of MRI and associated CRM positivity</td>
<td>Surgical Resection Margins Recurrence / Survival</td>
<td>1. Histological CRM+ve rate 16/62 - 26% (CI 16.6-39.7%) vs Histological CRM+ve rate 1/116 - 1% in group who proceeded to surgery alone after MDT discussion of MRI 2. Overall Histological CRM+ve rate in patients discussed at MDT (all groups) - 16/197 - 8% 3. Patients discussed at MDT - MRI CRM+ve of 60/197 - 30%, however actual histological CRM+ve - 4 - 2% - significant downstaging (all groups) - additionally further 15 patients (12 unresectable, 3 refused surgery) - 8% unresected</td>
</tr>
<tr>
<td>Chang-Zheng D, Jie L et al (2011), China</td>
<td>1. Pre-operative evaluation 2. Sphincter preservation surgery 3. Local recurrence 4. Distant metastases 5. 5 year disease free and overall survival</td>
<td>1. MDT group - 13/35 (37.14%) had sphincter preservation surgery for tumours &lt;5cm vs non-MDT - 5/37 (13.51%) - p=0.041 2. MDT group - 4/101 (3.96%) had local recurrence vs non-MDT - 18/162 (11.11%) - p=0.042 3. MDT group - 22/101 (21.78%) had distant mets vs non-MDT - 36/162 (22.22%) - p=0.933 (not significant) 4. MDT group - 77/101 (76.24%) 5yr disease free survival vs non-MDT - 109/162 (67.28%) - p=0.039 5. MDT group - 78/101 (77.23%) 5yr overall survival vs non-MDT - 113/162</td>
<td></td>
</tr>
</tbody>
</table>
1. Number of lymph nodes found - 69.75% - p=0.049

1. Increase in number of nodes from mean of 9 (median 7, range 1-33) to mean 17 (median 16, range 5-36) - p<0.05
2. Increase in positive nodes from mean of 1.7 to 2.4
3. Improvement in requirement of 12 nodes to be examined - from 27% to 67% (p<0.05)

1. Colon cancer: 57.5% (no MDT) vs 58.2% (General MDT) vs 60.2% (CRC specific MDT) – p=0.24
2. Rectal cancer: 52.5% (no MDT) vs 56.2% (General MDT) vs 54.6% (CRC specific MDT) – p=0.37

1. Less operative blood loss in Group A (200mls, 0-1500) than Group B (387.5mls, 0-2500), p=0.03
2. Higher overall survival in Group A (3.6years, 0.08-7.8) vs Group B (2.61years, 0-9.6), p=0.0001
3. Smaller tumour size in Group A (30mm, 3-130), vs Group B (35mm, 5-150), p=0.05

1. Dukes C 3 year survival - 58% post vs 66% pre (p=0.023)
2. No statistically significant difference in Dukes B
3. Overall more patients prescribed chemo post MDT (31.3%) vs pre (13%) - p=0.0002.

1. Positive margins - 20% to 6.5% (p<0.03)
Balentine C et al (2011), USA
2. Disease free survival
3. Proportion of R0 resections
4. Recurrence rates
5. Number of lymph nodes found

2. Number lymph nodes - 9 to 17 (p<0.01)
3. Adjuvant therapy (rectal) - 53% to 74% (p<0.04)
4. Laparoscopic procedures - 0% to 34.7%
5. Unadjusted 3 year overall survival - 65% to 82% (p=0.03) - Hazard ratio 0.42 (0.19-0.92) p<0.03

Palmer G, Martling A et al (2010), Sweden
1. Pre-operative staging techniques / completeness
2. Type of surgery
3. R0 Resection
4. Residual tumour / recurrence

1. R0 resection - 52% in group 1, 43% in 2, 21% in 3 (p<0.001) (assessed in patients without metastases at time of surgery)
2. Percentage with no sign of pelvic tumour at end of follow-up - 57% in group 1, 36% in 2, 19% in 3 (p<0.001)

Segelman J, Singomklao T et al (2008), Sweden
1. Assessment by MDT
2. Overall survival

1. Patients not assessed by MDT had significantly higher risk of dying than those who were assessed by MDT (HR 2.52, CI 2.20-2.90, p<0.001)

Swellengrebel H, Peters E et al (2011), Netherlands
1. Staging methods
2. Treatments
3. Positive CRM

1. Overall CRM +ve rate not significantly different between both groups

Wilks J, Liebig C et al
1. Number of lymph nodes resected
2. % of patients

1. Number of lymph nodes resected - 9.3+/−0.9 (pre) to 16.1+/−1.1 (post)
2. % of patients undergoing R0 resection 78% pre and 95% post (p<0.05)
<table>
<thead>
<tr>
<th>Study</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2009), USA</td>
<td>Number of patients undergoing R0 resection</td>
</tr>
<tr>
<td></td>
<td>Number of patients receiving neoadjuvant therapy</td>
</tr>
</tbody>
</table>
2. R0 resection  
3. >12 lymph nodes  
4. Curative surgery  
5. Postoperative mortality <30 days  
6. Local recurrence  
7. Distant metastases |
| Ye Y, Shen Z et al (2012), China | 1. Mean number of lymph nodes resected 8.5+/-.9 (pre) to 13.7+/-.4 (post) (p<0.001), but no statistically significant difference between number of positive nodes  
2. Overall survival - patients in pre-MDT survived for significantly shorter time than those post-MDT (log-rank test, p=0.015).  
3. Rate of tumour recurrence in MDT group lower than pre-MDT group (log rank test, p<0.001)  
4. Mean time to recurrence: 11.0 months in pre-MDT group, 14.1 months in MDT group (p<0.01) |
2.6 Discussion

2.6.1 Summary of results

The aim of this review was not to question whether or not multidisciplinary team management in colorectal cancer care should continue, but simply to identify a body of evidence to validate its use. Furthermore I aimed to review the current literature on functioning and quality. This is the first review that systematically evaluates multidisciplinary care in colorectal cancer, and provides an overview of current practice, and a broad outline of the impact of multidisciplinary teams on management strategies and outcomes.

Multidisciplinary teams are now established in colorectal cancer care in the UK, with increasing acceptance globally. However it is clear that the direct impact of their introduction is difficult to measure, given the numerous changes in overall care for colorectal cancers over the same period. Similar results have been found in previous studies in obstetrics and cardiology.

The primary aim of this review was to identify the available literature on Colorectal Cancer. We identified 42 empirical studies on colorectal cancer MDTs. Given the widespread use in clinical practice, it is perhaps surprising that there are so few studies available. Within the UK, where MDTs are a mandatory part of cancer care, there were 13 studies, with only a few studies in recent years. Indeed, despite the recommendations made by Fleissig et al in 2006 (27), there have been few studies that have addressed the issues raised.

The secondary aims of the review were to identify studies in three distinct categories. We were able to classify the studies in this way, and separated them further into sub-themes, based on particular factors. In doing this, it was clear that there was wide variation in the studies, and differing methods of assessment. There were very few studies (those selected for meta-analysis) where similar measures were used. However, one could argue that the studies included in the meta-analysis are mismatched and therefore that the results not valid. However they do provide a broad picture of benefit from MDT introduction. Leading on from this, there was considerable variation in study methodology, and some of the studies report responses to surveys or questionnaires regarding current practice – and therefore may not be a true reflection of actual processes in place. However such studies are clearly identified, and do not form the basis for any of the meta-analysis.
What this review highlights is that MDTs in colorectal cancer care are still a “work in progress”, and there are considerable differences in how Colorectal cancer MDT meetings are run, and how individual clinicians and teams choose to assess their effectiveness.

There are variations in the frequency and organization of meetings, and significant issues in ensuring a full complement of core team members are present. Additionally, the increased volume of cases that come through meetings, with increased awareness, screening and diagnosis mean that the time pressures for clinicians and meetings are ever increasing. This raises the somewhat controversial suggestion that not all cases should be discussed at MDT, with the MDT lead reviewing cases beforehand, and highlighting complex cases for discussion, whilst making decisions on simpler cases with the aid of a pre-agreed protocol.

Cancer care clinicians do feel the benefit of attending meetings, describing them as valuable opportunities for learning and improving practice, whilst enhancing job satisfaction. Notably, however, there is little mention of the value of MDTs as teaching aids – this may be influenced by the limited time available.

### 2.6.2 Limitations

The results of both the systematic review and the meta-analysis are limited by the quality of the studies included. There is significant variation in the studies in terms of study type, methodology, numbers and types of participants. Furthermore, with the studies looking at improvements in practice, there was considerable variation in the measured outcomes. Additionally, all of these studies were before and after studies, with the majority being retrospective.

Whilst we have undertaken a meta-analysis of a subset of the studies, it must be noted that there was variation between these studies as well. We attempted to categorise these studies based on the similarities between the MDT groups and the pre-MDT groups, but found that there were significant differences in all these studies.

The lack of standardized studies presents a challenge, in an area where it is no longer feasible to conduct prospective, double blinded randomised clinical trials. However, it does highlight the significant task set in identifying assessment measures for colorectal cancer MDTs.
The types of studies presented and their study location and participants may introduce bias. There are a number of survey and questionnaire studies, which, by their nature, introduce bias from the participants. Additionally some of the studies have low response rates. The majority of studies emerge from large centres, where multidisciplinary team working may be established, and therefore the results may not reflect practice or results elsewhere.

2.7 Conclusion

This review highlights that despite the high prevalence of MDTs in colorectal cancer care, there are no standardised methods of measuring how well they work, or whether they improve outcome. Specific outcome measures have been quoted, however it is important to appreciate that these are often more specific measures of particular aspects of care within the process, or global measures of the overall cancer care pathway. With this in mind, the review highlights the difference between measuring how well the MDT works – something which is inherently measurable; to how MDTs impact on clinical outcomes – more difficult as there are numerous factors that may affect this – and outcomes therefore measure a series of events in the cancer care pathway.

The next chapter outlines an interview study with core clinical members of the colorectal multidisciplinary team, aimed at identifying specific measures that could be used to assess colorectal cancer multidisciplinary teams.
3.1 Chapter overview

Chapter 2 identified the key aspects of colorectal cancer multidisciplinary care. It highlighted that there are variations in structure and implementation of Colorectal Cancer MDTs and established that there are no specific measures of effectiveness and performance of a multidisciplinary team. It showed different clinical outcomes used to illustrate improvements in care following the introduction of multidisciplinary teams – however, again, there is variation in what measures are used.

In order to explore in detail some of the issues raised in Chapter 2, in this chapter I report the results of a qualitative interview study aimed at exploring the views of core members of the colorectal cancer MDT on assessment in colorectal cancer MDTs.

3.2 Introduction

Whilst the previous chapter has gone some way to identifying specific areas that could be utilised to evaluate how a colorectal cancer multidisciplinary teams works, the results show that there is huge variation in how this is done. Furthermore, the studies included are over a long period of time, meaning that some of the measures raised may no longer be suitable, particularly as the management of colorectal cancer is constantly evolving.

To obtain a current, diverse view of what assessment measures could be used, I conducted an interview study involving all the core clinical members of a colorectal cancer MDTM. I deliberately chose this qualitative approach as it offers detailed information from individual participants and is well-suited to explore complex matters with clinical experts, from which hypotheses can be generated and tested further (91).

3.3 Aims

The aims of the study were to:

1. Explore individuals' perceptions of their roles within colorectal cancer MDTMs, and particular individual and team characteristics they consider important to effective colorectal cancer MDTM
working;

2. Investigate awareness of any assessment tools, both for individuals as well as for the colorectal cancer MDTM as a whole;

3. Define what measures may be suitable for assessing colorectal cancer MDTMs, taking into account the characteristics mentioned above.

3.4 Methods

3.4.1 Protocol development

This was a qualitative, semi-structured interview study. In the first instance, I developed a semi-structured interview topic guide based upon the aims of this study and piloted it in iterative phases to ensure feasibility and adequate content. In addition to the findings from the Chapter 2, I utilised the expertise of our research team, who have published similar studies on surgical teams’ views on their communication problems, stressors in the operating theatre, and views of urology MDT members on their team working (92, 93) to refine the interview protocol. An overview of the final version (Figure 3.1) consisted of key questions which explored participants’ opinions on the following issues in colorectal cancer MDTs: Individual roles and responsibilities, evaluation of performance, current methods of assessment and options for further measures of assessment. A complete version of this is presented in Appendix 2.

3.4.2 Participants

I recruited 20 MDT members from three different hospitals (District General Hospital, tertiary referral and university teaching) using purposive sampling techniques. For each of these three settings, participants included all core clinical MDT members who make clinical decisions and have contact with patients. MDT members recruited were colorectal surgeons (a proportion of whom had acted as MDT chair), oncologists, radiologists, pathologists and clinical nurse specialists. As per standardized qualitative methodological techniques (91), recruitment of MDT members continued until ‘saturation’ of the themes that emerged from participants’ interviews was reached (i.e. no new themes were arising from successive interviews). Participation in the study was voluntary and informed consent was obtained. Anonymity was ensured throughout the study.
3.4.3 Procedure

I undertook individual interviews face to face at a pre-arranged venue between March and August 2012. All the interviews were audio-taped and transcribed verbatim. Transcripts were cross-checked with the original recordings to ensure accuracy and anonymised. A sample transcript is shown in Appendix 3.

3.4.4 Data analysis

I used emergent theme analysis for qualitative data that emerged from the study (91). Transcripts were cross-checked with the original recordings to ensure accuracy. I then read the transcripts multiple times to ensure full immersion in the data. I subsequently analysed each transcript for content to identify emergent themes. A random sample of interview transcripts (25%) was selected using a free online random number generator (www.random.org). These were then coded independently by another member of the research team, with qualitative methodology expertise (Wheelock) to ensure reliability of theme extraction. Finally, I reviewed all the emergent themes together with another researcher (Arora), who was blind to the theme extraction process, and key themes were tabulated.

I evaluated the level of coding agreement between researchers (i.e., reliability) both qualitatively and quantitatively. First, I discussed emergent themes with the other coder (Wheelock) and we obtained consensus on theme content to include (qualitative evaluation). Second, the overall number of themes identified from each interview by myself and the second coder (Wheelock) was submitted to a correlational analysis (Pearson’s r correlation coefficients) to ensure that similar numbers of themes were extracted (quantitative evaluation). Where quantitative analysis was appropriate, analyses were performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Significance was set at the 0.05 level.
**Figure 3.1: Interview protocol**

**INTRODUCTION**
- Establish ID of who I’m speaking to – name, job title
- Introduce myself
- Introduce project – State aim of the interview: To identify outcomes that can be used to evaluate Colorectal Cancer MDTs.
- Ask permission to tape interview, assure anonymity
- Confirm that the information provided will be treated confidentially

**RESPONSIBILITIES**

<table>
<thead>
<tr>
<th>2.1.1</th>
<th>1. Can you please describe your role in the Colorectal Cancer MDT?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ What strengths do you bring to the MDT</td>
</tr>
<tr>
<td></td>
<td>+ Do you think your role is limited to the meeting?</td>
</tr>
<tr>
<td></td>
<td>+ Do you have time to prepare for the MDT beforehand? How much time is typically required?</td>
</tr>
<tr>
<td></td>
<td>+ Is there anything that limits your ability to perform your role? If yes, what is it?</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>2.1.2</th>
<th>2. How do you know that you are performing your role satisfactorily?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ Do you ever self-evaluate your contribution?</td>
</tr>
<tr>
<td></td>
<td>+ How is your performance measured and reviewed?</td>
</tr>
<tr>
<td></td>
<td>+ Have you received any detailed feedback (verbal or written)?</td>
</tr>
<tr>
<td></td>
<td>+ Are such performance assessments / reviews regular / formal or ad hoc?</td>
</tr>
</tbody>
</table>

**CURRENT METHODS OF ASSESSING COLORECTAL CANCER MDTs**

<table>
<thead>
<tr>
<th>3.</th>
<th>Do you know of any tools or methods available to assess how well Colorectal Cancer MDTs work?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ Do these assess individual members?</td>
</tr>
<tr>
<td></td>
<td>+ Do these assess the overall process of the MDT?</td>
</tr>
<tr>
<td></td>
<td>+ Do these assess the outcomes from MDTs?</td>
</tr>
<tr>
<td></td>
<td>+ If there are such tools, how are they applied (ie how frequently, in what form?)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>1.</th>
<th>Do you think these tools are suitable?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ How could they be improved?</td>
</tr>
</tbody>
</table>

**YOUR OPINIONS**

<table>
<thead>
<tr>
<th>2.</th>
<th>What measures of performance would you recommend for assessing how well Colorectal Cancer MDTs work?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ What aspect of the MDT would these measures assess?</td>
</tr>
<tr>
<td></td>
<td>+ Rather than focusing on the process, are there measures that could assess the outcome?</td>
</tr>
<tr>
<td></td>
<td>+ If you were designing a tool, what outcome measures would you include? – Do you think these assess the MDT decision individually, or do they assess the whole process, from initial referral to final treatment?</td>
</tr>
</tbody>
</table>

**EXPERT OPINION**

<table>
<thead>
<tr>
<th>6.</th>
<th>Who would you consider to be experts who could provide a consensus on outcome measures for Colorectal Cancer MDTs?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ Do you think that these should be specialty specific, or that an overall consensus for all MDTs would be suitable?</td>
</tr>
<tr>
<td></td>
<td>+ Are there any particular organisations?</td>
</tr>
<tr>
<td></td>
<td>+ What do you think is the best way to collect this consensus – ie are there particular groups / conferences that could be contacted to facilitate this?</td>
</tr>
</tbody>
</table>

**RESPONSIBILITY**

<table>
<thead>
<tr>
<th>7.</th>
<th>In the event of any complaints / proceedings, who do you think is responsible for the recommendations of multidisciplinary team meetings?</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>+ Do individual clinicians have responsibility / liability, even if they have not been actively involved in the discussion?</td>
</tr>
<tr>
<td></td>
<td>+ What would you do in the event that you did not agree with the final recommendation given by the MDT?</td>
</tr>
</tbody>
</table>
3.5 Results
Twenty colorectal cancer MDT members participated in the study – all at expert Consultant level. There were six colorectal surgeons (S1-6), five radiologists (R1-5), three pathologists (P1-3), three oncologists (O1-3) and three colorectal clinical nurse specialists (CN1-3). Four of the colorectal surgeons had previous or current experience as the MDTM chair. All twenty interviews took place face-to-face at a pre-arranged venue at the participants’ place of work between March and August 2012, lasting a median 22 minutes (range 12 – 35 minutes).

3.5.1 Intercoder agreement (reliability)
Following blind coding, the second coder (Wheelock) and I discussed the content of themes identified in the interview transcript. Only one disagreement arose at this stage due to a misunderstanding on specific medical terminology by my colleague, a non-medical coder and once clarified, consensus was reached. Moreover, a correlation was carried out between the number of themes that we identified per interview: this was very good (r=0.73, p<0.01) indicating that both of us extracted similar number of themes. Taken together, these findings indicate reliability of theme extraction.

3.5.2 Roles, responsibilities and characteristics of MDTM members

3.5.2.1 Awareness of Roles
Of the 20 participants, 19 were able to clearly define their role within the MDTM. 19 individuals felt that their role extended beyond the domain of the meeting, whilst only one felt that their role was limited solely to the meeting. As one radiologist put it, “the meeting is just one facet of the colorectal multidisciplinary team…. so no, I don’t think the MDT stops when the meeting finishes” (R4).

Importantly, there was no consensus amongst the participants as to who assumed overall responsibility for the decisions made at the MDTM. Ten participants stated that it was individual clinicians. Six participants stated that it was the team’s responsibility, and the remainder stating that it was a combination of the two. The group that felt it was individual clinician’s responsibility included all of the oncologists and five out of the six surgeons – suggesting that those clinicians that come into direct contact with patients had a greater sense of ownership. One oncologist stated that “it’s ultimately the decision of the Consultant that’s looking after the patient, and the MDT is a
guide” (O2) – a view echoed by other clinicians who felt that the ultimate decision and responsibility lay with the treating clinician – taking into account the discussion from the MDT. The opposing group, which included all three pathologists, felt that once patients were discussed at meetings., the responsibility was collective – a view emphasized by a pathologist: “I think it’s a collective responsibility at the end because of all the different elements are brought together and then a final decision is taken”(P3).

3.5.2.2 Barriers to performing roles

The most common barriers quoted by the participants to adequately performing their role were insufficient time and inadequate information about the patient. Only half of the individuals felt that they always had sufficient preparation time before the meeting. Interestingly, eight of the ten participants who stated lack of sufficient time, did not feel that dedicated preparation time was necessary prior to the meeting. Although there was no apparent difference between specialties regarding these barriers, it was interesting to note that all those individuals who felt that inadequate patient information was an issue were from the District General hospital. As one radiologist put it, “getting a feel for the actual clinical background, how does the patient present, what other relevant clinical laboratory findings were there, is important obviously in the whole process of reaching an opinion and a conclusion” (R3).

3.5.2.3 Important characteristics of the team and its members

Characteristics identified by participants were split into two groups: those specific to individuals, and those related to the team.

Key characteristics that were highlighted for individuals were individual specialist knowledge / skills (11 participants), experience (nine participants), and ability and readiness to offer different opinions (three participants). Surprisingly, only two participants mentioned the importance of acting as the patient’s advocate, although both highlighted the importance of this role, as highlighted by a clinical nurse specialist: "I get an idea of other psychosocial issues with the patient, and a holistic view of the patient, their social support, things about them that may be affected by treatment decisions that we make...so it’s important for the other members of the team to actually have access to that information, and what the patients are worried about, and things that may have implications on treatment decisions” (CN1).
Characteristics related to the team were focused around the team’s ability to include all parties in the discussion (six participants), establishing and maintaining good relationships with colleagues and educating trainees: “inform the trainees or the juniors that are at the MDT because I think the MDT if it works well can be a very educational meeting and it’s crucial in understanding the complexities regarding patients, and I think hopefully offer knowledge and experience of oncology and managing colorectal patients.” (O2).

The MDTM chair was identified as a key individual within the team, and in addition to the above characteristics, nine individuals highlighted the importance of their effectiveness at controlling the discussion – “it would be a poor chairman who perhaps interferes with the flow of discussion too early... Important to recognize when the discussion has run its natural course” (S1).

### 3.5.3 Current methods of assessment of the Colorectal Cancer MDTM

#### 3.5.3.1 Self-assessment

Six of the participants in the study regularly carried out self-assessments, whilst a further five did so occasionally (radiologists did this most frequently). This self-assessment was undertaken in various forms: audit of MRI staging versus pathological staging adherence to guidelines were the most common.

#### 3.5.3.2 Formal assessment methods

None of the individuals interviewed were able to identify any formal methods of assessment of the colorectal cancer MDT or the MDTM. Five individuals went on to discuss formal assessments of performance that they undertook as part of their wider clinical roles, however, they all acknowledged that none of these methods were specific to MDTMs. These included patient satisfaction surveys and 360 degree / multi-source feedback tools. When the subject of ‘peer review’ in MDTs was raised in the interviews (i.e., the annual mandatory procedure of assessing how MDTs are faring across all cancer types in England), this was not seen as an assessment method, but as a quality improvement tool. Not all clinicians interviewed had been part of a peer review process.
3.5.3.3 Informal assessment methods

Informal methods identified included verbal feedback from colleagues; approximately half of the individuals interviewed received informal feedback from colleagues, and felt it was useful: "it would all be completely informal, people coming down and telling me they didn’t like this or they didn’t like that" (R1). Three of the participants also stated that they actively asked their colleagues for informal feedback. Non-verbal feedback was less obvious, but two participants felt that whether or not others listened to them attentively during the meeting was indicative of their performance.

3.5.4 Proposed methods of assessment of the Colorectal Cancer MDTM

Participants were asked to identify what methods they thought would be useful in assessing colorectal cancer MDTMs. They identified two broad categories of elements which could form the basis of assessing MDTM performance: how the MDTM worked (i.e., process measures; Table 3.1) and clinical outcomes associated with the decisions made at the MDTM (i.e., outcome measures; Table 3.2).

Overall, there was awareness that whilst no specific assessment measures were used in the MDTMs regular practice, there were specific measures that existed elsewhere, and could be used to good effect. As an oncologist participant stated, “I think it would be good to evaluate whether there could have been stronger oncological input, whether there could have been stronger histological input; I think that would be useful to be able to identify weak areas that you can develop” (O3). In discussing the different process measures, participants were aware that a lot of this information was likely to be readily available (including, for example, attendance, length of meeting), and specific assessment tools would need to combine these data and standardize them as a first step. Interestingly, process measures like those mentioned above were more readily reported by participants who did not have direct contact with patients – mainly radiologists and pathologists.
Table 3.1: Process measures for application to Colorectal MDTMs

<table>
<thead>
<tr>
<th>Measure</th>
<th>N of participants mentioning</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attendance and contributions, particularly core members</td>
<td>7</td>
<td>O2: “Making sure you have all the core members for the very least the minimum amount of MDTs and ideally much closer to 100% of MDTs”</td>
</tr>
<tr>
<td>Length of meeting</td>
<td>4</td>
<td>P1: “Just the length of the meeting – I mean, that’s a basic one”</td>
</tr>
<tr>
<td>Creation and completion of standardised proforma</td>
<td>4</td>
<td>R1: “Probably ought to report on a standardized proforma ..(so you can ask).. Are you doing it?.. Are you doing it accurately?”</td>
</tr>
<tr>
<td>No of times a case is (re)discussed</td>
<td>3</td>
<td>R2: “The ones that keep coming back, maybe five or six times. Why?”</td>
</tr>
<tr>
<td>Ability of chair to co-ordinate meeting</td>
<td>3</td>
<td>S1: “I think it’s important to recognise when the discussion has run its natural course and so that we can move on in an expeditious manner”</td>
</tr>
<tr>
<td>Peer review</td>
<td>2</td>
<td>R4: Informally, “you rely on your peers to tell you you’re doing a good job or you’re doing a bad job” AND formally, “our formal peer review process, and that covers a lot of the effectiveness of the MDT.”</td>
</tr>
<tr>
<td>Recording time spent discussing cases</td>
<td>2</td>
<td>R2: “Record how much time we spend discussing certain cases, and having a feel whether, as individuals, we feel that was appropriate for that case, if there are any cases we feel, at the end of a session, were rushed through because of time issues”</td>
</tr>
</tbody>
</table>
Table 3.2: Outcomes measures for application to Colorectal MDTMs

<table>
<thead>
<tr>
<th>Measure</th>
<th>N of participants mentioning</th>
<th>Illustrative quote</th>
</tr>
</thead>
<tbody>
<tr>
<td>Correlating radiological staging and pathology</td>
<td>5</td>
<td>R3: “Looking at pathological staging, and comparing this with the pre-treatment radiological staging gives you two figures you can easily compare”</td>
</tr>
<tr>
<td>Long term survival rates</td>
<td>4</td>
<td>We can measure surgical outcomes - …, survival,…”</td>
</tr>
<tr>
<td>CRM positivity</td>
<td>4</td>
<td>We have these indirect measures – CRM positivity…”</td>
</tr>
<tr>
<td>30 day mortality</td>
<td>3</td>
<td>We have these indirect measures – …, 30 day mortality..”</td>
</tr>
<tr>
<td>Recurrence</td>
<td>3</td>
<td>We can measure surgical outcomes- cancer recurrence,….”</td>
</tr>
<tr>
<td>Decision reached or not, and clearly documented</td>
<td>3</td>
<td>You’ve got to look at decision making and whether a decision is formulated, and that’s correctly recorded”</td>
</tr>
<tr>
<td>Percentage of decisions not carried through</td>
<td>2</td>
<td>: “Looking at percentage of decisions that aren’t carried through, and looking at what reason they’re not necessarily carried through”</td>
</tr>
</tbody>
</table>
Conversely, surgeons and oncologists spoke more readily about outcome measures. However, the suitability of these measures was questioned by the same participants, as they realized that the majority of these measures were not specific to the MDTM but covered wider aspects of colorectal cancer care. These measures included evaluating the post-operative resection margins and comparing these with pre-operative staging, to identify any discrepancies. Three participants felt that it would be appropriate and useful to measure the specific processes that individual team members carried out – an example being the lymph node yield as a means of assessing how thorough the pathologist was in examining the specimen. How different MDTs managed specific case vignettes was also a popular idea on assessment, particularly from surgeons - “a theoretical example that you can give out to various different groups and just see how they’re behaving”(S6). One radiologist (R2) also mentioned global targets, such as the proportion of cancer patients who were treated within the required time-frame, and argued that failure to progress smoothly through the MDTM would result in delays and inability to achieve set targets. Therefore such measures could measure the efficiency of the MDTM process.

3.6 Discussion

3.6.1 Summary of results

The first aim was to explore individuals’ perceptions of their roles within colorectal cancer MDTMs, and characteristics they felt were important. This study established that individuals were clear about their roles, and were able to identify key characteristics that they felt were important for all team members. Particular importance was placed by all team members on the MDT chair – they were thought to be critical in ensuring the smooth, efficient running of MDT meetings. Additionally, the medical members of the team valued the role of the CNS – particularly due to their significant role in approaching the patient in a holistic manner. The role of the MDT co-ordinator, whilst understood, was not mentioned frequently, as much of their work was done between meetings, and there may be a degree of under-appreciation of their importance.

The second aim was to investigate cancer experts’ awareness of any assessment tools that could be used for colorectal cancer MDTs. It was clear that there are currently no methods specific to the colorectal cancer MDT that individuals were able to identify. Finally, therefore, we set out to define what performance measures may be suitable for assessing colorectal cancer MDTMs from the
clinicians that made up the teams. This aim produced a number of different points, which we then organized into a structured set of suggested measurements – including measures of MDTM processes and also outcomes.

Previous studies on MDTs in other specialties have also highlighted the absence of specific tools to assess how MDTMs work. Various methods have been used, and include implementation of MDTM decisions (94), evaluation of resection margins (57, 73, 95) and overall survival (71, 77). Recent work in urological cancer MDTMs has seen the development of an observational tool for the assessment of decision making in meeting (96). In their review, Fleissig et al (27) highlighted the variability in cancer services in the UK, and in highlighting barriers to successful implementation of MDTMs, they have identified the areas where assessment tools should focus. It is these similar areas that I have identified in this study.

One additional area of interest that was raised in these interviews was that of patient ownership. It was interesting to note that the members of the MDT that had direct clinical contact with patients felt personally responsible for the care of these patients, whilst those that did not felt it was a team responsibility. Sidhom and colleagues (111) discuss the potential legal aspects of this, but there are no clear-cut legal cases or guidelines to refer to. At a time where medico legal cases are on the increase, it is perhaps necessary to clarify the position of patient responsibility for MDTs.

3.6.2 Limitations

This study does not come without limitations. Firstly, the views of the participants involved may not represent the views of colorectal cancer MDT members elsewhere. However, I have interviewed a breadth of expert clinicians, with the sample taken from three different hospitals; a district general hospital, a tertiary referral hospital, and a university teaching hospital. Secondly, with interviews, important issues may be missed in the data collection phase. To avoid this, I ensured all interviews were recorded and transcribed, and proceeded to review all transcripts to ensure completeness. Furthermore, extraction of themes may be subjective and open to bias – therefore, I had a subset of the interviews analysed by a second reviewer which showed good agreement.
3.7 Conclusion

This study has provided a detailed analysis of individual colorectal cancer MDTM members’ views on assessment of their MDTMs. My findings suggest that whilst individuals are clear of their roles, they agree that there are very few mechanisms to assess how they are performing their roles. They have gone on to identify a series of measures that may be used for assessment, which I will look at in subsequent chapters. The next chapter takes a detailed look at a single colorectal cancer MDT, and provides information about the costs of running a multidisciplinary team.
4.1 Chapter overview
While previous chapters identified key areas useful for the assessment of colorectal cancer multidisciplinary teams, with information from previous studies as well as practicing core clinical members of the multidisciplinary team. Before going into more detail about assessment methods, this chapter looks at the overall costs of running a multidisciplinary team at a single hospital trust, made up of two district general hospitals.

4.2 Introduction
Multidisciplinary teams have become an integral part of the overall cancer care pathway. Whilst there is evidence of that, and they have improved clinical outcomes as outlined in Chapter 2, there is little evidence to show at what cost this improvement has come.

Colorectal cancer MDTs require large amounts of long term investment in facilities, infrastructure, as well as significant organisation and management in the short to medium term. For the meeting to run effectively, it is imperative that the appropriate core members are present, relevant patient details are readily available and that those attending the meeting have had ample opportunity to prepare for the cases to be discussed (97). All the above require significant investment of time and resources, both of which cost money. Estimates suggest that the National Health Service spends nearly £100 million annually on cancer MDT related services, though there is limited data available to provide a more reliable estimate (98).

I have therefore conducted an analysis of the costs associated with running a colorectal cancer multidisciplinary team meeting, and report the findings of this in the current chapter.

4.3 Aims
The specific objectives of this study are:
1. Identify the personnel and resources that were essential for the running of a colorectal cancer multidisciplinary team;
2. Quantify the time spent preparing for and attending MDT meetings;
3. Calculate the costs associated with running a colorectal cancer MDT.

4.4 Methods
I received expert guidance from a Health Economist (Hauck) in survey development, relevant financial information, derivation of specific measures and data analysis.

4.4.1 Survey development
In order to collect information regarding time spent on preparing for and attending the colorectal cancer MDT, I developed a structured survey based upon one of the study aims. This survey was piloted in iterative phases and the final version (Appendix 4) consisted of specific questions regarding the amount of time individuals spent carrying out MDT related activities. A hard copy of this survey was distributed to all the core members of the relevant MDTs.

4.4.2 Participants
Surveys were given to all the core members of two multidisciplinary teams from one NHS Trust. The Trust is split between two hospital sites in North London, and has an overall catchment area of approximately half a million people. At the time of the study, the Trust provided colorectal cancer services at both sites, with a fully functioning MDT at each site. The MDTs each met on a weekly basis. I gathered information regarding mandatory core member attendance from the Lead Clinicians for Colorectal Cancer at either site, and verified this with the MDT co-ordinator (single co-ordinator for both sites). Data were collected from all core members of the two MDTs in early 2013, and participants asked to base their answers on their experiences in the year 2012.

4.4.3 Procedure
I conducted this study in multiple phases. In Phase 1, I compiled a complete list of all participants, and then hand delivered surveys to them. Once completed, I collected these surveys personally. Verbal consent was obtained, and anonymity ensured. I tabulated the collected data and combined this with additional data regarding staff salaries received from the Trust’s Finance Department. In Phase 2, I compiled derived data on the running costs and overhead costs from the Finance Department. Phase 3 combined all this data together with observed data at one MDT over a period of 24 meetings as well as data on cancer patient numbers, and calculated estimates for annual MDT
costs, costs per meeting, costs per cancer patient and costs per patient discussion.

Utilising the observational data from 24 meetings, we calculated the mean length of time spent at a weekly meeting. This data was collected in real time, and is described in more detail in Chapters 6 and 7. For the purpose of this study, only the overall length of the meeting was utilised. We added on the amount of time, as per the results of the survey, that core members spent preparing for the MDT, completing work after the MDT, and attending training related to MDTs. Using these mean figures we calculated the estimated time spent by core members on MDTs over the year.

I collated a list of potential overhead costs, which included the following:

1. Cost of running the room – including utilities;
2. Equipment costs, including initial installation costs and ongoing servicing costs for: videoconferencing equipment, a microscope, a desktop computer with access to the hospitals Electronic Patient Record (EPR) and Picture Archiving and Communication System (PACS) and a projector;

In order to quantify the costs of these items, I reviewed the previous year’s financial records. However, it was not possible to calculate an exact figure for the above items, and following discussion with the Finance departments at the Trust, I used a figure of 15% of direct costs. We arrived at this figure jointly based on previous years’ accounts. Previous calculations on the Colorectal Cancer service had used this same figure. Whilst similar data was lacking, a 2013 study by Chinai and colleagues used a different method and used a figure of 11.2% to represent overhead costs. Due to the lack of further available data on this subject, it was not possible to corroborate this value with pre-existing studies, and in the current study a figure of 15% was therefore utilised.

### 4.4.4 Data analysis

All the quantitative information was collated in a Microsoft Excel database, which was then used for further data analysis.
4.5 Results

4.5.1 Members of the MDT

The Colorectal Cancer MDT that I based my calculations on is made up of the following core members: Colorectal Surgeon, Oncologist, Radiologist, Histopathologist, Clinical Nurse Specialist and MDT co-ordinator. Figure 4.2 below shows the total number of these core member groups present at the Trust (across both sites). I collected completed surveys for all but one of the core members, who chose not to participate (n=19).

Figure 4.2: Total number of core MDT members

NB: There was overlap between the Pathologists, one of whom covered for both sites, and the MDT co-ordinator, who covered both sites (Total number of Pathologists = 3, MDT Co-ordinator = 1)

4.5.2 Total time spent on MDTs

The results of overall time spent by core members carrying out MDT related activities is summarised in Table 4.1 on the next page

4.5.3 Direct costs of the MDT

These were calculated using the overall times in the previous section, and the average salaries of the members involved. The results of this are also shown in Table 4.1 on the next page.
Table 4.1: Staff costs per MDT

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Time spent at MDT</th>
<th>Preparation time - pre and post</th>
<th>Training time</th>
<th>Total time per individual</th>
<th>Mean number of individuals per meeting</th>
<th>Total time per specialty (in WTE)</th>
<th>Weekly average cost of WTE (£)</th>
<th>Cost per MDT (£)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorectal surgeon</td>
<td>63</td>
<td>120</td>
<td>17.39</td>
<td>200.39</td>
<td>2.67</td>
<td>535.04</td>
<td>0.2229</td>
<td>2367</td>
</tr>
<tr>
<td>Radiologist</td>
<td>63</td>
<td>120</td>
<td>30.43</td>
<td>213.43</td>
<td>2.5</td>
<td>533.58</td>
<td>0.2223</td>
<td>2306</td>
</tr>
<tr>
<td>Pathologist</td>
<td>63</td>
<td>120</td>
<td>13.04</td>
<td>196.04</td>
<td>1.04</td>
<td>203.88</td>
<td>0.0849</td>
<td>2219</td>
</tr>
<tr>
<td>Oncologist</td>
<td>63</td>
<td>60</td>
<td>21.74</td>
<td>144.74</td>
<td>0.75</td>
<td>108.56</td>
<td>0.0452</td>
<td>2409</td>
</tr>
<tr>
<td>Clinical Nurse Specialist</td>
<td>63</td>
<td>420</td>
<td>21.74</td>
<td>504.74</td>
<td>0.83</td>
<td>418.93</td>
<td>0.1746</td>
<td>1072</td>
</tr>
<tr>
<td>MDT co-ordinator</td>
<td>63</td>
<td>240</td>
<td>13.04</td>
<td>316.04</td>
<td>1</td>
<td>316.04</td>
<td>0.1317</td>
<td>495</td>
</tr>
</tbody>
</table>

Total: £1590.13

1. Data for time spent at MDT and mean number of individuals per meeting taken from observational data.
2. Data from results of survey
3. WTE = Whole Time Equivalent i.e. if your are full time and your hours are 40 and the full time hours for your grade of staff are also 40, then your WTE is 40/40 = 1.00. This is a standard measure throughout the NHS.
4.5.4 Additional costs
As described in the previous section, I used a figure of 15% of direct costs to calculate additional costs. I therefore calculated average weekly additional costs as follows:

£1590.14 * 0.15 = £238.52

4.5.5 Total costs
The average weekly cost of the MDT was calculated as follows:

£1590.14 + £238.52 = £1828.66

Based on this figure, I calculated the average annual cost of the MDT using the number of meetings during the year (50):

£1828.66 * 50 = £91,433

4.5.6 Average costs per case discussion
Between 1st January 2012 and 31st December 2012, 50 colorectal cancer multidisciplinary team meetings were held. A total of 897 cases were discussed at these meetings. The average MDT cost of each patient case discussion was calculated as follows:

£ 91,433 / 897 = £101.93

4.5.7 Average costs per cancer patient
Between 1st January 2012 and 31st December 2012, a total of 86 new cancer cases were diagnosed. The average MDT cost of each cancer patient was calculated as follows:

£91,433 / 86 = £1,063.17
4.6 Discussion

4.6.1 Summary of findings

This study set out to quantify the actual costs associated with running a multidisciplinary team. Furthermore, I have attempted to calculate the average cost per patient case discussion and per cancer patient. The results of this study show that there is a large financial investment similar to that quoted by the National Institute for Clinical Excellence (99, 100) for various cancers. However, it must be noted that these quoted reference costs do not take into account the costs of additional preparation time required by specialists. They do include costs for non-core members of the MDT, as well as junior medical staff. These two factors may explain why we have reached similar figures as they are likely to balance each other.

These results provide the minimal cost for running of a colorectal cancer MDT over one year. In reality, the costs may be higher, as meetings are often attended by non-core members as well as junior medical staff (I have not included any additional staff members in my analysis).

By defining the cost per patient case discussion, this study highlights that there is an almost ten-fold increase in cost when comparing with cost per cancer patient. Whilst this is partly due to the fact that there may be some cases discussed that do not turn out to be cancers, as well as the fact that patient case discussions are carried out at various stages in management (including recurrent cases and surveillance cases, which would not be reflected in the number of new cancer patients), this figure suggests that there may be instances where patients are discussed more than once, possibly due to a lack of a definitive decision. Putting an individual cost to each discussion perhaps magnifies the importance of avoiding so called unnecessary repeat discussions, and emphasises the need for definitive, first time decision-making. This relies heavily on the presence of the appropriate team members as well as comprehensive information regarding the patient and any investigations that they may have already had.

The costs per patient case discussion calculated in this study reflect the overall cost of a patient’s care and treatment planning by a group of experts from different specialist backgrounds. Chapter 2 has provided evidence for improvements in clinical outcomes as a result of the introduction of such specialist teams, and this chapter provides data on the costs of this. When compared with costs for
alternatives (101), such as multiple individual outpatients appointments with different specialties, these figures are favourable, or at best, equivalent.

### 4.6.2 Limitations

These findings are subject to certain limitations. Firstly, these relate to calculation of staff costs. I utilised a staff average for consultants involved, and used average numbers of core members present at the meeting. This may have altered the results slightly as different consultants had different salaries based on their seniority. However, it was not feasible to acquire individual data on salaries for all the individuals, and so I followed this method. Furthermore, to be as specific as possible, I used the average salary of the specific members from each specialty group, rather than use a national or trust average. I only included those staff members that were designated core members of the MDT. This is likely to have led to an underestimation of cost as there are additional staff members who attend these meetings. However, I chose to only include the core members as these were considered essential to the running of the meeting.

Another source of possible error is in the preparation and training times, which were self-reported retrospectively. I tried to limit the error from this by asking all the members to quantify their preparation and training times, and then calculating averages for each specialty group.

The estimation of indirect costs as 15% of direct costs meant that I did not have an exact figure for these costs. However, it was not feasible to accurately collect this data, and based on previous years’ experiences this figure was utilised. This was a similar figure to that used by the trust in calculating their ongoing costs and reference costs and therefore is likely to be as accurate as possible.

Whilst a more detailed analysis is possible, with more precise figures, the objective was to gain an idea of the costs associated, so as to highlight the financial implications of multidisciplinary teams. A more detailed analysis was beyond the scope of this thesis, and would have diverted attention from the primary aims of the thesis.

Finally, it is important to note that the results of this study are based on a single MDT, at a single hospital. NBOCAP figures from 2012/13 confirm that the number of cancer patients at this hospital lies close to the national average (102). With regards to the MDT members, anecdotal reports suggest that the composition of this MDT is largely representative of a standard District General Hospital Colorectal Cancer MDT. Despite this, it is important to bear in
mind that the results of this study may not be easily transferable to other hospitals, and any similar studies may have to be altered for local practice. This may affect the overall costings calculated.

4.7 Conclusion

With increasingly stringent financial measures present in the National Health Service, it is pertinent to ask whether Multidisciplinary teams are worth the expense. As previously described, these teams ‘snuck in under the radar’ with little evidence for their cost effectiveness.

Chapter 2 provided evidence of improvement in clinical outcomes following the introduction of multidisciplinary teams in colorectal cancer, there is limited data on the cost of this. This study provides detailed data on costs of MDTs, and shows that there is a significant cost for each cancer patient as well as each patient case discussion. We should bear these costs in mind when discussing patients repeatedly.

The financial cost of these meetings, highlighted in this chapter, identifies the need to ensure that meetings are run as efficiently as possible, and with a focus on quality improvement.
Section Two Summary

The results of the previous chapters provide compelling reasons for the introduction of mechanisms to evaluate colorectal cancer MDTs. There is evidence of variations in practice, both within the United Kingdom, as well as globally. In addition to this, these meetings come at a significant cost, and whilst there is sufficient evidence for their ongoing implementation, the increasingly stringent financial measures present in the National Health Service, it is pertinent to ensure that these teams are run efficiently. The first step in these processes is the introduction of a robust assessment tool, which takes into account the different elements highlighted in the previous chapters. There are certain areas that are evaluated by the Peer Review Process but these largely relate to the running and implementation of the colorectal cancer MDT meeting.

I have already identified a series of potential measures, which can be utilised in the assessment of Colorectal Cancer MDTs. These can be split into process and outcome measures, and Figure 4.3 below proposes a model for viewing colorectal cancer MDTs, based upon the ‘Systems Approach’, popular in patient safety research (103). The Systems Approach proposes an Input-Process-Output model to the colorectal MDT and recognizes a range of inputs to the MDT, which can impact on the effectiveness of the case discussion, which in turn determines the MDT outputs. Taken together, these factors can affect colorectal cancer patient outcomes. Whilst some of the performance measures identified in the previous chapters echo those in non-colorectal studies (94, 104-106) there are particular aspects of the MDT that are unique to colorectal cancer – which are reflected in the contents of the model. It is clear that there is no single measure of how well the colorectal cancer MDT works. What I propose, based on the contents of the previous chapters, is that a number of different aspects can be easily measured in the short term (particularly process measures, including team working), and that longer term patient outcomes, many of which are already collected routinely, can be used as a measure of the overall patients’ cancer pathway, of which the MDT forms an integral part.
Figure 4.3: The "Systems Approach" to Colorectal Cancer MDTs

**Inputs**
- Information
  1. Patient
  2. Radiology
  3. Pathology
- Equipment
  1. Radiology
  2. Pathology
  3. Telecommunications
- Individual experts
  1. Attendance of core team

**Processes**
- Individual
  1. Specialty specific performance metrics
  2. Individual team member contributions
- Team
  1. Teamwork
  2. Leadership
- Meeting
  1. Length of meeting
  2. Number of cases
  3. Distractions at meetings
- Organisational
  1. Time targets

**Outputs**
- Clinical Outcomes
  1. Decision made
  2. Decision documented
  3. Decision implemented
  4. Consensus

**Clinical Outcomes**
1. Short term – Resection Margins
2. Medium term – 30 day mortality
3. Long term – Overall survival
With this in mind, further chapters will develop an assessment tool to evaluate the functioning of the Colorectal Cancer multidisciplinary team. From the model, I have specifically chosen those areas where there is limited or no previous work. These include an assessment of how decisions are made in meetings – looking at the availability of relevant clinical information as well as the specific elements of team behaviours – individual members’ contributions to patient case discussions. Additionally I have chosen to incorporate information on whether or not clinical decisions are made and implemented. I have not chosen to use clinical outcomes at this stage, as they reflect the longer term, and are more a measure of the overall cancer care pathway.

Within other healthcare settings, tools have been developed for assessing the performance of teams in a quantitative manner (107-109). Much of this work has borrowed heavily from experiences in other fields such as aviation. These studies suggest that team-performance can be measured using a reliable and validated approach. Moreover, they have highlighted the importance of communication, decision-making and leadership to both patient and clinical outcomes. Within cancer care, there were no such tools to assess and develop MDTs until the recent development of a tool to assess urology MDTs (termed ‘Multidisciplinary Team Metric for Observation of Decision-Making’, MDT-MODe) (96, 110). No such work has been carried out in colorectal cancer settings, and the aim of the next chapters is to develop and validate such a tool.
5.1 Chapter overview

The previous section reviewed the current evidence on colorectal cancer MDTs and gathered the views of current clinical members of the colorectal cancer MDT on proposed assessments. In addition to highlighting the improvements in outcomes associated with MDTs, it showed that there is a cost associated with these, and that the aim of future work should be to maximize efficiency and improve service quality.

In this chapter I describe the development and validation of an objective observational tool used to evaluate teamwork and team performance in Colorectal Cancer MDTs.

5.2 Introduction

Whilst the importance of multidisciplinary care in colorectal cancer is clear, the optimal manner in which these teams should run is unclear. In order to run efficiently, they are reliant on the presence of all team members, the availability of patient clinical information and investigation results. In addition, the opportunity to engage in an open management discussion involving all the team members is crucial to their functioning. Studies suggest however, that such constructive discussions do not always take place, leading to a decision not being reached and subsequently the case postponed for a further meeting. This is costly, in terms of the time required by members to attend the meeting, and can lead to delays in care. Reasons underlying an expert teams’ failure to reach consensus regarding further management are complex, but contributory factors may include poor team cohesion (111), sub-optimal case information (112) or a misunderstanding of patient views and expectations (94).

Moreover, in an area where there is such potential variation in practice, there are no standardized models for operation or assessment of MDT meetings. This is despite the presence of national guidelines advocating their use around the world. In the United Kingdom, where multidisciplinary
team-working in cancer care is mandatory, the only formal process of evaluation of multidisciplinary services is the National Cancer Peer Review program (26) – however this focuses mainly on the organisational aspects of cancer care delivery, with limited emphasis on team-working and information presentation within multidisciplinary team meetings.

Within other healthcare settings, tools have been developed for assessing the performance of teams in a quantitative manner (92, 107). These studies suggest that team-performance can be measured using a reliable and validated approach. Moreover, they have highlighted the importance of communication, decision-making and leadership to both patient and clinical outcomes. Within cancer care, there were no such tools to assess and develop MDTs until the recent development of a tool to assess urology MDTs (termed ‘Multidisciplinary Team Metric for Observation of Decision-Making’, MDT-MODe) (96). No such work has been carried out in colorectal cancer settings, despite the fact that it is the 4th most common cause of cancer mortality globally, and in many healthcare settings its management is guided by a MDT.

5.3 Aims

The aim of this current study was to develop a reliable, valid and feasible tool to assess team performance in colorectal cancer multidisciplinary team meetings. Specific objectives were to:

1. construct a robust tool for the systematic assessment of colorectal cancer MDT performance;
2. define which aspects of MDT performance can be validly and reliably assessed by observers;
3. assess the usability and feasibility of the tool.

5.4 Methods

5.4.1 Phase 1 – Tool development and validation

The tool developed in this study was based on the recently developed MDT-MODe tool, designed for use in the assessment of urology MDT meetings. The specific content of the new tool was informed by literature review (Chapter 2) and the opinion of end-users from 3 UK hospitals on the important characteristics of colorectal cancer MDT performance and proposed methods of assessment (Chapter 3).
5.4.1.1 Content Validation

The colorectal MDT-MD e tool based on the original urology framework and developed from the review and interviews above, together with a validation questionnaire (see Appendix 4), was presented to 27 experts in colorectal cancer – all at Consultant or senior nurse specialist level. There were 8 colorectal surgeons, 7 radiologists, 4 pathologists, 3 oncologists, 3 colorectal cancer nurse specialists and 2 MDT coordinators. Each person was asked to rate the importance of the various elements of MDT performance contained within the tool and descriptors on a 1-5 Likert scale (with 5 = very important), as well as to provide free text comments.

The results of the three steps described above were used to develop a preliminary version of Colorectal MDT-MD e for use in Phase 2 (Figure 5.1 below). This tool provided performance indicators of two key areas of a colorectal cancer MDT meeting:

1. The quality of the information presented – including case history, patient co-morbidity, psychosocial issues, patient views, radiological information and pathological information. Each of these factors is rated on a scale of 1 to 5 in real-time by an observer with 1 indicating poor quality and 5 indicating high quality. A Global Information score was also calculated – this was the sum of the each individual factor – totalling 30. Finally a percentage Global Information score was calculated.

2. The quality of contributions to team decision-making of the participants within the meeting: the surgeons, oncologists, radiologists, pathologists, colorectal cancer nurse specialists and meeting coordinators. Each of these specialists’ contribution is rated on a scale of 1 – 5 in real-time by an observer with 1 indicating no contribution and 5 indicating articulate and precise contribution aiding patient management. A Global Contribution score was also calculated – this was the sum of the each individual factor – totalling 35. Finally a percentage Global Contribution score was calculated.
**Figure 5.1: Colorectal MDT MODe (CMDT-MODe)**

<table>
<thead>
<tr>
<th>History</th>
<th>6</th>
<th>Fluent, comprehensive case history</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Good case history</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Partial case history</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Short / inadequate case history</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No patient case history</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Radiology</th>
<th>5</th>
<th>All relevant radiological images (CT +/- MRI) with complete information on staging and margins presented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>All radiological images presented with partial information on margins and staging</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Some radiological images presented with partial information on margins and staging</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Some radiological images with no information on margins and staging</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No provision of radiological information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Pathology</th>
<th>5</th>
<th>All relevant pathological images (micro +/- macroscopic) with complete information on staging and margins presented</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>All pathological images with partial information on margins and staging</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Some pathological images, with partial information on margins and staging</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Some pathological images with no information on margins and staging</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No provision of histopathological information</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>History</th>
<th>6</th>
<th>Fluent, comprehensive case history</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Good case history</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Partial case history</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Short / inadequate case history</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No patient case history</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Psycho-Social</th>
<th>5</th>
<th>Comprehensive first-hand knowledge of patient's personal circumstances, social &amp; psychological issues</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Good second-hand knowledge of personal circumstances, social &amp; psychological issues (i.e. from letter)</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Vague knowledge of personal circumstances, social &amp; psychological issues</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Limited knowledge of personal circumstances, social &amp; psychological issues</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No knowledge of personal circumstances, social &amp; psychological issues</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Co-morbidity</th>
<th>5</th>
<th>Comprehensive first-hand knowledge of past medical &amp; surgical history and performance status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Good knowledge of past medical history or performance status</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Vague knowledge of past medical history or performance status</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Limited knowledge of past medical history or performance status</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No knowledge of past medical history or performance status</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Patients views</th>
<th>5</th>
<th>Comprehensive first-hand knowledge of patient's wishes or opinions regarding treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Good knowledge of patients wishes or opinions regarding treatment</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Vague second-hand knowledge of patient's wishes or opinions regarding treatment</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Limited knowledge of patient's wishes or opinions regarding treatment</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No knowledge of patient's wishes or opinions regarding treatment +/- assumptions made</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chair</th>
<th>5</th>
<th>Excellent leadership: Clarified information presentation &amp; enhanced team discussion &amp; decision making including all team members</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Good leadership enhanced team discussion &amp; decision making</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Leadership neither enhanced or impeded team discussion &amp; decision making</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Passive Chair</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>Inadequate leadership impeded information presentation, team discussion &amp; decision making</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Members</th>
<th>5</th>
<th>Articulate &amp; precise specialty related contribution relevant to patient management</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4</td>
<td>Adequate specialty related contribution</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>Inarticulate or vague specialty related contribution</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>Partial specialty related contribution</td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>No contribution / impedes contribution of others</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Point</th>
<th>Y</th>
<th>Yes</th>
<th>Decision</th>
<th>Y</th>
<th>Clear decision about treatment(s) to be offered</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>No</td>
<td>D</td>
<td>No</td>
<td>Decision to defer to next MDT</td>
</tr>
<tr>
<td></td>
<td>D</td>
<td>Don't know</td>
<td>N</td>
<td>No decision / decision unclear</td>
<td></td>
</tr>
</tbody>
</table>
5.4.2 Phase 2 – Psychometric testing – feasibility and reliability
Real-time testing of the Colorectal MDT-MODE was conducted by two independent and trained observers with a background in surgery and training in quantitative observational methods (myself and Addison). Both observers used the tool to rate the live performance of 8 colorectal cancer MDT meetings at a single London hospital. Each case discussed by the MDT was scored using all elements of the tool on a scale of 1 to 5 with 5 representing the highest score/excellent performance. Informed consent was obtained from all participants. The study protocol and materials were submitted to the hospital R&D team for approval prior to data collection and the study was approved as a ‘service evaluation’. At the end of the observation period, data were collated for statistical analyses.

5.4.3 Data analysis
Statistical analyses were performed using SPSS version 20.0 and significance was taken at the 0.05 level. Regarding phase 1, Content validation scores were formally assessed by computing a ‘content validity index’ (CVI) for each category and each set of descriptors, as well as an overall value for the Colorectal MDT-MODE tool. This was done by calculating the proportion of experts with a rating of 4 or higher (on the 5-point scale). The CVI is a way to statistically express the level of agreement between experts that an item is of relevance to the area that is measured. The higher the value of a content validity index the higher the inter-reviewer agreement and hence the higher the content validity (113).

Regarding Phase 2, the inter-observer reliability was assessed statistically using intra-class correlation coefficients, ICCs (114). Mean and standard deviation are reported for all individual ratings. All categories within the tool were also assessed against each other using an Analysis of Variance (ANOVA). Finally, to assess improvement in tool utilisation over time, observed cases were grouped into cohorts of 10 and ICC calculated for each cohort. Improving ICCs would demonstrate learning curves in tool usage by the observers. 13 cohorts of real-time MDT observations (corresponding to 130 cases) were analysed for most categories – except for the contribution of the oncologist and cancer nurse where there were 12 cohorts due to absence during one meeting. Regarding the assessment of pathological information and contribution of the histopathologist, there were only 5 cohorts as all cases did not require pathological input.

In this chapter, Global Scores and Global Percentage Scores were not utilised for any of the analysis, and are therefore not reported. They are reported in the Chapter 6.
5.5 Results

5.5.1 Phase 1 – Tool development and validation

The results of the systematic review are presented in Chapter 2. A key finding was that there were no specific methods or tools to evaluate the MDT in colorectal cancer. However my literature search did identify a tool to measure performance in urology multidisciplinary team meetings termed MDT Metric for Observation of Decision-making (MDT-MODe) (96). I utilised this extensively validated urology MDT-MODe tool as a template to guide the development of the tool to assess Colorectal MDTs. Regarding the interviews, described in Chapter 3, no participant was aware of any tool or method which formally assessed the quality of MDT meetings (reinforcing the lack of such tools in practice) although informal feedback by a peer was cited as useful. Proposed measures of assessment included an assessment of team working, specific measures of individual performance, quality of the information presented on which to base the decision, attendance levels and outcome measures of relevance.

5.5.1.1 Content Validation

The results of the content validation are summarized in Table 5.1. The values were high, both for the categories of MDT assessment (median CVI=0.85, range 0.74 to 0.96), and for the specific descriptors used in Colorectal MDT-MODe (median CVI=0.81, range 0.63 to 0.85).
<table>
<thead>
<tr>
<th>Category</th>
<th>CVI – Category</th>
<th>CVI – Descriptors</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case history information</td>
<td>0.96</td>
<td>0.85</td>
</tr>
<tr>
<td>Radiological information</td>
<td>0.96</td>
<td>0.74</td>
</tr>
<tr>
<td>Pathological information</td>
<td>0.96</td>
<td>0.81</td>
</tr>
<tr>
<td>Psychosocial issues</td>
<td>0.74</td>
<td>0.70</td>
</tr>
<tr>
<td>Patient co-morbidity</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>Patient views</td>
<td>0.74</td>
<td>0.67</td>
</tr>
<tr>
<td>Contribution of MDT Chair</td>
<td>0.89</td>
<td>0.85</td>
</tr>
<tr>
<td>Contribution of Surgeon</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>Contribution of Oncologist</td>
<td>0.85</td>
<td>0.81</td>
</tr>
<tr>
<td>Contribution of Radiologist</td>
<td>0.85</td>
<td>0.81</td>
</tr>
<tr>
<td>Contribution of Histopathologist</td>
<td>0.81</td>
<td>0.81</td>
</tr>
<tr>
<td>Contribution of Clinical Nurse Specialist</td>
<td>0.85</td>
<td>0.81</td>
</tr>
<tr>
<td>Contribution of MDT Co-ordinator</td>
<td>0.89</td>
<td>0.74</td>
</tr>
<tr>
<td>Point of discussion</td>
<td>0.74</td>
<td>0.63</td>
</tr>
<tr>
<td>Final MDT decision</td>
<td>0.81</td>
<td>0.78</td>
</tr>
</tbody>
</table>

**Overall Content Validity Index**  
0.81  
n/a
5.5.2 Phase 2 – Psychometric testing – feasibility and reliability

5.5.2.1 Colorectal Cancer MDT meeting characteristics

131 cases were observed and rated in real-time across 8 MDT meetings by two blinded observers. Upon completion of this, minor modifications were further made to the wording of the tool in light of its usage. Figure 5.1 earlier presents the current version of the Colorectal MDT-MODe assessment tool, following all modifications. An earlier version of the tool is contained in Appendix 3.

Descriptive information about the meetings is summarized in Table 5.2. On average, we found that the teams consisted of 13 to 20 cancer specialists and discussed an average 16 patients in just over 60 mins – with each case review lasting 3.68 mins.

5.5.2.2 Inter-rater reliability

Table 5.3 summarizes the observers’ intraclass correlations (ICCs). The ICCs were high (>0.70) for all but one of the assessed categories - contribution of the MDT Chair (0.69). This suggests that the two observers were consistent in their observational scores and had good inter-rater agreement.

5.5.2.3 Performance of Colorectal Cancer MDT meetings: Quality of Information and Team Contributions

Table 5.3 also highlights the observer’s ratings (mean and SD) of each element that was assessed using Colorectal MDT-MODe. Regarding the quality of presented information to the team, case history information was rated highest (observers’ mean=4.57), followed by pathological information (observers’ mean=4.49) and radiological information (observers’ mean=4.46). Regarding each team-member’s contribution to discussion, surgeons were scored highest (observers’ mean=4.35), followed by radiologists (observers’ mean=4.14) and MDT coordinators lowest (observers’ mean=1.33).
Table 5.2: Characteristics of meetings

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Meeting</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>Total</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases</td>
<td></td>
<td>19</td>
<td>14</td>
<td>17</td>
<td>21</td>
<td>10</td>
<td>19</td>
<td>11</td>
<td>20</td>
<td>131</td>
<td>16.38</td>
</tr>
<tr>
<td>Length of meeting</td>
<td></td>
<td>65</td>
<td>49</td>
<td>60</td>
<td>79</td>
<td>41</td>
<td>56</td>
<td>53</td>
<td>79</td>
<td>482</td>
<td>60.25</td>
</tr>
<tr>
<td>Average time per case</td>
<td></td>
<td>3.42</td>
<td>3.50</td>
<td>3.53</td>
<td>3.76</td>
<td>4.10</td>
<td>2.95</td>
<td>4.82</td>
<td>3.95</td>
<td>3.68</td>
<td>3.68</td>
</tr>
<tr>
<td>Surgeon</td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>19</td>
<td></td>
</tr>
<tr>
<td>Oncologist</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td>Radiologist</td>
<td></td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>20</td>
<td></td>
</tr>
<tr>
<td>Pathologist</td>
<td></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td></td>
</tr>
<tr>
<td>Cancer nurse</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>6</td>
<td></td>
</tr>
<tr>
<td>MDT Coordinator</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>Other</td>
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<td>12</td>
<td>7</td>
<td>6</td>
<td>7</td>
<td>12</td>
<td>9</td>
<td>11</td>
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<tr>
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<td>24</td>
<td>15</td>
<td>16</td>
<td>13</td>
<td>20</td>
<td>17</td>
<td>20</td>
<td>141</td>
<td></td>
</tr>
</tbody>
</table>
Table 5.3: Inter-observer reliability and descriptive ratings of Colorectal MDT performance

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of observations</th>
<th>Intraclass correlation (95% CI)</th>
<th>p-values</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case history</td>
<td>131</td>
<td>0.87 (0.82-0.91)</td>
<td>&lt;0.05</td>
<td>4.57</td>
<td>0.69</td>
</tr>
<tr>
<td>Radiological</td>
<td>131</td>
<td>0.96 (0.94-0.97)</td>
<td>&lt;0.05</td>
<td>4.47</td>
<td>1.15</td>
</tr>
<tr>
<td>Pathological</td>
<td>51</td>
<td>0.81 (0.66-0.89)</td>
<td>&lt;0.05</td>
<td>4.49</td>
<td>0.75</td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychosocial issues</td>
<td>131</td>
<td>0.86 (0.80-0.90)</td>
<td>&lt;0.05</td>
<td>2.18</td>
<td>1.39</td>
</tr>
<tr>
<td>Patient co-morbidity</td>
<td>131</td>
<td>0.82 (0.74-0.87)</td>
<td>&lt;0.05</td>
<td>2.82</td>
<td>1.44</td>
</tr>
<tr>
<td>Patient views</td>
<td>131</td>
<td>0.82 (0.74-0.87)</td>
<td>&lt;0.05</td>
<td>2.24</td>
<td>1.38</td>
</tr>
<tr>
<td>MDT Chair</td>
<td>131</td>
<td>0.69 (0.56-0.78)</td>
<td>&lt;0.05</td>
<td>4.12</td>
<td>0.91</td>
</tr>
<tr>
<td>Surgeon</td>
<td>131</td>
<td>0.89 (0.84-0.92)</td>
<td>&lt;0.05</td>
<td>4.34</td>
<td>0.85</td>
</tr>
<tr>
<td>Oncologist</td>
<td>121</td>
<td>0.83 (0.76-0.88)</td>
<td>&lt;0.05</td>
<td>3.72</td>
<td>1.65</td>
</tr>
<tr>
<td><strong>Contribution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiologist</td>
<td>131</td>
<td>0.93 (0.90-0.95)</td>
<td>&lt;0.05</td>
<td>4.13</td>
<td>1.35</td>
</tr>
<tr>
<td>Histopathologist</td>
<td>51</td>
<td>0.74 (0.54-0.85)</td>
<td>&lt;0.05</td>
<td>3.71</td>
<td>1.32</td>
</tr>
<tr>
<td>CNS</td>
<td>121</td>
<td>0.80 (0.71-0.86)</td>
<td>&lt;0.05</td>
<td>3.9</td>
<td>1.46</td>
</tr>
<tr>
<td>MDT Co-ordinator</td>
<td>131</td>
<td>0.92 (0.88-0.94)</td>
<td>&lt;0.05</td>
<td>1.33</td>
<td>0.79</td>
</tr>
</tbody>
</table>
In order to compare the mean ratings of the different categories an analysis of variance (ANOVA) to evaluate statistically significant differences between ratings was performed, followed by Bonferroni’s post-hoc pairwise comparisons.

These analyses demonstrate whether certain aspects of clinical information are systematically better presented at the MDT, and whether certain cancer specialists are likely to have more contribution to the case review during the meeting. The overall results revealed a statistically significant difference between the different scoring categories: $F(12,3033) = 187.37, P<0.05$.

Analysis of the post-hoc Bonferroni procedure revealed systematic differences in quality of information presentation – with case history, radiological and pathological information significantly better presented at the meeting compared to co-morbidities, psychosocial elements, and patients’ views (all $Ps<0.05$). Regarding team-members’ contributions, surgeons and oncologists scored significantly higher than other team-members, whereas in contrast the MDT coordinators scored lowest (all $Ps<0.05$) – these findings are discussed in more detail in the Discussion.

5.5.2.4 Observer learning curves

Figures 5.2 and 5.3 display ICCs for cohorts of 10 cases in each category of observation. The plots are annotated with a horizontal line at ICC=0.70. The ICCs can range from 0.00 to 1.00, with a higher value indicating higher agreement. Whilst there are no specific cut-offs described for “adequate” ICCs, we have used the broadly acceptable as a reliability standard for research purposes value of 0.70 (176). Reliability coefficients above the line (>0.70) indicate adequate agreement between observers; observations below the line (<0.70) indicate some but not adequate agreement – generally, the lower the value the lower the level of agreement.

Overall, these learning curves between the blinded observers show that there was a general improvement in ICCs between the first cohort and the last cohort over time in the assessment of case history information, radiological information, psychosocial issues, patient co-morbidity, patient views, contribution of MDT chair, contribution of the surgeon, the oncologist, the radiologist, the histopathologist, the CNS and the MDT co-ordinator. These are positive findings, in that they demonstrate that surgeon observers can feasibly evaluate the quality of these meetings. A problematic finding emerged in relation to the evaluation of the quality of pathological information – where no learning curve was obtained. Although the overall ICC for this category was 0.81
(indicating overall good reliability between observers), this finding was not expected. This suggests that it is somewhat more difficult for surgeon observers to rate the quality of pathological information.

Further analysis of these learning curves revealed systematic drops in agreement in the 10th cohort in all the categories, and also in the 9th cohort for the assessment of contribution of the oncologist and the CNS. Review of field notes from the associated meetings identified a high number of people attending the MDT, as well as a high number of interruptions during the course of the meeting. This suggests that external influences such as these may affect the observers’ ability to evaluate a cancer MDT. I return to this in the Discussion.
Figure 5.2: Learning curves: ICC – Information scores

Legend: ICC "Adequate" correlation
Figure 5.3: Learning curves: ICC – Contribution scores
5.6 Discussion

5.6.2 Summary of findings

This study goes some way to addressing the issue of a lack of a standardized mode of operation for colorectal cancer MDT, by developing a tool to allow objective assessment of how colorectal cancer MDTs are performing. It combines the assessment of the quality of the information presented to the MDT and the quality of the contributions of various team members. The results show that observational metrics can be derived and provide an objective measure of performance, which is acceptable to colorectal specialists from a range of disciplines – including surgery, oncology, radiology and nursing. Furthermore, these metrics can be used reliably by surgeon observers to assess the different aspects of MDT performance. There was good agreement between the two observers in nearly all the categories assessed, and there was improvement in this agreement over a period of time in eight out of the thirteen categories assessed.

This study borrowed some key elements from previous work from looking at urology MDTs (96, 110). The results of my study show that the broad categories of team evaluation across urology and colorectal cancer teams are similar – but also that specific aspects of colorectal cancer assessment and management should be used. These have been incorporated into Colorectal MDT-MoDe.

Whilst previous studies assessing team work and performance have demonstrated good reliability between medical and non-medical observers, the higher ICCs in this study suggest that medical observers may be better suited for such assessments, as they are often able to interpret clinical specificities better, and translate these to the observational tools. As an example, Lamb et al (96) suggested that non-medical observers may find it difficult to interpret the presentation of specific information if not presented by the relevant individual – this is less likely to be an issue with a medical observer who would be able to identify the information, irrespective of its source.

5.6.3 Limitations

The results of this study, though encouraging, are subject to limitations. My results come from a single London hospital – and therefore may not be representative of MDTs across England, or the rest of world for that matter. Further work is required in a variety of settings to fully evaluate the functionality of this tool. This will also aid in identifying practical issues in the tool’s usage in a clinical setting, which may require further improvements to the tool.
Two issues with scoring MDT-MODe became apparent during the study. The first one was that in meetings attended by a large number of experts and where distractions were prevalent the observers found it difficult to score – which was reflected in the drop in their agreement around cohort 10. This is a recognized limitation of observational assessments, and suggests that the clinical environment may impact on the quality of an assessment.

Furthermore the lower scores given to the MDT coordinators may not accurately reflect the role of this key individual – which is relatively new in the UK and continues to evolve (80). A lot of the work carried out by the coordinator takes place before and after the meetings – a view highlighted in one of the comments in the content validity questionnaire. During meetings, their role is often limited to recording data, and as such is much less visible. The true extent of their contribution is thus difficult to capture in this sort of an observational tool, and may require other forms of assessment. Further studies are required to investigate these scoring issues.

Finally, correlational studies are required to evaluate the construct validity of these assessments – in other words, do teams which score higher on MDT-MODe objectively manage their patients better? These are questions for further prospective research.

5.7 Conclusion

Overall, this study reinforces the view that performance of colorectal cancer MDTs can be assessed objectively and reliably, with adequate attention to the specifics of different specialties. The observational tool developed has been shown to have face and content validity, and is feasible to use by different users. The use of the tool in evaluating Colorectal Cancer MDTs may be the first step to a regular process of quality assessment and improvement. It has particular use in providing a structure to a “team debrief” – giving the observer a platform for identifying strengths and areas of development for individual teams.

In the next chapter I make further use of Colorectal Cancer MDT MODe to evaluate an MDT, and analyse whether the scores provided with the tool are able to predict the team’s ability to reach a clinical decision.
CHAPTER 6: WHAT FACTORS AFFECT MDT DECISION MAKING AND MEETING OUTCOMES?

6.1 Chapter overview

The previous chapter described the development of Colorectal MDT MODe, and provides evidence of its validity, reliability and feasibility. Previous chapters have highlighted the use of a team’s ability to reach a decision, as well as a review of whether these decisions are implemented as a measure of the MDT’s performance. In this chapter, I combine the two measures, to see if the results of colorectal MDT MODe do indeed predict a team’s ability to reach a decision, as well as whether this decision is implemented. In addition to this, I explore some of the other factors described in Chapter 5 to see if they impact on a team’s ability to make and to implement a clinical decision.

6.2 Introduction

Evaluating the performance of a colorectal cancer multidisciplinary is, as has been discussed in earlier chapters, a difficult undertaking. The previous chapter presents a novel method of evaluating team performance, but does not take into account whether this method correlates with outcomes. Figure 4.3 in Chapter 4 describes both meeting outcomes and clinical outcomes. Clinical outcomes such as recurrence rates and overall survival are regarded by many as the ideal method of evaluating cancer treatment. However, as discussed earlier, they may not be entirely appropriate when solely evaluating the multidisciplinary team, as they are more a reflection of the entire cancer care pathway. Therefore, a simple measure to evaluate the efficacy of a multidisciplinary team is whether or not the team reaches a clear clinical decision (94), and whether or not this decision is actually implemented at a later date.

In order to further validate Colorectal Cancer MDT MODe, I conducted another observational study to test specific hypotheses.
6.3  Aims

The aims of the study reported here are to prospectively assess the relationship between the quality of the presented information, contribution to discussion of team members, team size, number of cases per meeting and the number of distractions and the ability of a colorectal cancer MDT to reach clinical decisions using the MDT assessment tool developed and validated in the previous Chapter. Additionally, I aim to evaluate whether the other factors have an effect on the information and contribution scores.

The following specific hypotheses were tested:

**Hypothesis 1:** A higher Global Information percentage score predicts a team’s ability to reach a decision regarding further management

**Hypothesis 2:** A higher Global Contribution percentage score predicts a team’s ability to reach a decision regarding further management

**Hypothesis 3:** The composition and number of core members in the team predict a team’s ability to reach a decision regarding further management
6.4 Methods

6.4.1 Cases and Study setting

A prospective observational study took place between January and December 2012 at a single London Hospital, with a busy colorectal department. The colorectal cancer MDT discussed 897 cases over the course of 50 meetings in 2012. Prospective observations were carried out 24 of these meetings, where a total of 423 patients were discussed. Details of the meetings can be found in Table 6.1 below.

6.4.2 Procedure

Real-time observations using Colorectal MDT-MODe were conducted by me. In addition to using the tool rate the live performance of 24 colorectal cancer MDT meetings, I collected data on meeting length, number of people present, number of core members present and details of any absent core members. Additionally, I noted whether a clear clinical decision had been made at the end of each patient case discussion. In order to evaluate whether clinical decisions were implemented, I reviewed patient records after 3 months to check for implementation. I chose 3 months as this allows sufficient leeway for patients to commence any treatment within the government stated guidelines (184). Where decisions were not reached or had not been implemented at 3 months I noted the reasons for this. Oral informed consent was obtained from all participants in the MDT. The study protocol and materials were submitted to the hospital R&D team for approval prior to data collection and the study was approved as a ‘service evaluation’. At the end of the observation period, data were collated for statistical analyses.

6.4.3 Data collection

Data collected on features of team decision-making in the MDT meeting was collected using colorectal cancer MDT-MODe, and all additional data were collected with a pre-prepared proforma.

6.4.4 Data analysis

Values for the mean, 95% confidence intervals, standard deviation, Spearman’s correlations and logistic or linear regressions are reported for outcomes and meeting characteristics and results tabulated. All statistical analyses were performed using SPSS version 20.0 (SPSS Inc., Chicago, IL, USA). Significance was taken at the 0.05 level.
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Mean
6.5 Results

Prospective observations were carried out at 24 colorectal cancer MDTs at a single London hospital. A total of 423 patients were discussed. Details of the meetings can be found in Table 6.1 above.

Table 6.2 below presents data on each domain of MDT meeting assessment (information and professional contribution) as well as information score, contribution score and decision score for each MDT meeting. Overall, a clinical decision could be reached in 347 of 423 cases (82%) of the cases discussed. In the 76 cases where decision could not be reached, reasons included insufficient radiological information, inadequate pathological information, lack of patient information, unavailable clinical notes, and non-attendance of team members. Furthermore, of the 347 cases where a decision was reached, this decision was implemented in 317 of these cases (91.4%). In the 30 cases where decisions were not implemented, reasons included change in patient’s clinical condition (including requiring emergency admission), patient co-morbidity, patient choice and availability of additional clinical information.
## Table 6.2: CMDT MODe Results by meeting

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<th>Comorbidity</th>
<th>Patient views</th>
<th>Global %</th>
<th>MDT Chair</th>
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<td>2.00</td>
<td>2.82</td>
<td>2.53</td>
<td>64.27</td>
<td>4.29</td>
<td>4.06</td>
</tr>
<tr>
<td>R</td>
<td>3.95</td>
<td>4.00</td>
<td>4.00</td>
<td>2.55</td>
<td>3.40</td>
<td>2.65</td>
<td>66.50</td>
<td>4.00</td>
<td>3.40</td>
</tr>
<tr>
<td>S</td>
<td>3.62</td>
<td>4.27</td>
<td>3.46</td>
<td>2.23</td>
<td>3.35</td>
<td>2.19</td>
<td>65.21</td>
<td>4.00</td>
<td>3.69</td>
</tr>
<tr>
<td>T</td>
<td>3.84</td>
<td>4.53</td>
<td>4.28</td>
<td>2.00</td>
<td>3.11</td>
<td>2.05</td>
<td>64.39</td>
<td>3.89</td>
<td>3.58</td>
</tr>
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<td>U</td>
<td>3.87</td>
<td>4.22</td>
<td>4.20</td>
<td>2.48</td>
<td>2.78</td>
<td>1.87</td>
<td>61.80</td>
<td>3.87</td>
<td>3.39</td>
</tr>
<tr>
<td>V</td>
<td>3.75</td>
<td>3.44</td>
<td>3.43</td>
<td>3.25</td>
<td>2.88</td>
<td>2.81</td>
<td>64.46</td>
<td>3.25</td>
<td>3.88</td>
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<tr>
<td>W</td>
<td>3.75</td>
<td>3.42</td>
<td>3.83</td>
<td>2.83</td>
<td>3.17</td>
<td>3.08</td>
<td>66.83</td>
<td>3.42</td>
<td>4.00</td>
</tr>
<tr>
<td>X</td>
<td>3.71</td>
<td>4.00</td>
<td>4.18</td>
<td>2.38</td>
<td>3.10</td>
<td>2.52</td>
<td>64.54</td>
<td>3.67</td>
<td>3.86</td>
</tr>
</tbody>
</table>
6.5.1 Correlations between domains and outcome measure

6.5.1.1 Individual components of CMDT-MODe and outcome measures

Correlational analysis was conducted in order to determine the relation between individual components of MODe and global contribution, global information (both calculated as a percentage), decision made and decision implemented. The results are displayed in Table 6.3 on the next page.
<table>
<thead>
<tr>
<th>Category</th>
<th>Global Information %</th>
<th>Global Contribution %</th>
<th>Decision made</th>
<th>Decision implemented</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case history</td>
<td>0.29**</td>
<td>0.18**</td>
<td>0.10*</td>
<td>0.10</td>
</tr>
<tr>
<td>Radiological</td>
<td>0.31**</td>
<td>0.11*</td>
<td>0.08</td>
<td>0.06</td>
</tr>
<tr>
<td>Pathological</td>
<td>0.23**</td>
<td>0.17*</td>
<td>0.09</td>
<td>0.21**</td>
</tr>
<tr>
<td>Information</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Psychosocial issues</td>
<td>0.47**</td>
<td>0.06</td>
<td>-0.03</td>
<td>0.14</td>
</tr>
<tr>
<td>Patient co-morbidity</td>
<td>0.58**</td>
<td>0.04</td>
<td>0.04</td>
<td>-0.05</td>
</tr>
<tr>
<td>Patient views</td>
<td>0.54**</td>
<td>0.14**</td>
<td>0.05</td>
<td>-0.11*</td>
</tr>
<tr>
<td>Global information %</td>
<td>-</td>
<td>0.21**</td>
<td>0.08</td>
<td>0.03</td>
</tr>
</tbody>
</table>

| Contribution      |                       |                        |               |                      |
| MDT Chair         | -0.01                 | 0.37**                 | 0.17**        | 0.02                 |
| Surgeon           | 0.09                  | 0.41**                 | 0.13**        | 0.04                 |
| Oncologist        | 0.07                  | 0.42**                 | 0.11          | 0.12*                |
| Radiologist       | 0.04                  | 0.28**                 | 0.12*         | 0.19**               |
| Histopathologist  | 0.18*                 | 0.36**                 | 0.26**        | 0.16*                |
| CNS               | 0.18**                | 0.43**                 | 0.05          | 0.1                  |
| MDT Co-ordinator  | 0.02                  | 0.20**                 | 0.07          | -0.04                |
| Global contribution % | 0.21**            | -                      | 0.26**        | 0.15**               |

Note: N = number. Analysis conducted by case (N = 423). * p < 0.05, ** p < 0.001
6.5.1.2 Predictors of decision made

Logistic regression was performed on the CMDT-MODE items that correlated significantly with the decision made. Specifically, case history, chair, surgeon, radiologists, histopathologists and Global Contribution % variables were entered as predictors and decision made as the predicted variable.

All the variables were retained in the model as they were the significant predictors, accounting for overall 30% of the variance in the decision made and having an overall prediction accuracy of 87%.

Table 6.4: Logistic regression predicting decision made

<table>
<thead>
<tr>
<th>Predictors</th>
<th>B</th>
<th>SE B</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Odds ratio</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-5.47</td>
<td>1.77</td>
<td></td>
<td>4</td>
<td>0.01</td>
<td>1.09</td>
<td>1.03</td>
<td>1.15</td>
</tr>
<tr>
<td>Contribution %</td>
<td>0.09</td>
<td>0.03</td>
<td>9.71</td>
<td>1</td>
<td>0.01</td>
<td>1.09</td>
<td>1.03</td>
<td>1.15</td>
</tr>
<tr>
<td>Chair</td>
<td>0.56</td>
<td>0.22</td>
<td>6.66</td>
<td>1</td>
<td>0.01</td>
<td>1.74</td>
<td>1.14</td>
<td>2.66</td>
</tr>
<tr>
<td>Histopathologist</td>
<td>0.54</td>
<td>0.24</td>
<td>5.19</td>
<td>1</td>
<td>0.02</td>
<td>1.71</td>
<td>1.08</td>
<td>2.71</td>
</tr>
<tr>
<td>Surgeon</td>
<td>-0.57</td>
<td>0.25</td>
<td>5.08</td>
<td>1</td>
<td>0.02</td>
<td>0.57</td>
<td>0.34</td>
<td>0.93</td>
</tr>
<tr>
<td>Model $X^2$</td>
<td>34.71</td>
<td>0.25</td>
<td>5.08</td>
<td>1</td>
<td>0.02</td>
<td>0.57</td>
<td>0.34</td>
<td>0.93</td>
</tr>
</tbody>
</table>

$R^2$ = 0.30

Note. Decision made was represented as 0 signifying no decision made, and 1 signifying decision made.
6.5.1.3 Predictors of decision implemented

Logistic regression was performed on the CMDT-MODE items that correlated significantly with the decision implemented. Specifically, pathological information, patient views, oncologists, radiologists, histopathologists and Global Contribution % variables were entered as predictors and decision implemented as the predicted variable.

Only patient views, radiological information and Global Contribution % were retained in the model as they were the significant predictors, accounting for overall 14% of the variance in the decision implemented and having an overall prediction accuracy of 91%.

Table 6.5: Logistic regression predicting decision implemented

<table>
<thead>
<tr>
<th>Predictors</th>
<th>B</th>
<th>SE B</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Odds ratio</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiologist</td>
<td>0.42</td>
<td>0.15</td>
<td>8.16</td>
<td>1</td>
<td>0.01</td>
<td>1.52</td>
<td>1.14</td>
<td>2.02</td>
</tr>
<tr>
<td>Patient views</td>
<td>-0.35</td>
<td>0.14</td>
<td>6.33</td>
<td>1</td>
<td>0.01</td>
<td>0.71</td>
<td>0.54</td>
<td>0.93</td>
</tr>
<tr>
<td>Contribution %</td>
<td>0.04</td>
<td>0.02</td>
<td>5.20</td>
<td>1</td>
<td>0.02</td>
<td>1.04</td>
<td>1.01</td>
<td>1.08</td>
</tr>
<tr>
<td>Model $X^2$</td>
<td>24.34</td>
<td>5</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>0.00</td>
<td></td>
</tr>
</tbody>
</table>

$R^2$ 0.14

Note. Decision implemented was represented as 0 signifying no decision implemented, and 1 signifying decision implemented.
6.5.2 Core members and decision making

6.5.2.1 The effect of absent members on CMDT-MODE components

Scores were non-normally distributed, thus a nonparametric method was employed. Kruskal-Wallis test was used to explore the difference on MODe scores between groups with various core members absent, namely, when nobody was absent, when oncologist only was absent, when CNS only was absent and when both, CNS and oncologist were absent.

There was a significant effect of absent members on the patient comorbidity ($H(3)=11.7$, $p<0.01$), patient views ($H(3)=8.02$, $p<0.05$), radiologist’s contribution ($H(3)=1427$, $p<0.01$), coordinator’s contribution ($H(3)=24.39$, $p<0.001$), and the Global Contribution % ($H(3)=131.01$, $p<0.001$). Mann-Whitney U tests were used to follow up this finding using significance level of 0.003 (corrected for multiple comparisons), however, only comparisons on patient comorbidity, patient views and Global Contribution % were explored due to their clinical relevance.

The group where nobody was absent had significantly higher Global Contribution % in comparison to the group where the CNS was absent ($U=1321$, $z=-5.10$, $p<0.001$), and where oncologist was absent ($U=4556.5$, $z=-7.13$, $p<0.001$), and where both (CNS and oncologist) are absent ($U=551.5$, $z=-8.78$, $p<0.001$). The contribution % was significantly lower when both (CNS and oncologist) were absent than when the CNS alone was absent ($U=1785$, $z=-3.84$, $p<0.001$), and when the oncologist alone was absent ($U=474$, $z=-5.2$, $p<0.001$). However, no statistical difference was detected in Global Contribution % when either CNS or oncologist were absent ($U=773$, $z=-0.49$, $p=0.63$).

6.5.2.2 The effect of absent named clinician on CMDT-MODE components

The Mann-Whitney test was performed to explore the variability in on CMDT-MODE components when the patient’s named clinician was absent and when present. The significance level was adjusted for multiple comparisons with a significance level being 0.001. The Global Contribution % was significantly higher when named clinician was present than absent ($U=8108$, $z=-3.18$, $p<0.001$).
6.5.2.3 Predictors of decision made and decision implemented – presence of team members

Logistic regression was performed on the items related to the core members’ absence that correlated significantly with the decision made and decision implemented. After initial analysis, only the absence of the Named clinician was retained in the model for both decision made and decision implemented as it was the only significant predictor for both outcome variables. It accounted for overall 19% of the variance in the decision made having an overall prediction accuracy of 86%, while it accounts for 17% of the variance in decision implemented with an overall prediction accuracy of 90%.

Table 6.6: Logistic regression predicting decision made – presence of team members

<table>
<thead>
<tr>
<th>Predictors</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Odds ratio</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.37</td>
<td>0.19</td>
<td></td>
<td>1</td>
<td>0.01</td>
<td>0.11</td>
<td>0.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Named clinician</td>
<td>-2.24</td>
<td>0.32</td>
<td>48.98</td>
<td>1</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model $X^2$</td>
<td>47.07</td>
<td></td>
<td></td>
<td>1</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R^2$ 0.19
Named clinician was represented as a dummy variable with 0 signifying their absence, and 1 signifying their presence.

Table 6.7: Logistic regression predicting decision implemented – presence of team members

<table>
<thead>
<tr>
<th>Predictors</th>
<th>B</th>
<th>SE</th>
<th>Wald</th>
<th>df</th>
<th>Sig</th>
<th>Odds ratio</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>2.69</td>
<td>0.23</td>
<td></td>
<td>1</td>
<td>0.01</td>
<td>0.09</td>
<td>0.6</td>
<td>0.20</td>
</tr>
<tr>
<td>Named clinician</td>
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<td>33.59</td>
<td>1</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Model $X^2$</td>
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<td></td>
<td></td>
<td>1</td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R^2$ 0.17
Named clinician was represented as a dummy variable with 0 signifying their absence, and 1 signifying their presence.
6.5.2.4 Predictors of decision made – number of core members

Additionally, in order to explore the effect of core members further, linear regression was conducted with the number of core members present as a predictor variable and decision made as a predicted variable. The number of core members present variable was retained in the model as it was a significant predictor, accounting for overall 49% of the variance in the decision made.

Table 6.8: Linear regression predicting decision made from number of core members present

<table>
<thead>
<tr>
<th>Predictors</th>
<th>B</th>
<th>SE B</th>
<th>t</th>
<th>Sig</th>
<th>β</th>
<th>95% CI Lower</th>
<th>95% CI Upper</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Constant</td>
<td>0.68</td>
<td>0.07</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No. of core members</td>
<td>0.02</td>
<td>0.01</td>
<td>2.49</td>
<td>0.02</td>
<td>0.47</td>
<td>0.00</td>
<td>0.04</td>
</tr>
</tbody>
</table>

*Note. R² = 0.49.*
6.6 Discussion

6.6.1 Summary of results

The aim of this study was to prospectively assess the relationship between the quality of the presented information, contribution to discussion of team members, team size and composition and the ability of a colorectal cancer MDT to reach clinical decisions using the MDT assessment tool developed and validated in the previous Chapter. In describing the results, I will consider these individually, based on the hypotheses generated at the beginning of the chapter:

**Hypothesis 1: A higher Global Information percentage score predicts a team’s ability to reach a decision regarding further management**

There was no significant correlation between the global information percentage score and the decision made, and so no further predictive analysis was carried out. The case history information correlated with the decision made, however it was not a significant predictor. With regards to whether or not decisions were implemented, I found that once more, the Global Information percentage score was not a predictor, however both information on patient views and radiological information were.

Interestingly, information on patients views was a negative predictor of whether or not a decision was implemented – i.e. a lower score in this category predicted that a decision would be implemented – this was the opposite of what I anticipated – I felt that low patient view scores – which would reflect a lack of knowledge about what the patient wanted - would mean a higher rate of decisions not being followed, as patients may not be agreeable to the decisions based on their own opinions. However, the results suggest that this is not the case, and may be explained by the fact that those patients with low scores for patient views may in fact be those patients that did not wish to express any particular views – leaving decisions to the doctors, and therefore were less likely to challenge the decision made and result in non-implementation.

**Hypothesis 2: A higher Global Contribution percentage score predicts a team’s ability to reach a decision regarding further management**
I found this to be true – the Global Contribution percentage was a significant predictor of whether or not a decision was made by the team. Furthermore, the individual contribution scores of the Chair, surgeon, radiologist and histopathologist all predicted whether or not a decision was made. Finally, the Global Contribution percentage was also a significant predictor of whether or not a decision was implemented.

**Hypothesis 3: The composition and number of core members in the team predict a team’s ability to reach a decision regarding further management**

Within this category, I found that the presence of the patient’s named clinician was a significant predictor of whether or not a decision was made as well as whether or not this decision was implemented. Of the other parameters, only the number of core members present predicted whether a decision was made – i.e. the greater the number of members, the more likely the team was to make a decision.

### 6.6.2 Limitations

This study takes the results of the previous chapter and builds on them. By nature it is a similar observational study, and therefore has similar limitations – observational studies are open to some bias, and the clinical environment may impact on the results. Additionally, in this instance, I was the only observer. Whilst the previous chapter showed that CMDT-MODE can be reliably used by different users, I collected additional data for this study, and therefore there is a risk that there may have been data missed or included. However, the majority of additional items were quite objective and could be quantified easily – not requiring interpretation to produce a score. Finally, the results showing correlational relationships between different factors do not necessarily suggest causality, and therefore we proceeded to carry out further regression analysis to evaluate the predictive value of the different components of CMDT-MODE.

Once again, the results come from a single London hospital – and therefore may not be representative of MDTs across England, or the rest of world for that matter. Further work is required in a variety of settings to add strength to the predictors identified in this study. Whilst the overall number of cases was high, certain characteristics were analysed on a meeting basis, and therefore the overall number of meetings was not sufficient to draw wide-reaching conclusions. Ongoing studies will build on this data and aim to produce suitably powered results fully evaluating the functionality of this tool.
6.7 Conclusion

In this chapter, I described a study that takes CMDT-MODe and evaluates how the different components are related as well as looking at its use as a predictive tool for decision making and decision implementation. The results are promising, and highlight the fact that the global contribution percentage score (as well as the individual contributions of various individuals) is important in predicting whether or not decisions are made and implemented. It reinforces the view introduced in the previous chapter that CMDT-MODe can be used in the development of a process of quality assessment and improvement. The performance of colorectal cancer MDTs can be assessed objectively and reliably and the tool can then be used to facilitate improvements for the wider team. The structure that the tool provides makes it useful in identifying particular areas of the team and the service that perform well and those that can be developed and improved further.

In the next chapter I make use of Colorectal Cancer MDT MODe in live and video recorded settings to establish whether it is feasible to use the tool to evaluate MDTs whilst the observer is not physically present at the meeting – either by video conferencing facilities or at a later date and time following video recording.
CHAPTER 7: ASSESSMENT AND EVALUATION OF PERFORMANCE – A VIDEO OBSERVATIONAL STUDY – HOW WELL DO WE CORRELATE?

7.1 Chapter overview

Chapters 5 and 6 described the process of developing and initial evaluation of an evidence based tool for the observational assessment of team decision-making at Colorectal MDT meetings. I have demonstrated that the tool can be used reliably, and that it can be used to predict whether or not a Colorectal Cancer multidisciplinary team is able to come to a clear clinical decision. In this Chapter I evaluate the feasibility of utilising Colorectal Cancer MDT MODe to assess video recordings of meetings.

7.2 Introduction

In this Chapter, I report a study to evaluate whether it is feasible to use colorectal MDT MODe to assess video recordings of MDT meetings. As I have shown in Chapter 3, MDT meetings cost money, and the additional cost of having a designated observer – either internal or external – may detract teams from using this tool. Previous studies in other healthcare settings (115, 116) have showed good reliability between live and video observers. However, these have often utilised expensive video recording systems. After exploring the feasibility of using the video conferencing facilities, it was clear that the added cost of adding a video recorder to these cameras would be high. Therefore, I chose to record the MDTs through a digital handycam, which is readily available, and reviewed unedited videos on my computer.

7.3 Aims

The aims of this Chapter are to:

1. assess intra-rater reliability of utilising Colorectal Cancer MDT MODe for live observations and video observations

2. assess inter-rater reliability of utilising Colorectal Cancer MDT MODe with video observations
7.4 Methods

7.4.1 Cases and study setting

I conducted real-time observations and video recording using Colorectal MDT-MODe at 10 colorectal cancer MDT meetings at a two London hospitals (5 meetings at each). Each case discussed by the MDT was scored using all elements of the tool on a scale of 1 to 5 with 5 representing the highest score/excellent performance. Following initial live scoring, I proceeded to review the videos following an interval of 6 weeks and scored the cases once more using all elements of CMDT-MODE tool. A sample of one meeting was observed by a second observer (Matharoo) and both live and video scores were recorded in the same manner. I encountered problems with the video recorder at one meeting, and therefore the results of this meeting were not included in the analysis (this was not one of the 10 meetings included above). The assessment process was similar to that described in Chapter 5.

Informed consent was obtained from all participants. The study protocol and materials were submitted to the hospital R&D team for approval prior to data collection and the study was approved as a ‘service evaluation’. At the end of the observation period, data were collated for statistical analyses.

7.4.2 Video recording

MDTs were recorded using a readily available digital handycam (Figure 7.1). As the layout of the meetings and the positions of core members varied slightly, the handycam was placed on a tripod at a point where maximal coverage was guaranteed. Digital recordings were reviewed at the end of the meeting and files transferred to a secure disk drive for further review and analysis at a later time.
7.4.3 Data analysis

Statistical analyses were performed using SPSS version 20.0 and significance was taken at the 0.05 level. The intra-observer and inter-observer reliability was assessed statistically using intra-class correlation coefficients, ICCs (114). Mean and standard deviation are reported for all ratings. Furthermore, to assess improvement in tool utilisation with the videos over time, observed cases were grouped into cohorts of 10 and ICC calculated for each cohort. Improving ICCs would demonstrate learning curves in tool usage with the videos by the observer. 16 cohorts of real-time MDT observations (corresponding to 160 cases) were analysed for most categories – except for the contribution of the oncologist and cancer nurse where there were 14 and 15 cohorts respectively due to absences during meetings. Regarding the assessment of pathological information and contribution of the histopathologist, there were only 8 cohorts as at one site the histopathologist left the meeting after all the cases requiring pathological input were discussed.

7.5 Results

7.5.1 Meeting characteristics

164 cases were observed and rated in real-time across 10 MDT meetings by myself, and the videos rated again 6 weeks after the meeting. In addition, one meeting was attended by a second observer (Matharoo) who carried out live observations using CMDT-MODE, and followed this up 6 weeks later with an assessment of the video of this meeting using CMDT-MODE.
Descriptive information about the meetings is summarized in Table 7.1. On average, we found that the teams consisted of 13 to 24 cancer specialists and discussed an average 16 patients in just under 64 minutes – with each case review lasting 3.90 mins. This table also summarizes the observers’ ratings. Regarding the quality of presented information to the team, radiological information was rated highest (observers’ mean=4.48), followed by case history information (observers’ mean=4.41). Regarding each team-member’s contribution to discussion, surgeons were scored highest (observers’ mean=4.44), followed closely by radiologists (observers’ mean=4.43) and MDT coordinators lowest (observers’ mean=1.97).
Table 7.1: Characteristics of meetings

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Meeting</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>Total</th>
<th>Mean</th>
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<tr>
<td>Number of cases</td>
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<td>19</td>
<td>14</td>
<td>17</td>
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<td>19</td>
<td>11</td>
<td>20</td>
<td>17</td>
<td>16</td>
<td>164</td>
<td>16.40</td>
</tr>
<tr>
<td>Length of meeting</td>
<td></td>
<td>65</td>
<td>49</td>
<td>60</td>
<td>79</td>
<td>41</td>
<td>56</td>
<td>53</td>
<td>79</td>
<td>82</td>
<td>75</td>
<td>639</td>
<td>63.90</td>
</tr>
<tr>
<td>Average time per case</td>
<td></td>
<td>3.42</td>
<td>3.50</td>
<td>3.53</td>
<td>3.76</td>
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<td>2.95</td>
<td>4.82</td>
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<td>4.82</td>
<td>4.69</td>
<td>3.68</td>
<td>3.90</td>
</tr>
<tr>
<td>Surgeon</td>
<td></td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
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<td>3</td>
<td>2</td>
<td>4</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Oncologist</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Radiologist</td>
<td></td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>3</td>
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<td>3</td>
<td>2</td>
<td>2</td>
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<tr>
<td>Pathologist</td>
<td></td>
<td>1</td>
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<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>12</td>
<td></td>
</tr>
<tr>
<td>Cancer nurse</td>
<td></td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>MDT Coordinator</td>
<td></td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<td>1</td>
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<td>10</td>
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<td>7</td>
<td>9</td>
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<td>20</td>
<td>16</td>
<td>19</td>
<td>176</td>
<td></td>
</tr>
</tbody>
</table>
7.5.2 Inter-observer reliability

The results of the inter-observer reliability were based on one meeting where 21 patients were discussed. The mean intraclass correlation coefficient for live inter-observer reliability was 0.83 (0.75-0.89), whilst the mean ICC for video inter-observer reliability was 0.72 (0.64-0.80). Further analysis on this group was not carried out due to the small number of cases.

7.5.3 Intra-observer reliability

Table 7.2 summarizes the intraclass correlations (ICCs) between the live and video observations carried out by myself. The ICCs were high (>0.70) in only four of the 13 categories assessed. The remainder ranged from 0.44 (information on patient views) to 0.69 (contribution of the radiologist). The ICCs can range from 0.00 to 1.00, with a higher value indicating higher agreement. Whilst there are no specific cut-offs described for “adequate” ICCs, we have used the broadly acceptable as a reliability standard for research purposes value of 0.70 (190). Reliability coefficients above the line (>0.70) indicate adequate agreement between live and video observations; coefficients below the line (<0.70) indicate some but not adequate agreement – generally, the lower the value the lower the level of agreement. This suggests that there was limited agreement between the live and video observations carried out.

I proceeded to analyse this further and reviewed cohorts of ICCs to see if there was an overall improvement, suggesting ongoing learning. Figures 7.2 and 7.3 display ICCs for cohorts of 10 cases in the overall categories of observation (Global Information Percentage and Global Contribution Percentage scores). The plots are annotated with a horizontal line at ICC=0.70. Overall, these learning curves show that there was a general, if gradual, improvement in ICCs between the first cohort and the last cohort over time. Despite the fact that the overall ICCs are low, these are positive findings, as they suggest that it may be feasible to utilise video based assessments to evaluate MDTs, but that the learning curve may be over a greater period of time.
Table 7.2: Intra-observer reliability (live vs video) and descriptive ratings of Colorectal MDT performance

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of observations</th>
<th>Intraclass correlation (95% CI)</th>
<th>p-values</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Information</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Case history</td>
<td>164</td>
<td>0.76 (0.72-0.82)</td>
<td>&lt;0.05</td>
<td>4.57</td>
<td>0.69</td>
</tr>
<tr>
<td>Radiological</td>
<td>164</td>
<td>0.56 (0.54-0.57)</td>
<td>&lt;0.05</td>
<td>4.47</td>
<td>1.15</td>
</tr>
<tr>
<td>Pathological</td>
<td>67</td>
<td>0.51 (0.51-0.59)</td>
<td>&lt;0.05</td>
<td>4.49</td>
<td>0.75</td>
</tr>
<tr>
<td>Psychosocial issues</td>
<td>164</td>
<td>0.68 (0.64-0.70)</td>
<td>&lt;0.05</td>
<td>2.18</td>
<td>1.39</td>
</tr>
<tr>
<td>Patient co-morbidity</td>
<td>164</td>
<td>0.82 (0.74-0.87)</td>
<td>&lt;0.05</td>
<td>2.82</td>
<td>1.44</td>
</tr>
<tr>
<td>Patient views</td>
<td>164</td>
<td>0.44 (0.41-0.49)</td>
<td>&lt;0.05</td>
<td>2.24</td>
<td>1.38</td>
</tr>
<tr>
<td>MDT Chair</td>
<td>164</td>
<td>0.69 (0.56-0.78)</td>
<td>&lt;0.05</td>
<td>4.12</td>
<td>0.91</td>
</tr>
<tr>
<td>Surgeon</td>
<td>164</td>
<td>0.89 (0.84-0.92)</td>
<td>&lt;0.05</td>
<td>4.34</td>
<td>0.85</td>
</tr>
<tr>
<td>Oncologist</td>
<td>143</td>
<td>0.63 (0.56-0.68)</td>
<td>&lt;0.05</td>
<td>3.72</td>
<td>1.65</td>
</tr>
<tr>
<td><strong>Contribution</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Radiologist</td>
<td>164</td>
<td>0.69 (0.66-0.72)</td>
<td>&lt;0.05</td>
<td>4.13</td>
<td>1.35</td>
</tr>
<tr>
<td>Histopathologist</td>
<td>67</td>
<td>0.64 (0.54-0.75)</td>
<td>&lt;0.05</td>
<td>3.71</td>
<td>1.32</td>
</tr>
<tr>
<td>CNS</td>
<td>149</td>
<td>0.80 (0.71-0.86)</td>
<td>&lt;0.05</td>
<td>3.9</td>
<td>1.46</td>
</tr>
<tr>
<td>MDT Co-ordinator</td>
<td>164</td>
<td>0.62 (0.58-0.64)</td>
<td>&lt;0.05</td>
<td>1.33</td>
<td>0.79</td>
</tr>
</tbody>
</table>
Figure 7.2: Intra-observer reliability Learning curves: ICC, Global Information scores

![Global Information %](image1)

Figure 7.3: Intra-observer reliability Learning curves: ICC, Global Contribution scores

![Global Contribution %](image2)
7.6 Discussion

7.6.1 Summary of findings

In this study I set out to explore whether it was feasible to use CMDT-MODE to evaluate colorectal cancer multidisciplinary teams by video. I have utilised the tool developed in previous chapters and assessed its suitability for a different mode of assessment. Whilst the results do not show excellent reliability, they are encouraging as they appear to show that there is a trend towards improvement. The results show that the observational metrics can be derived using Colorectal Cancer MDT-MODE are not simply for use in real time – there may be a role in video based assessments.

The implications of this are significant as, without the need to have somebody observing in person, MDTs can take advantage of the benefits afforded by CMDT-MODE for quality assessment and improvement by recording meetings and sending them to a suitably qualified observer. Furthermore, this may limit the time and man-power resources – and the associated costs. Alternatively, pairs of multidisciplinary teams could utilise video conferencing facilities for a similar purpose.

7.6.2 Limitations

The results of this study, though encouraging, are subject to limitations. My results come from a small sample (10 MDT meetings) from two London hospitals – and therefore may not be representative of MDTs across England. Additional observations are required to see if the improving trends in the learning curve continue to improve. Furthermore there is an element of bias as I reviewed both the live observations as well as the videos, although I allowed a 6 week gap between these evaluations. Further work may be required using a separate observer for the videos to see if the interobserver reliability between one live observer and another video observer is sufficiently high to utilise this concept further.

The use of the videos produces some challenges in itself. Whilst every effort was made in this study to ensure maximal coverage, there is inherent difficulty in ensuring that videos capture all that is going on during meetings. There may be aspects of communication – particularly non-verbal communication that may be missed. Additionally, those being assessed are more aware of this in the presence of a video camera, and this may affect results.
7.7 Conclusion

Overall, this study reinforces the view that performance of colorectal cancer MDTs can be assessed objectively and reliably, with adequate attention to the specifics of different specialties. Furthermore, the observational tool developed in previous chapters has been shown to be feasible when used to assess MDTs on video. Whilst its reliability is lower than for paired live observations, there is sufficient evidence to suggest with a longer learning period this may improve.

In the final chapter of this thesis I review the findings in view of the aims of this thesis, discuss the specific results and their implications as well as set out ideas for future work in this area.
CHAPTER 8: GENERAL DISCUSSION

This final chapter begins with a summary of the key findings from each of the chapters. I proceed to examine each of the individual aims set out, with specific links to relevant literature. Next, I consider the methodological strengths and limitations, practical implications and areas for ongoing and future research. I complete the section with concluding remarks.

8.1 Summary of thesis findings

This thesis has presented a series of studies exploring the role of multidisciplinary teams in the management of colorectal cancer. Chapter 1 highlighted specific aspects of colorectal cancer management that make the multidisciplinary team approach a vital part of clinical care. In Chapter 2 I performed a systematic review and meta-analysis of the available literature on colorectal cancer multidisciplinary teams. This highlighted the high prevalence of the use of multidisciplinary teams to guide decision making, with improved clinical outcomes as a result of their introduction. However, the studies reviewed did not identify any specific methods of measuring how well colorectal cancer MDTs work. I proceeded to explore some of the issues raised in Chapter 2 further in Chapter 3, by conducting an interview study – targeting the core members of the colorectal cancer MDT. This study reiterated the finding that few methods existed to assess how well colorectal cancer MDTs work, or how well individual members were performing their specified roles. Importantly, the study identified specific measures that core members of the colorectal cancer MDT felt would be suitable for assessment.

In chapter 4, I presented a study reporting financial data on the cost of colorectal cancer multidisciplinary teams. This data showed that there is significant cost associated with each MDT discussion – both overall costs per cancer patient, as well as costs per patient case discussion. This provides compelling financial reasons to ensure that these meetings run efficiently.

I introduced the idea of a “Systems Approach” to Colorectal Cancer MDTs and proceeded to focus on specific process measures and meeting outputs. In Chapter 5 I utilise the findings from previous chapters and described the development of an observational assessment tool – Colorectal Cancer MDT-MODE. I proceeded to demonstrate validity and feasibility of use by different users. In Chapter 6, I utilised the validated tool to assess Colorectal Cancer MDTs, and demonstrated there are relationships between the different components of the assessment tool. Furthermore, I was able to
identify specific components and global scores which predicted whether or not care decisions were made and implemented. Finally, in Chapter 7, I showed that it is feasible to utilise Colorectal Cancer MDT-MODE to assess pre-recorded videos of Colorectal Cancer MDTs, with sufficient reliability with paired live observations.

8.2 Thesis findings by aim

In this section I will now explore each individual thesis aim in more detail.

8.2.1 Aim 1: To review the evidence base on Colorectal Cancer MDTs

At the time of starting this period of research, Colorectal Cancer multidisciplinary teams were embedded in clinical practice in the UK, and across a large part of Europe. Outside of these areas, the presence and extent of multidisciplinary care was variable. From the outset, I set out to review the literature related to multidisciplinary team management in colorectal cancer. Whilst there use is widespread, there was little conclusive evidence to support their use and the positive impact they had on patient care, primarily due to the concurrent advances in patient management.

The systematic review and meta-analysis of the literature highlighted that there were few reliable, empirical studies on Colorectal Cancer MDTs. There was significant variation in the types of study and the data presented, making further data analysis challenging. Indeed, despite the recommendations made by Fleissig and colleagues nearly ten years ago, there have been few studies that have addressed the issues raised. Whilst the body of evidence suggests a general acceptance of their use and benefit, there remain significant variations in the make-up, implementation and running of Colorectal Cancer multidisciplinary teams. One of the major issues identified has been variable attendance levels from core members - an issue raised in serial reports of national data. The work of National Cancer Action Team in producing key guidelines and mandatory auditing of data has gone a long way to improving this.

The review proceeded to separate studies and identify those that reported changes to pre-treatment decisions and clinical outcomes. Overall, the findings support the hypothesis that the introduction of Multidisciplinary teams in the management of Colorectal cancer have resulted in more appropriate pre-treatment decisions being made – with better adherence to “gold standard guidelines”, as well as improvements in clinical outcomes.

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A key conclusion from the review of the literature was that there were no standardised tools for assessment of how well multidisciplinary teams were performing.

8.2.2 Aim 2: To identify key aspects that could be utilised in evaluating Colorectal Cancer MDTs

The results from the systematic review identified a number of potential areas that could be used for the assessment of Colorectal cancer multidisciplinary teams – different standards and benchmarks had been used in a number of different studies. In addition to this, the then mandatory NCAT reports and the submission of specific data to NBOCAP provided a wide range of potential sets of information to use. The interview study reported in Chapter 3 identified a number of similar areas, with a broad split between process measures and outcome measures. I proceeded to introduce a “Systems approach” to assessment of Colorectal Cancer Multidisciplinary teams which included areas highlighted by the previous studies – broadly split into inputs, processes, outputs and clinical outcomes. This has been shown previously (Figure 4.3) and is highlighted again below in Figure 8.1.
Whilst the majority of clinicians preferred utilising clinical outcomes to assess colorectal cancer multidisciplinary teams, the disadvantage of using these was that there were a number of factors – clinician, hospital and patient based that would affect these. Therefore I focussed on the other aspects identified – a viewpoint shared by other studies assessing teams in healthcare. I chose to proceed with assessments of information presented, team member contributions and whether or not a decision was made and implemented. The latter two areas are easily objectively measured. The challenge was developing a tool that could reliably assess quality of information presented and team member contributions.
8.2.3 Aim 3: To develop an objective evaluation tool for Colorectal Cancer MDTs, which can be used in different formats

In Chapters 5 and 6 I developed and assessed the inter-rater reliability of a tool to assess the quality of teamwork and decision-making in colorectal cancer MDT meetings (cMDT-MODE), followed by a period of use of the tool for assessment. Development was based on a recently designed tool which underwent a process of revision based on the findings of Chapters 2 and 3, followed by a rigorous process of content validation utilising 27 experts in colorectal cancer. A period of observations using this tool followed. The studies demonstrated that this observational assessment tool can reliably be used by different observers to assess the quality of information presentation to the team, and the contributions to team decision-making of the core members of the MDT. Reliability between observers was good, with only one area falling below the accepted level for an adequate score (0.7). This was in the assessment of the contribution of the MDT chair. Overall learning curves showed that there was a general improvement between raters from the first to the last cohort of patient discussions.

In Chapter 7 I utilised the same tool to assess Colorectal cancer Multidisciplinary team meetings that I recorded using a video recorder. I then assessed the reliability of real time observations against those from the video recordings of the meetings. The results here are less reliable then live observations between 2 different individuals. However, there was a definite trend to improvement with the learning curves – albeit a slower improvement. The results suggest that with adequate support and time, video based assessments may be useful adjunct in assessing Colorectal Cancer Multidisciplinary team utilising CMDT-MODE.

8.2.4 Aim 4: To identify key elements that predict decision making in Colorectal Cancer MDTs

In Chapter 6 CMDT-MODE I analysed the relationships between different components of CMDT-MODE, as well as between the components and the team’s ability to come to a definitive clinical decision and latterly, whether this decision was implemented. The results suggest that the Global Contribution percentage score was able to predict the ability of an MDT to reach a clinical decision, as well as the actual implementation of said decision. Finally, the presence of a patient’s named clinician was a significant predictor of the MDT’s ability to reach a clinical decision.
8.3 Thesis Limitations

8.3.1 Subject area

Chapter 1 highlighted the specific reasons for choosing Colorectal Cancer multidisciplinary teams as the focus for this thesis. It is these same reasons that, to an extent, limit the data presented. Managing patients with colorectal cancer is challenging, given the number of cases, the different presentations and the various options for treatment modalities. There remain a number of areas where there is equipoise with regards to optimal management – related to pre-operative investigations, neoadjuvant therapies – type and duration, and operative techniques and strategies (51, 53, 57, 117, 118). Furthermore, there are numerous stages to the management process, involving a wide range of healthcare workers. Therefore clinical outcomes in patients with colorectal cancer are affected by numerous factors - the quality and efficiency of care provision as well as variations in patient. It is therefore not accurate to utilise clinical outcomes as a marker for assessing colorectal cancer Multidisciplinary teams, as they are a more accurate marker of the overall cancer pathway, taking into account the factors listed earlier. Furthermore, it is not possible to attribute improvements in clinical outcomes solely to the introduction of multidisciplinary team working as there have been technological and pharmacological advances in the assessment and management of patients with Colorectal cancer.

8.3.2 Studies on the subject

There are several limitations in the evidence base identified for Colorectal Cancer MDTs working. The systematic review and meta-analysis presented in Chapter 2 identified a relatively a small number of studies on multidisciplinary teams in colorectal cancer – an interesting finding given how large the evidence base is on colorectal cancer alone, and the fact that multidisciplinary teams in cancer care are mandatory in the UK and large parts of Europe. Furthermore, there was significant variation in the study types and results presented, making further analysis difficult. A simplified quality assessment tool, to assess study suitability for meta-analysis identified only a small number of studies suitable for inclusion. Importantly, there were no randomised controlled trials comparing interventions to improve the processes of the multidisciplinary team or the effect of multidisciplinary team working on clinical outcomes. The majority of comparative studies were retrospective studies, with a longitudinal assessment of pre-MDT and post-MDT outcomes. This in itself limits their value as the retrospective nature introduces bias, and the longitudinal nature of these studies means that advances in clinical care cannot be accounted for and eliminated.

The gold standard scenario of carrying out a prospective, randomised controlled trial with strict inclusion criteria to evaluate the impact of colorectal cancer MDTs on clinical outcomes is not an
option in the UK setting given that MDTs are now mandatory and there is no allowance for clinical care in cancer patients without the involvement of a multidisciplinary team.

The next step was to identify studies that presented data on MDT running and implementation. Again there was significant variation in practice and reporting, and one could argue that the published papers represented a sample of MDTs that were focussed on quality improvement, and therefore providing a biased sample of the better end of the spectrum.

8.3.3 Choice of assessment methods

The first 2 sections of this thesis identified the key challenge of identifying specific assessment tools, given the variation in methods previously used. The development of the “Systems Approach” to assessment of Colorectal cancer Multidisciplinary teams, described at the end of Section 2, allowed me to identify different areas, and distil my thoughts to identify key measures to focus on, that would reflect accurately the workings of these multidisciplinary teams. These measures focus on inputs, processes and outputs and this thesis has shown that they can be reliably assessed.

One of the overarching aims of any healthcare research is to improve outcomes for patients. It is therefore the focus of results presented in clinical journals, and is often more easily understood then the measures described in this thesis. Similar difficulties arise in related healthcare disciplines, where process measures have been shown to be components of reliable assessment tools. However, a significant challenge, and one that this thesis has not addressed, is linking these measures of process to clinical outcomes to see if there is significant improvement in these “hard” clinical outcomes, which remain the standard when assessing the effectiveness of clinical care.

8.3.4 Study methodology

I chose observation as the method of assessment of teamwork and team decision-making in colorectal cancer MDT meetings. Whilst this methodology has clear advantages, the limitations mentioned in other experiences of observational studies in healthcare settings applied to my studies.

Firstly, the colorectal cancer MDTs being assessed are generally busy meetings, with a number of people attending. Case discussions were often rapid and discussions moved on to the next patient very quickly. As a result, it was sometimes difficult to capture all the information required to complete the rating tool and record this accurately. This problem was more of an issue when
evaluating the videos of the MDTs for data analysis in Chapter 7, as the presence of a single, static camera meant that some aspects were missed entirely. This is likely to be a significant reason for the lower levels of intra-observer reliability found in this study. Additionally, the often disorganised presentation of information and contribution to team discussion that I observed made data capture difficult. Information on pathology or radiology was often presented within the case history, not by the expected or appropriate professional (i.e. the Histopathologist or the Radiologist), which at the start was difficult to keep up with for both observers. However, learning curves were apparent across the course of the study, which implies that observers can eventually learn to separate the information from the contribution.

8.4 Implications of thesis findings and areas for further research

The research presented in this thesis was carried out with the overarching aim of improving patients’ outcomes and safety. With the different methodologies employed, I have presented a series of studies that have significant implications for clinical practice, whilst at the same time identifying related areas for further research.

8.4.1 Multidisciplinary teams are here to stay

The value of multidisciplinary teams in colorectal cancer care has been scrutinised in numerous studies. However as they form the basis of a number of cancer care systems globally, they are likely to continue in their current form. What is apparent from the data presented in this thesis is that there is significant variation in practice. Despite national guidance there are shortcomings when it comes to effective and efficient use of Multidisciplinary teams in Colorectal Cancer. This thesis aims to address this with the development of an objective assessment tool to assess and improve Multidisciplinary teams in Colorectal Cancer. The tool has been validated and has been used in multiple formats.

Future work should aim to build on this by utilising the tool further, in different hospital settings to build up a large set of data for analysis. This will have the additional benefit of refining and developing further versions of the tool to ensure it remains up to date with current clinical practice.
8.4.2 Decision making and implementation ability

In this thesis I have used a multidisciplinary team’s ability to reach a clinical decision, as well as whether this decision is implemented as a marker for the effectiveness of decision making. This is a novel way of approaching the problem, and provides a clear endpoint for assessment. Studies presented in the systematic review have also identified concordance with individual clinicians’ decisions (made blindly) and adherence to guidelines as study endpoints. However I strongly believe that using decision making and implementation ability will lead to largely unbiased data, as at that point there is no argument as to whether this was a right or wrong decision (which could be argued when using the other two methods), but simply whether a decision was reached. I believe that at this stage all studies should present this data which will allow for useful data collection and analysis of larger data sets.

It is important to note that whilst I have referred to MDT decisions in this thesis, the views and treatment options presented to a patient following a MDT discussion are in truth recommendations for management and the final decision lies with the patient – following a careful consideration of the options, facilitated by appropriately informed healthcare professionals. Patient autonomy is a fundamental principle of healthcare today, and whilst the specialist members of the MDT are able to make decisions based on the information available, the final decision to consent to treatments lies with the patient. It may be prudent therefore to refer to MDT recommendations in further work in this area.

8.4.3 Clinical outcomes

I have outlined my rationale for using decision making and implementation as a measure of effectiveness. As explained above, this does not answer the question of whether this is the ‘right’ clinical decision for the patient. As a larger data set is developed, the next step should be to examine whether implemented decisions are ‘good decisions’ that do indeed lead to patient health benefits; a proposed method would be to assess if there is a relationship between CMDT-MODe scores, decision implementation and clinical outcomes – in colorectal cancer these could include, but are not limited to, R0 resection rate, disease free survival and 30 day morbidity and mortality.

8.4.4 Quality improvement

One of the proven advantages of objective scoring systems is that repeated scoring and feedback carried out in the right manner will result in gradual improvements over time. Whilst there is an argument that some of the effect seen is as a result of the Hawthorne effect, this in itself is not necessarily a bad thing as it does drive improvement. The results of this thesis showed a gradual
improvement in the scores for the teams assessed over time. What I have not explored is the role of effective de-briefing following a period of observation. There is evidence to support the fact that an effective de-briefing is just as important as objective assessment in driving improvements in individuals and teams, and this is an area for future work.

Additionally, the tools used in this thesis may be a useful adjunct to the National Peer Review Programme, which is in itself a formal Quality assurance and improvement process. This is not an area I addressed in detail, and one may argue that going forward, aligning the work in this thesis with the Programme increases the chances of successfully incorporating cMDT MODe in regular practice.

### 8.4.5 Resource implications

One of the things that my research has shown is that Colorectal Cancer MDTs cost money. Whilst it is difficult to compare this with patient management without these teams, it is clear that any potential savings of time and money should be looked at in more detail. The colorectal cancer MDT provides a unique area where it is worth considering whether all patients need to be discussed equally. Given that there are often established departmental, local, regional, national or international guidelines in place for some of the disease stages, it is an area that needs further research to establish whether savings can be made without compromising patient care.

Anecdotally, there has also been an increase in the number of colorectal cancer cases managed in the private sector. Whilst there is limited information in this area, such cases are often brought to the clinicians’ local MDTs for discussion. If there are significant increases in these numbers, there may be certain cost implications for those involved, and the data in this thesis may provide a framework for calculating this.

### 8.4.6 Teaching and training

The MDT provides a relatively underused method for training of junior doctors. There is a large amount of clinical knowledge that is discussed and it is a brilliant opportunity for keeping up to date with management options and engaging in critical discussion with like-minded colleagues. Additionally, the video based assessments described in this thesis can prove to be an invaluable resource in training of junior doctors, as well as whole MDTs. It may be of particular use in training MDT co-ordinators – as the only non-clinical members of the team, the videos may be useful in ensuring they are familiar with terminology and maximize their engagement and impact in meetings.
8.5 Concluding remarks

I started this thesis at a time when there was a little in the way of research in the area in question. My period of research has proved to be an exciting time in the field, with a number of new contributors to this area from different backgrounds.

The research presented in this thesis has shown that whilst there is variation in practice, it is possible to objectively assess Colorectal Cancer Multidisciplinary teams with the aim of improving their practice. Given the current climate in the healthcare setting, there is a need for ensuring that clinical practice continues to provide safe healthcare for patients with good clinical outcomes, whilst maximising the efficiency of the processes involved.

Multidisciplinary teams in colorectal cancer are an area where this is especially true, and this thesis sets the foundation for an ongoing process of objective quality improvement. There is a need for further research in this area, and I hope that the work presented in this thesis provides the foundation for this.
REFERENCES


29. Thompson JF, Shaw HM, Stretch JR, McCarthy WH, Milton GW. The Sydney Melanoma Unit - A multidisciplinary melanoma treatment center: Surgical Clinics of North America. 83 (2) (pp

31. NICE. Colorectal Cancer - The diagnosis and management of colorectal cancer. NICE; 2011.


63. Genovesi D, Mazzilli L, Trignani M, M DIT, Nuzzo A, Biondi E, et al. Developing a decision-making model based on an interdisciplinary oncological care group for the management of


evaluation of the impact of the PELICAN MDT-TME Development Programme on the working lives of colorectal cancer team members: BMC health services research. 10 (pp 187), 2010. Date of Publication: 2010.; 2010.


93. Lamb BW, Sevdalis N, Arora S, Pinto A, Vincent C, Green JS. Teamwork and team decision-


98. www.kingsfund.org.uk.


APPENDICES

APPENDIX 1: Initial Search Strategy for Systematic Review
APPENDIX 2 - Interview Schedule

**Interview Schedule: User defined opinions of outcome measures for Colorectal cancer MDTs**

**Objectives for this interview:**
- To explore individuals perceptions of their roles in MDTs and their insight into their performance
- To investigate awareness of any assessment tools, both for individuals as well as for the MDT as a whole
- To understand what outcome measures may be suitable for assessing Colorectal cancer MDTs
- To identify groups that may represent an expert consensus on outcome measures for Colorectal cancer MDTs

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**INTRODUCTION**

- Establish ID of who I'm speaking to – name, job title
- Introduce myself
- Introduce project – State aim of the interview: To identify outcomes that can be used to evaluate Colorectal Cancer MDTs.
- Ask permission to tape interview, assure anonymity
- Confirm that the information provided will be treated confidentially

**RESPONSIBILITIES**

1. **Can you please describe your role in the Colorectal Cancer MDT?**
   - What strengths do you bring to the MDT?
   - Do you think your role is limited to the meeting?
   - Do you have time to prepare for the MDT beforehand? How much time is typically required?
   - Is there anything that limits your ability to perform your role? If yes, what is it?

2. **How do you know that you are performing your role satisfactorily?**
   - Do you ever self-evaluate your contribution?
   - How is your performance measured and reviewed?
   - Have you received any detailed feedback (verbal or written)?
   - Are such performance assessments / reviews regular / formal or ad hoc?

**CURRENT METHODS OF ASSESSING COLORECTAL CANCER MDTs**

3. **Do you know of any tools or methods available to assess how well Colorectal Cancer MDTs work?**
   - Do these assess individual members?
   - Do these assess the overall process of the MDT?
   - Do these assess the outcomes from MDTs?
   - If there are such tools, how are they applied (ie how frequently, in what form?)

4. **Do you think these tools are suitable?**
   - How could they be improved?

**YOUR OPINIONS**

5. **What measures of performance would you recommend for assessing how well Colorectal Cancer MDTs work?**
   - What aspect of the MDT would these measures assess?
   - Rather than focusing on the process, are there measures that could assess the outcome?
   - If you were designing a tool, what outcome measures would you include? – Do you think these assess the MDT decision individually, or do they assess the whole process, from initial referral to final treatment?
### EXPERT OPINION

6. Who would you consider to be experts who could provide a consensus on outcome measures for Colorectal Cancer MDTs?
   - Do you think that these should be specialty specific, or that an overall consensus for all MDTs would be suitable?
   - Are there any particular organisations?
   - What do you think is the best way to collect this consensus – i.e. are there particular groups / conferences that could be contacted to facilitate this?

### RESPONSIBILITY

7. In the event of any complaints / proceedings, who do you think is responsible for the recommendations of multidisciplinary team meetings?
   - Do individual clinicians have responsibility / liability, even if they have not been actively involved in the discussion?
   - What would you do in the event that you did not agree with the final recommendation given by the MDT?

Do you have any questions? Is there anything else that you would like to add?

**Additional notes:**

Interviewee

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Location / Settings

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Any new avenues
APPENDIX 3 – Sample Interview Transcript

Interviewer: Good morning, it’s 13th July. It’s Sujay Shah, I’m one of the Research Fellows at Imperial College and Barnet. Thank you for taking the time to complete this interview. Can I just ask you, for the purpose of the interview, just to introduce yourself, your role within the hospital and within the MDT?

Respondent: So my name is [redacted]. I’m a Consultant Colorectal General and Laparoscopic Surgeon at Barnet. I am the lead for lower GI cancer in the Trust, and I was MDT lead at Barnet but am no longer, so I’m a core member of the MDT.

Interviewer: Okay. The purpose of this interview is to explore individuals’ perceptions of their roles within their MDT, in, insight into their performance and awareness of any assessment tools. And also to understand if there are any specific outcome measures that they’re, they may feel are suitable for assessing colorectal cancer, MDT specifically. So just, in the first instance, can you briefly describe your role within the MDT? I know you’ve mentioned what you do but what does that involve?

Respondent: Well, as a (coughs) core member, it, it, it involves attending the MDT every week, being knowledgeable of your patients and playing an active part in the MDT. I often step in for the MDT lead and chair the MDT and, and that. And I’ve, and I’ve done that before for about four or five years. My role there, I very much felt, was to facilitate the meeting, make sure that all the information is available for each patient, to ensure that every, sort of, person that’s involved in a patient’s care gets a say when discussing each patient. Then to make sure that a, a MDT decision is recorded and decided at the end, yeah.

Interviewer: Any particular strengths that you think, that you feel you bring to the MDT?

Respondent: Myself? I think I’m organised, I think I can chair a meeting well, and… I think I’m fairly knowledgeable and fair, probably(?) (coughs).

Interviewer: And do you see your role as being limited to the meetings, so the, whatever, the hour and a half of the meeting on a Friday morning? Or does your role extend beyond that?

Respondent: No(?), because I’m lead for lower GI cancer, my overall role is to ensure that we are, you know, running proper MDTs if you like on both sites. We have two sites and two separate MDTs, and to make sure that both are, are functioning in an appropriate manner.

Interviewer: Fine. Do you have specific time set aside for MDT preparation before the, before the MDT meeting itself?

Respondent: When I was leading the MDT, I would make sure I had about an hour the day before to look through the list and look through any problems. I mean, now, as a core member, I just attend on the morning so I don’t have any other time.

Interviewer: Anything in particular that you think limits your ability to perform your role within the MDT?

Respondent: No (laughter), okay(?), no, yeah.

Interviewer: No, okay, that’s fine. Moving on to your perceptions of your role, how do you know that you are performing your role satisfactorily?

Respondent: (Hums) I think, as a core member… I mean I, I don’t really know, except that I feel that at the end of, you know, and discussion about a particular patient, we, I feel that I’ve had my say and that… the other members that I may want to get advice from have also had their say. So we, we’ve had a very fair discussion and so I, you know, the decision of the MDT that’s recorded, I feel is a, you know, a good outcome for that patient. What else did you ask?
Interviewer: How do you know whether you're performing your roles, kind of, satisfactorily, so?

Respondent: Yeah, as, in terms of performing my role, I, there, there's nothing to measure that. There was nothing to measure when I was chairing the meeting, there was nothing to measure that to say, aside from people, you know, verbally feeding back that the MDT’s great and it works well, we get through the patients and nothing is missed really. But we're not measuring it per say.

Interviewer: So kind of informal feedback?

Respondent: Yeah, yeah.

Interviewer: Okay. Anything that, even within your overall remit as, as consultant surgeon, in the way of formal, either self evaluation or formal external assessment, that specifically focuses on the MDT, so?

Respondent: No, I mean, a, years back when PELICAN ran the, sort of, national MDT programmes, they sent out people to every MDT who looked at our MDT, and they, sort of, I don't know if they scored it but they, they said our MDT was doing well. Obviously there's peer review that looks at certain aspects of the MDT and, and scores us on those outcomes. But there's, there's nothing else really, out there, to, to really ascertain whether the, you know, one's MDT is functioning properly.

Interviewer: Okay. Do you, and do you know of any other tools or any other methods that, that may be of use? Not that, that are not in use at the moment but anything that you, you could use to assess how the MDT functions, how the teams work, overall efficiency(?)?

Respondent: No, I mean, aside from, you know, the things we've been discussing, I don't know of an actual tool or a score that measures MDT function. We have tried doing some work in the past to use CRM positivity as a, as a surrogate marker for the functioning of an MDT for rectal cancer. But, and there's a few papers around that, but I don't know of any other scores, tools.

Interviewer: Okay. In your opinion, what sort of things would be useful to measure? So breaking down the MDT into the actual process of the MDT and, and, sort of, process measures that you could use, things like whether everybody's there. So that's, kind of, the first sort of things. And then the second thing is kind of the outcomes, so you mentioned, for example, using the CRM positivity radar as a surrogate marker. Is there any other, you know, any other things like that that you could, that you feel would be useful in, in measuring and assessing an MDT?

Respondent: I think in, in terms of the process, I mean, when I was chairing the meetings, I had very strong feelings about, if you like, what the, you know, if, if people are attending the MDT and they're a core member, of what they should actually do, i.e., switch off their mobile phones or put them on silent and really focus on the MDT. And that, there, there was, you know, I was quite strict about there being just one meeting and not little meetings in the, in the audience where people are discussing things so you have a... you know. So some kind of tool to, in, in a way, measure things that disrupt an MDT rather than, you know, I, I think we all know of things that can make it run smoothly, that, you know. So, in the process, thing, things that disrupt or... you know, perhaps results aren't there and it's a recurrent problem, that, that sort of thing in the process. In terms of, you know, clinical outcome, I do think rectal cancer is the group of patients where the, a successful MDT could be measured, if you like. For the reasons we've discussed in that, you know, there's a lot, the, the, there's no real clear consensus about how, you know, which patient's getting the urgent therapy, what kind are the urgent therapy, what is classified as a CRM positive, you know, are lymph nodes at this(?), you know. So there's a lot of uncertainty, and, so that, you're kind of begging to
develop a consensus across the board in that field, so, for, for rectal cancer. Yeah, because I think that the colonic cancer’s fairly straightforward most of the time and, you know, lower rectal cancer and rectal cancer, that, that’s the group we really need to focus on.

Interviewer: With that group specifically then, are, are there any particular, as you said, it’s difficult to get consensus nationally, or, or internationally. But are there any particular guidelines that you as an MDT follow, or whether it be international guidelines, or do you have local guidelines for your MDT?

Respondent: We don’t have local (laughter), strict local guidelines, no. We’re very much, it’s almost like every patient is individually assessed. But you, you, you know, if you examined things over a few weeks you’ll probably find some trends in, you know, T3N1s or whatever. But a lot of the time I feel that we, we, we make the decision based on each patient rather than the.

Interviewer: And are you aware of any guidelines that… within the UK or sort of nationally that you could use?

Respondent: No, I’m not, I’m not, nothing’s been published really, or.

Interviewer: Okay. Moving on to kind of specialty groups or, or national, national organisations that would, that may be involved in development of guidelines. What sort of groups would you, as a consultant surgeon, would you see developing these sort of guidelines or?

Respondent: Well I think it’s, it’s a sort of collaboration between the surgeons, oncologists, I mean, yeah, the, the core members basically, you know, surgeons, radiologists, oncologists and pathologists probably, do need to get together and come up with some kind of guidelines.

Interviewer: And are there, are there kind of an existing group of, of core members, so you mentioned the PELICAN group earlier on. Is, is there a, an organisation that involves core group, core group members within the MDT? Because obviously there are specialty specific organisations but is, is there one that involves the whole MDT?

Respondent: Not really, not that I know of, no.

Interviewer: Okay. And finally, moving on to the, the, the actual decisions made, and, and how they are… how they’re, they’re implemented. There are occasions when there is not full agreement within the MDT. What’s your view on discussions in the MDT that don’t have full agreement from the group, so?

Respondent: I mean, I have to say, in our MDT, that’s, that’s pretty rare actually. At the end of the day, the, the, the doctor who’s seen the patient, obviously it’s their responsibility as to the decision that’s made. And they’ll be, often seen the patient so they know what they look like and comorbidities, etc. I mean, I, I seriously cannot remember a time when, you know, the MDT has advised one thing and the surgeon thought something different. At the end of the day, we, we usually go with what the physician, you know, the responsible physician wants. But we’ll always discuss all the other options. But, you know, I don’t think there’s been a time when there’s been any kind of argument about the, the outcome.

Interviewer: In a situation where you had a difference of opinion with what everybody else was saying, would you voice it, as a, kind of a minority in a group, would you, would you?

Respondent: No, I’d definitely voice it. I mean, again, one of the strengths of our MDT is that I, I feel completely safe in doing so, no matter how crazy maybe my ideas may be, I do voice them and see what people think. And I have no fear that people will ridicule it or contest it really.

Interviewer: And in, in the event that there is a problem or, or there are some complications related to treatment, and, and, for example, there are any proceedings against, against the trust as
such. Do you see individual responsibility per clinician, per lead clinician, or collective responsibility for the MDT decision? Any kind of thoughts(?) about that?

Respondent: Yeah, I mean, both. I would, I, you know, I would support any of my colleagues in, if there were such proceedings, I would support them from the point of view of our MDT. I do think it’s our collective responsibility for whatever decisions we’ve made.

Interviewer: Okay, fine. Anything else related to what we’ve talked about that you want to add on to, we’re essentially at an end to the interview?

Respondent: No, I think it’s a very interesting, you know, area to, to look into, because there isn’t any kind of consensus about MDTs. MDTs are sort of central to our functioning and becoming more and more important so I think it would be very helpful to come up with some scores, guidelines on how we do.

Interviewer: Any questions that you have regarding any of this?

Respondent: No, good luck.

Interviewer: Thank you very much, that’s the end of the interview, thank you.

[End of Transcript]
APPENDIX 4 – The Cost of an MDT – Survey

Thank you for agreeing to take part in this survey. Please complete all the responses as accurately as possible, relating to your activities in 2012. Survey results will be anonymised.

1. What is your current specialty?

2. How many years have you been a consultant in this specialty?

3. Are you a core member of this MDT?

4. What was your gross annual salary in the year January to December 2012?

5. Did this include any awards / performance bonuses? If so, to what amount?

6. In an average week, how long do you spend at the Colorectal Cancer MDT?
   a) Under 1 hour
   b) Between 1 and 1.5 hours
   c) Between 1.5 and 2 hours
   d) Over 2 hours

7. In an average week, how long do you spend preparing for the Colorectal Cancer MDT?
   a) Under 1 hour
   b) Between 1 and 2 hours
   c) Between 2 and 3 hours
   d) Between 3 and 4 hours
   e) Over 4 hours

8. On average, over the year, how many MDT meetings did you miss?

9. On average, how many hours / days in a year do you spend on training related to MDTs?

10. What types of training does this include? Do you have to pay for this?

    From your experience,

11. On average, how many patients are discussed per MDT?

12. How long, on average, do you spend discussing one patient?

13. How often do you discuss the same patient again in the next MDT?

14. Have you changed your treatment decision because of the MDT?
    a) often
    b) occasionally
    c) rarely
    d) never

15. Does it happen that treatment of patients gets deferred because of non-attendance of team members?
    a) often
b) occasionally
  c) rarely
  d) never

16. The MDTs lead to better patient outcomes:
  a) agree strongly
  b) agree
  c) not sure
  d) disagree
  e) strongly disagree

Thank you for completing this survey.
## APPENDIX 5 – Validation Questionnaire

### Colorectal Cancer Multi Disciplinary Team meetings

Please read the following list of categories and associated scores & descriptors and rate them according to the extent to which you feel they are suitable for assessing Colorectal Cancer MDT meetings.

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<th>Category</th>
<th>Is this category appropriate to assess quality of Colorectal MDT meetings?</th>
<th>Scores and descriptors</th>
<th>Are the descriptors appropriate for scores allocated?</th>
<th>Additional comments</th>
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<td>Psychosocial issues</td>
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<td>Patient comorbidity</td>
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<td>Patient views</td>
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APPENDIX 6 – Participant Information Presentation (Observational Study)

An evaluation of the functioning and quality of decision-making in Colorectal Cancer Multi-disciplinary Meetings – how can we improve the process?

Primary researcher: Sujay Shah
Co-supervisors: Nick Sedalis, Sonal Arora, Rob Glynn-Jones, Pawan Mathur

Introduction
- Colorectal cancer is the 3rd most common cancer in the United Kingdom
- "Recent" changes to multidisciplinary care
  - Rationalise involvement of all key clinical groups in decision making
  - Multidisciplinary team defined as "group of people of different healthcare disciplines, which meets together at a given time to discuss a given patient and who are each able to contribute independently to the diagnostic and treatment decisions about the patient".
- Widespread use in UK, variable in rest of world
- Limited data on functioning, impact on outcomes

Aims and objectives

- **Aims**
  - To evaluate and assess the functioning of Colorectal MDTs and their decision making
  - To develop methods of assessing outcomes which reflect the appropriateness of MDT recommendations
  - To implement a series of measures aimed at improving functioning, appropriate decision making and continuous self-appraisal of MDT

- **Objectives**
  - To systematically review the current literature on colorectal cancer MDT decision making
  - To translate a pre-existing tool for MDT evaluation for use in colorectal MDT
  - To outline decisions made in MDTs with outcomes
  - To derive surrogate markers of outcomes for MDT from expert colorectal cancer panels
  - To outline a system of feedback into the colorectal cancer MDT and evaluate whether this improves MDT functioning and outcomes

Progress to date – an overview

Systematic review & meta-analysis

- Not enough to draw any conclusions
- Review of 36 articles identified; not specific to colorectal cancer
- Rationale: For colorectal cancer, there is agreement on the need for MDTs

Systematic review – materials and methods

- **Search strategy and inclusion criteria**
  - Medline, EMBASE, Cochrane, PsycINFO, Scopus, Medline in progress
  - Latest update: September 2015
  - English language
  - Observational studies
  - Patients with colorectal cancer
  - Data collection
    - Practice level criteria
    - Systematic review
      - Decision making
      - Functions
      - Implementation
  - Study duration
    - Not always clear

- **Data extraction**
  - Outcomes from the data sheet included
  - Five papers excluded:
    - One included data/MDT meetings
    - Two included data/MDT meetings
    - Two included data/MDT meetings
  - Data was recorded from 73 papers

- **Results**
  - Number of papers identified: 165
  - 5 papers found: not specific colorectal cancer
  - 73 papers included
  - 5 papers excluded
  - Final number of papers: 68
  - Rationale: For colorectal cancer, there is agreement on the need for MDTs

- **Reports**
  - Not enough to draw any conclusions
Impact of MDTs on occurrence of positive resection margins

- Reduction of positive resection margins is one of the primary outcomes when measuring effectiveness of treatments.
- The introduction of MDTs has seen occurrence of positive resection margins decrease – OR 0.33 (0.17, 0.67)

Impact of MDTs on use of MRI/TRUS for staging in rectal cancer

- MRI/TRUS is the gold standard for evaluation of patients with rectal cancer.
- The introduction of MDTs has seen the use of MRI/TRUS increase – OR 7.62 (2.07, 28.02)

Impact of MDTs on 3 year overall survival

- 3 year overall survival is one of the primary outcomes when measuring effectiveness of treatments.
- The introduction of MDTs has seen overall 3 year survival increase – OR 1.81 (1.13, 2.91)

Interview study – materials and methods

- Semi-structured individual interview with a purposive sample of expert MDT members.
- Interview protocol developed and piloted in phases.
- Distilled into a topic guide, consisting of key questions which explored participants’ opinions on the following issues related to Colorectal cancer MDTs:
  - Individual roles and responsibility
  - Evaluation of performance
  - Current methods of assessment
  - Potential measures of assessment
  - Expert consensus

- Interviews utilised MODe: Impact study/interview (Final).
- Emergent theme analysis undertaken.

Interview study – results

- 20 interviews with core colorectal cancer MDT members (5 Surgeons, 5 Radiologists, 3 Oncologists, 3 Pathologists, 3 CNSs).
- Emergent themes included:
  - Individuals were able to clearly define their roles
  - Limitations included time constraints and insufficient information regarding the patient
  - No formal MDT specific assessments are currently in use in colorectal cancer MDTs in the UK
  - Measures of MDT working can be divided into process measures, overall outcome measures and measures of individual performance

Prospective validation study – materials and methods

- Materials:
  - Content validation questionnaire
- Methods:
  - MDT NODe tool and content validation questionnaire: v5.
  - Study task: a single colorectal cancer MDT was piloted in a sample of core colorectal MDT members to make the tool suitable for colorectal cancer.
  - Results utilised to develop a modified version of MDT NODe for use in Colorectal Cancer.
  - The modified MDT NODe was then used to record observations at a single Colorectal Cancer MDT over a number of meetings.
Prospective validation study – results

- The content validity index for MDT MODE was excellent at 0.83, with nearly identical item having high content and face validity.
- The inter-rater reliability was high (ICC = 0.79).
- Regarding quality of information presented:
  - Radiological (mean 3.3, 3/5) was significantly higher than pathological (mean 3.2, 3/5).
- Presentation of patient views (mean 3.1, 3/5) and and prosoplastic history (mean 3.1, 3/5) was significantly lower than pathological (mean 3.4, 3/5).
- Contributions of the surgeon (mean 4.0, 5/5) were significantly higher than contributions of the oncologist (mean 1.44, 0/5) with an intraclass correlation coefficient (ICC) of 0.54.
- A decision was reached in 246/267 cases. In cases where a treatment decision was not reached, absence of a key member of the MDT was noted.

Future studies

- A comparison between self-assessment, observer assessment and impact of combined feedback.

Study design: Prospective observational study
- Research questions: Are different methods of assessment of MDTs comparable?
- Intervention for performance evaluation and feedback to Colorectal MDT.

Study design: Development and piloting of intervention
- Research questions: Can interventions be developed that allow evaluation and feedback to Colorectal MDTs that improve performance?

Which intervention is best? - a study testing different interventions to improve the performance of colorectal MDTs.

Study design: Prospective evaluation of Intervention
- Research questions: Which intervention is best for use to evaluate and provide feedback to Colorectal MDTs?

What next for this MDT?

- No change to current practice
- Period of self assessment (in real time)
- Period of video recording
  - Initial trial / pilot
  - Further 4 weeks
- All videos will be edited to anonymise patient specific data

Questions / comments

References

6. Development, implementation and evaluation of a development and piloting of intervention.
9. National Cancer Foundation website (http://www.cancerresearchuk.org/)

Future studies
- A comparison between self-assessment, observer assessment and impact of combined feedback.