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Environmental Scan and Assessment: MCC Technology Enablers of CCO's MCC Standards

Prepared by: eHealth, Strategy & Innovation

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Acronyms

Acronym	Meaning
ACPGBI	Association of Coloproctology of Great Britain and Ireland
AMIA	American Medical Informatics Association
BaCCS	Bristol Cancer Solution
BSWRICS	Barwon South Western Regional Integrated Cancer Service
CCO	Cancer Care Ontario
CIIMS	Clinical Information and Image Management System
CME	Continuing Medical Education
CRC	Colorectal Cancer
EHR	Electronic Health Record
EMS	Experiment Management System
EMSBE	EMS-Building Environment
GP	General Practitioner
HFN	Hospital File Number
HIS	Health Information Services
iPath	Internet Pathology Suite
JGH	Jewish General Hospital
LHIN	Local Health Integration Network
MCC	Multidisciplinary Cancer Conference, or Multidisciplinary Care Conference
MDM	Multidisciplinary Team Meeting
MDR	Multidisciplinary Rounds
MDT	Multidisciplinary Team
MDTC	Multidisciplinary Team Coorindators
NICE	National Institute for Clinical Excellence
NHS	National Health Service
OASys	Oncology Analysis Systems
OTN	Ontario Telemedicine Network
PACS	Picture Archiving and Communication Systems
PATS	Patient Analysis & Tracking System
PC	Personal Computer
PDA	Personal Digital Assistant
QCCAT	Queensland Cancer Control and Analysis Team
QOOL	Queensland Oncology Online
QOR	Queensland Oncology Repository
RFI	Request for Information
RCP	Regional Cancer Program
SCR	Somerset Cancer Register
VBTB	Virtual Brain Tumor Board
WIRM	Web Interfacing Repository Manager

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Executive Summary

The 2008-2011 Ontario Cancer Plan identifies the need for continued development of Regional Cancer Programs (RCPs) across Ontario to ensure patients get timely access to effective diagnosis and high-quality cancer care. Cancer Care Ontario (CCO) has identified four service goals, one of which specifies that all cancer patients should receive a multidisciplinary review of their care plan.

To facilitate the creation of multidisciplinary cancer conferences (MCCs) in Ontario, CCO established the MCC Implementation Planning Project. Under the leadership of CCO's Clinical Programs and Surgical Oncology Program, the MCC Implementation Planning Project was tasked with the following:

- Understand the gaps in current compliance with CCO's MCC standards
- Develop an implementation and evaluation strategy for improving access to MCCs in Ontario, including an understanding of the costs and timelines
- Help facilitate enhancements to existing MCCs and establish new ones
- Initiate a knowledge exchange strategy to increase coverage of MCCs
- Develop indicators to monitor uptake and impact

The MCC Implementation Planning Project recognized that technology could facilitate and support achievement of these objectives. In order to understand its potential, representation from the CIO Portfolio's eHealth Strategy and Innovation Team and the Project Management Office were asked to complete an environmental scan of the current status and availability of technologies that could be used to support MCCs.

The environmental scan examined the availability, barriers, and enablers of MCC technologies, as well as data collected for measurement and monitoring of MCCs by hospitals and central organizations. The objective of the scan is to inform discussions at a MCC workshop taking place in Toronto on November 24, 2008 and to develop a provincial strategy for evaluating and implementing MCCs in Ontario.

The environmental scan commenced with a literature and internet (Google) search to identify and understand the current landscape of technologies that have been developed and are being used to support MCCs internationally. The search for published literature was conducted primarily through two research literature databases (Ovid MEDLINE and PubMed). Searches were limited to English-language articles published during or after the year 2000. Websites were identified by using the same search terms as for the literature review. The search focused on technologies that support one or more of the meeting processes (pre, during, post), are easy to implement, have low integration needs and costs. Of particular interest was the technologies' ability to support the submission

of data to a central organization. The search resulted in 27 relevant articles and two conference abstracts. Five tools had the ability to provide centralized tracking of data. Seven tools were used to facilitate the administration and coordination of MCC meetings. Four tools provided web or videoconferencing functionality for MCCs to occur across diverse geographical areas.

The literature and internet scan informed the list of potential interviewees. An interview guide and questionnaire were developed. 13 interviews were conducted with representation from 16 sites. These interviews and supplementary email communications provided further information and details on the technologies, adoption and implementation strategies, barriers, enablers, and lessons learned.

The interview transcripts and supplementary documentation were then analyzed using a Grounded Approach to identify prominent and common themes and to answer the following questions.

1. What are the barriers and enablers of MCC technologies, and what adoption strategies are recommended?
2. What technology options are available for MCCs?
3. How can technology support the measurement of compliance with MCC standards?
4. What are some key considerations for the RCPs, CCO and the MCC Implementation Planning Project Team as they move forward to develop a provincial strategy for evaluating and implementing MCCs?

Six central themes emerged around the implementation of technological solutions to support MCCs. These themes are identified below. Other non-technology critical success factors, suggestions, and lessons learned for successful execution of MCC meetings were identified and recorded.

Theme	Definition
1. Benefits of the tool	The perceived advantages that the tool confers to its users
2. Outcomes of the data	The uses of the data generated by the tool
3. Enablers of adoption	The factors that facilitate the adoption of the tool
4. Barriers to adoption	The factors that hinder the adoption of the tool
5. Adoption strategy	Critical success factors to influence physicians and administrators to implement and use the tool
6. Integration	The degree of integration of data between MCC tools and HIS/EHR systems

Six of the most relevant tools identified are profiled in this report. The profiles describe how the tool is used during each phase of the MCC meeting (pre, during, post), its benefits and challenges, and the functionality changes that have or might be made. Seven other tools are also described; these tools could be of interest to some hospitals.

1. Introduction

1.1 Purpose of Report

This report presents the results of an environmental scan and assessment of Multidisciplinary Cancer Conference (MCC) technologies completed for the MCC Implementation Planning Project by the CIO Portfolio's eHealth Strategy and Partnerships Team in collaboration with the Project Management Office.

The environmental scan and assessment of MCC technologies was undertaken to better understand the potential of technology to enable hospitals to follow CCO's MCC Standards [1].

Specifically, this environment scan assessed the following:

- Current availability of MCC technologies
- Barriers and enablers of using available MCC technologies
- Data currently collected using MCC technologies

As technology cannot be separated from the business context in which it is implemented, this report includes a discussion of broader barriers and enablers of MCCs.

The findings in this report will inform discussions at the November 24th workshop on the future direction of MCCs in Ontario. The aim of this workshop is to develop a provincial strategy for the next steps in evaluating and implementing MCCs.

1.2 Overview of Report

This report is organized into five key sections:

Background:
Provides an overview of the context for the environmental scan and assessment of MCC technologies, including the origin and goals of the MCC Implementation Planning Project and an overview of the phased approach used for the environmental scan and assessment of MCC technologies.

Phase I – Literature and Google Scan
Provides a high-level overview of the extent and types of tools being used to support and facilitate MCC meetings

Phase II – Key Informant Interviews
Describes the key informant interview methodology, including how interviewees were selected and the interview guide was developed.

Phase III – Analysis
Describes the key findings related to the use of technology to support MCCs that emerged from the key informant interviews. A number of additional factors that did not relate specifically to the use of technology but to the running of successful MCCs are also discussed in this section.

This section of the report also contains in-depth profiles of sites that use technology to support their MCCs, and outlines the data elements that are collected or displayed by MCC tools identified by the environmental scan.

Key Considerations
Describes the reasons why hospitals embrace technology to support their MCC meetings and discusses the points that need to be considered when selecting and implementing technology.

2. Background

2.1 Multidisciplinary Cancer Conferences

A Multidisciplinary Cancer Conference or Multidisciplinary Care Conference (MCC) is defined as a regularly scheduled meeting where health care providers prospectively review individual cancer patients and make recommendations on best management, keeping in mind that individual physicians are responsible for making the ultimate treatment decision.

The primary purpose of the MCC is to ensure that all appropriate diagnostic tests, all suitable treatment options, and the most appropriate treatment recommendations are generated for each cancer patient. Other purposes include providing a forum for continuing education of medical staff and health professionals, contributing to patient care quality improvement, the development of standardized patient management protocols, innovation, research, participation in clinical trials and linking regions to ensure appropriate referrals and timely consultation and to optimize patient care. An MCC differs significantly from rounds or a mortality and morbidity conference as it is a prospective case review and multiple disciplines provide their input into the treatment offered.

Organizations and tools identified through the literature review and Google search sometimes referred to MCCs as tumour boards, case conferences or Multidisciplinary Team Meetings (MDT). For the purpose of this report, the term MCC will be used as the general term, except when specific tools are described.

2.2 MCC Implementation Planning Project

The 2008-2011 Ontario Cancer Plan identifies the need to continue to develop Regional Cancer Programs in every local health integration network (LHIN), to ensure timely access to effective diagnosis and high-quality cancer care. To support regional development, CCO has identified four service goals, one of which is that all cancer patients benefit from a multidisciplinary review of their care plan.

To facilitate the creation of multidisciplinary cancer conferences, CCO established the MCC Implementation Planning Project. Under the leadership of CCO's Clinical Programs and Surgical Oncology Program, the MCC Implementation Planning Project was tasked with the following:

- Understanding the gaps in current compliance with CCO's MCC standards
- Developing an implementation and evaluation strategy for improving access to MCCs in Ontario, including an understanding of the costs and timelines

- Helping to facilitate enhancements to existing MCCs and establish new ones
- Initiating a knowledge exchange strategy to increase coverage of MCCs
- Developing indicators to monitor uptake and impact

The MCC Implementation Planning Project identified that technology has the potential to facilitate and support achievement of these objectives. In order to understand this potential, the MCC Implementation Planning Project team requested an environmental scan and assessment of current MCC technologies from CCO's CIO Portfolio.

2.3 Environmental Scan and Assessment of MCC Technologies

2.3.1 Overview of Approach

A modified version of Donabedian's structure-process-outcome model, as employed by Ayse Gurses and Yan Xiao in their 2006 literature review of multidisciplinary rounds and information tools, was used to structure the environment scan and assessment of MCC technologies:

1. Structure: information tools used
2. Process: how the tools are used
   - Pre-rounds
   - During rounds
   - Post rounds
3. Outcomes: clinical outcomes, indicators and efficiencies gained by using the tools

The environmental scan and assessment focused on availability of technologies to support meeting administration, facilitation, and outcomes:

Pre-MCC: Meeting Administration

- Technologies that support the administrative set-up of MCCs (e.g., submitting cases, scheduling meetings), and the storage and retrieval of relevant data and images to support discussion and decision making.

During-MCC: Meeting Facilitation

- Technologies that support discussion and decision-making during MCC meetings, including video- and web-conferencing, the presentation of relevant information, and the recording of discussions, decisions and action items.

Post-MCC: Meeting Outcomes

- Technologies that support the management of decisions post MCC discussion (e.g., measuring patient outcomes) and facilitate patient follow-up.

Outcomes

- Technologies that collect data to measure and monitor MCCs against guidelines and standards, the effectiveness of MCCs and their contribution to patient care.

2.3.2 A Phased Approach

The environmental scan and assessment of MCC technologies was completed in three phases.

Phase I: Literature and Google Scan

A literature and Google scan was conducted to identify and understand the current landscape of technologies that have been developed and are being used to support MCCs. The search focused on identifying technologies that support one or more of the meeting processes (pre-, during-, post-MCC), are easy to implement, have low integration needs and have a low cost. Of particular interest was whether the technologies support the submission of data to a central location/agency.

Phase II: Key Informant interviews

Interviews were conducted with representatives (n=16) from thirteen sites to better understand the technologies being used to support MCCs, including impact, barriers and enablers

Phase III: Analysis

The interview transcripts and documentation on the corresponding technologies provided by the interviewees were analyzed to understand the role of technology in enabling MCCs and supporting CCO's MCC Standards.

In particular, the analysis sought to answer the following four questions:

1. What technology options are available for MCCs?
2. What are the barriers and enablers of MCC technologies, and what adoption strategies are recommended?
3. How can technology support the measurement of compliance with MCC standards?
4. What are some key considerations for the RCPs, CCO and the MCC Implementation Planning Project as they move forward to develop a provincial strategy for evaluating and implementing MCCs?

3. Phase I – Literature and Google Scan

3.1 Literature and Google Scan Methodology

3.1.1 Literature Scan Strategy

The search for published literature was conducted primarily through two research literature databases (Ovid MEDLINE and PubMed). Searches were limited to English-language articles published during or after the year 2000. The search-term categories shown in Table 1 were used in various combinations.

The purpose of the literature search was to understand the extent to which technology is currently being used to support MCCs, to identify technologies that were developed to support MCCs, and to identify hospitals and organizations using these technologies to support their MCCs.

Table 1: Search-term Categories

Category 1	Category 2	Category 3
• Multi-disciplinary (multidisciplinary) Case Conference • Multi-disciplinary (multidisciplinary) Cancer Conference • Tumour (tumor) boards • Tumour (tumor) rounds • Multi-disciplinary (multidisciplinary) teams	• Technology • Tools • Software • System • Web • Online • IT • Information Technology • Database	• Reporting • Tracking • Indicators • Coordinating • Facilitating • Summarizing
Category 4	**Category 5**	**Category 6**
• Enablers: - of technology - coordinators - financial support - administrative support • Barriers	• Compliance/Accountability • State/Province/Nation/Country • Repository/reporting • (Centralized) tracking system	• Patient Care

After an initial scan of the literature, additional articles were identified from the bibliographies of relevant articles, targeted author searches and by scanning the conference proceedings from the American Medical Informatics Association (AMIA).

In total, 81 articles and three presentation abstracts were selected for a more detailed review. Of these, 27 articles and two conference abstracts, which are summarized in Appendix 3, were most relevant.

3.1.2 Google Scan Strategy

The Google search was conducted using the same search terms identified in Table 1. Websites of organizations and technologies that were identified in the literature search were also reviewed. The purpose of the Google search was to gain more recent information on technologies already identified through the literature scan, gain a more complete understanding of these technologies, as well as to find information on MCC technologies that had not been published.

3.2 Literature and Google Scan Findings

3.2.1 Overview

Of primary interest to CCO is the ability of the technologies to assist in the measurement, evaluation and tracking of MCCs provincially, including the submission of data to a central provincial organization, like CCO. Along with CCO's mandate to help hospitals select and implement technologies to facilitate their own MCCs, CCO's mandate is to track the use of MCCs across Ontario and collect data for measuring quality indicators such as clinician/specialty attendance and how MCCs influence treatment decisions.

The following section provides a synopsis of some of the tools identified in the literature and Google scans that have been used to facilitate and manage MCC meetings. The selected articles and websites focus on tools used to support MCCs, tele/videoconferencing barriers and enablers, and the collection of regional data.

3.2.2 Current Landscape

The literature and Google scans identified a diverse range of software and systems being used to support MCC meetings. Some tools are focused on bringing people and sites together, while others manage the meetings themselves (i.e. coordinate tasks before and during the MCCs).

Information was found on technologies in Australia, Canada, England, France, Germany, Ireland, Scotland, South Africa, Sweden, and the United States. The technology solutions ranged from locally-developed MS Access databases to comprehensive systems integrated with a hospital's HIS and EHR [3, 4, 5, 6, and 7]. Web-based tools were identified at a number of sites [8, 9, 10, 11, 12, and 13]. Where hosted on a web-server,

no client software is needed other than a web browser, making it easier to for physicians to participate in MCCs at remote sites.

Overview of tools used to bring people and sites together

There was no geographical limitation in the scan. Information was found on technologies in Australia, Canada, England, France, Germany, Ireland, Scotland, South Africa, Sweden, and the United States.

In England [4], a trust-wide database was developed to allow for easy registration and tracking of patients. Patient case lists are automatically created by the database and sent to the pathologists and radiologists as work lists in advance of the meetings. Treatment decisions were also recorded in the database at the MCC meetings. This trust-wide database has opened communication channels across specialties and reduced delays in having cases discussed at the meetings, ultimately improving patient outcomes by reducing referral to treatment waiting times.

Another site in the US [14] runs a virtual web-based brain tumor board to enable physicians around the world to collaborate on challenging cases. Physicians can earn continuing medical education (CME) credits, submit cases in advance for discussion during live review, email questions to be answered during the live event, get a fast-paced case evaluation in real-time, and review the discussion from the online archive.

Overview of tools used to manage MCC meetings (before and during MCCs)

Many studies support the use of information tools for multidisciplinary rounds to improve communication processes and outcomes and to support collaborative work in health care settings. Computer-based tools can extract information from existing clinical information systems thus reducing manual copying of information. One study reported that decisions made during rounds were entered directly into patient records to avoid inputting duplicate information afterwards. Other studies are even examining the use of wireless tablet personal computers (PCs) and personal digital assistants (PDAs) to review patient information and input decisions during rounds [2].

At the 2001 Fall AMIA Symposium, a group from the US (University of Washington) highlighted a tumour conferencing tool, developed mostly with open source software, used for regional cancer care. Documents and images are uploaded onto the website by physicians in advance of the MCC and include pathology and radiology images, slide decks to lead the discussion, and links to a range of websites. Each participating location can then log into the website and view all the documents and images during the MCC. This web-based system is used in conjunction with videoconferencing to improve the visibility of documents for physicians in remote locations [10].

Another online tumour conference was developed in Germany for gynecological cancer patients. To participate in online discussions, physicians log into online sessions via the Internet. All patient data is prepared on PowerPoint slides by a tumour conference manager (physician in training) who also organizes the conferences, screens new patients and monitors the updates of international guidelines and standards [12].
A unique healthcare applications vendor in the UK, 4S Dawn, developed a web-based MDT meeting software called Dawn MDT. The software creates patient lists, sets up new and recurring meetings, organizes investigation work for the meeting, records diagnosis, staging, treatment decisions and follow-up actions, has an audit trail of decisions and actions taken, records attendees, emails information to attendees, records trial involvement, and has searching and reporting functionality.

Another UK product, Infoflex, is designed for modeling information and workflow processes across departments and organizations [3]. The Infoflex toolset has a cancer module, ideally suitable for MDT meetings. It supports patient tracking and monitoring including cancer wait times and patient pathways, supports MDT meetings, is a full clinical operational system designed to work with local clinical work processes, is configurable to meet all local information requirements, has reporting and analysis functionality, includes a full audit trail, and integrates with third party systems.

The Australia Queensland Co-operative Oncology Group developed an information system, Queensland Oncology Online (QOOL), to consolidate data from various locations and disciplines that is useful during MDT meetings [15]. QOOL tracks patients and conferences, provides clinicians with the ability to upload patient information for discussion during a meeting, records decisions, and includes post-meeting data analysis.

The literature and Google scan also found software that could be useful for clinicians during MCCs but are not necessarily developed for MCCs. These tools include decision aids [16] and radiology imaging systems [8].

Overview of telemedicine/videoconferencing solutions

Telemedicine generally refers to the use of communications and information technologies for the delivery of clinical care [17]. This report focuses on the use of videoconferencing to facilitate participation and discussion during MCCs. Findings on videoconferencing solutions are kept at a high level as this topic could be the focus of an entire scan on its own.

In Ontario, hospitals within the Regional Cancer Programs (RCPs) have access to the Ontario Telemedicine Network (OTN) for videoconferencing solutions. For this reason, this report focuses on the barriers and enablers of telemedicine and videoconferencing as well as the efficacies of using videoconferencing for MCCs. It should be noted that findings are kept at a high level as these topics could be the focus of an entire scan.

User perspectives on using videoconferencing for MCCs

Telemedicine appears to be a popular option for dispersed MCCs to support the display of relevant images and data [18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29]. The Scottish Telemedicine Project recently completed a cluster randomized trial to assess the use of telemedicine in multidisciplinary breast cancer decision making [30]. The study found that inter-regional breast cancer MDTs supported by telemedicine are clinically effective. Another study in Scotland found that participants were mostly positive about videoconferencing, especially if they had previous telemedicine experience. However, some allied health professionals and nurses had concerns about the size, duration, efficiency, and location of the meetings, leadership during the meetings, audio quality, and the process through which participants interact [25].

A study in Australia compared videoconferencing and face-to-face MCCs. Face-to-face meetings were informal and conducive to open discussion, while videoconferences were more formal and regimented. Doctors were less willing to display uncertainties, and addressed the cameras rather than each other. Results about increased attendance were mixed. Although videoconferencing allowed physicians to participate and attend MCCs from remote locations, there were other challenges that discouraged some from attending which need to be addressed (e.g., seating arrangements, training on equipment) [21].

Ontario surgeons participating in videoconference oncology rounds reported satisfaction with the format. Strategies for improving the conferences included: “more didactic teaching” and “less opinion, more facts”. One participant suggested that presenters be “encouraged to speak more loudly” and be more observant of “raised hands” of other participants [29].

The Research Councils in the UK have had success with videoconferencing but recommend that medical images and data be stored in distributed computers viewable from each site to maintain high quality.

Examples of central data collection systems

The literature and Google searches did not identify much on the use of technology to assist in the measurement, evaluation and tracking of MCCs across a jurisdiction. Only two articles [5, 6] mentioned central collection of data. Both examples are based in the UK and utilize home-grown, MS Access databases. Central data tracking in the UK appears to be successful because of government imposed mandates and the National Health Service (NHS) Cancer Plan goals to reduce wait times from referral to treatment.

One of the examples of central data tracking in the UK is a head and neck oncology database. MDT meetings are required for all cancer patients; however the incidence of head and neck cancers is quite small. Cancer care in the UK, like in Ontario, is centralized within regional units, but it is difficult to organize MDT meetings with the necessary specialists and institutions involved in the patients’ care around the country. A

trust-wide database was recommended to track patients. This MS Access database, available over a secure internet site, led to improved workflow planning, more patients being processed more quickly, and reduced wait times from referral to treatment. It allowed clinicians to register their own patients for MDT meetings, created work lists for pathologists and radiologists, produced weekly patient lists automatically, and recorded treatment decisions [5].

Informing Phase II

The purpose of the literature and internet scan was to understand the extent to which technology is being used to support MCCs, and to identify hospitals and organizations currently using technology tools. From the literature and internet scan results, organizations were identified as potentially being able to inform Ontario's use of technology to support MCCs. These organizations were contacted and invited to participate in a telephone interview.

4. Phase II: Key Informant Interviews

4.1 Methodology

Telephone interviews were conducted with 16 representatives from 13 sites in the US, Canada, the UK, and Australia. Of the 16 participants, eight were physicians, while the other eight were clinicians or administrators who work closely with MCCs.

A purposeful sampling approach was used to select interview participants that would capture the range of technologies currently being used to support MCCs. Interview participants were identified through the literature and Google scans and through the MCC Implementation Group. The list of interview participants is provided in Appendix 1.

The interview guide, developed in consultation with the MCC Implementation Planning Project, was developed to understand the impact of choosing a technology solution to support MCCs along with key enablers and barriers. Following the telephone interviews, individuals were sent a follow-up email survey. The survey questions were designed to capture basic features of and requirements for MCC technology solution Participants were also encouraged to send supporting documents (e.g., reports, presentations). A copy of the interview guide and the survey are provided in Appendix 1 and Appendix 2, respectively.

5. Phase III - Analysis

5.1 Methodology

In Phase III of the environment scan and assessment, the project team analyzed the results of the interviews, along with additional documentation provided by the interview participants and through the literature and Google scan.

A Grounded Approach [31] was used to analyze the interview data. To facilitate this analysis, the interviews were taped and transcribed, and notes were taken during the calls. Three transcripts were independently read by three team members to identify prominent themes. Two of the three members then met to review and discuss themes identified and resolve any differences in interpretation. From this discussion, a final draft framework was developed to analyze all interviews. This draft was reviewed with representatives from the MCC Implementation Planning Project. Following their review and feedback, a final framework was developed and one member of the team then used this framework to analyze the remaining interviews.

The analysis in Phase III sought to answer the following four questions. The resources available in this report that address each question are also detailed below.

1. What technology options are available for MCCs?
2. What are the barriers and enablers of MCC technologies, and what adoption strategies are recommended?
    - The responses to questions 1 and 2 can be found in Sections 5.2.1 and 5.3, which consist of the themes that emerged from the key informant interviews and detailed profiles of six technologies and sites, respectively.
3. How can technology support the measurement of compliance with MCC standards?
    - This question is addressed by Section 5.4, which discusses the data elements that are collected or displayed by the various MCC support tools found in this environmental scan.
4. What are some key considerations for the RCPs, CCO and the MCC Implementation Planning Project as they move forward to develop a provincial strategy for evaluating and implementing MCCs?
    - Section 6 is devoted to the discussion of some of the key considerations related to the benefits of technology, as well as the selection and implementation of tools to support and enable MCCs

5.2 Interview Themes

5.2.1 Common Themes

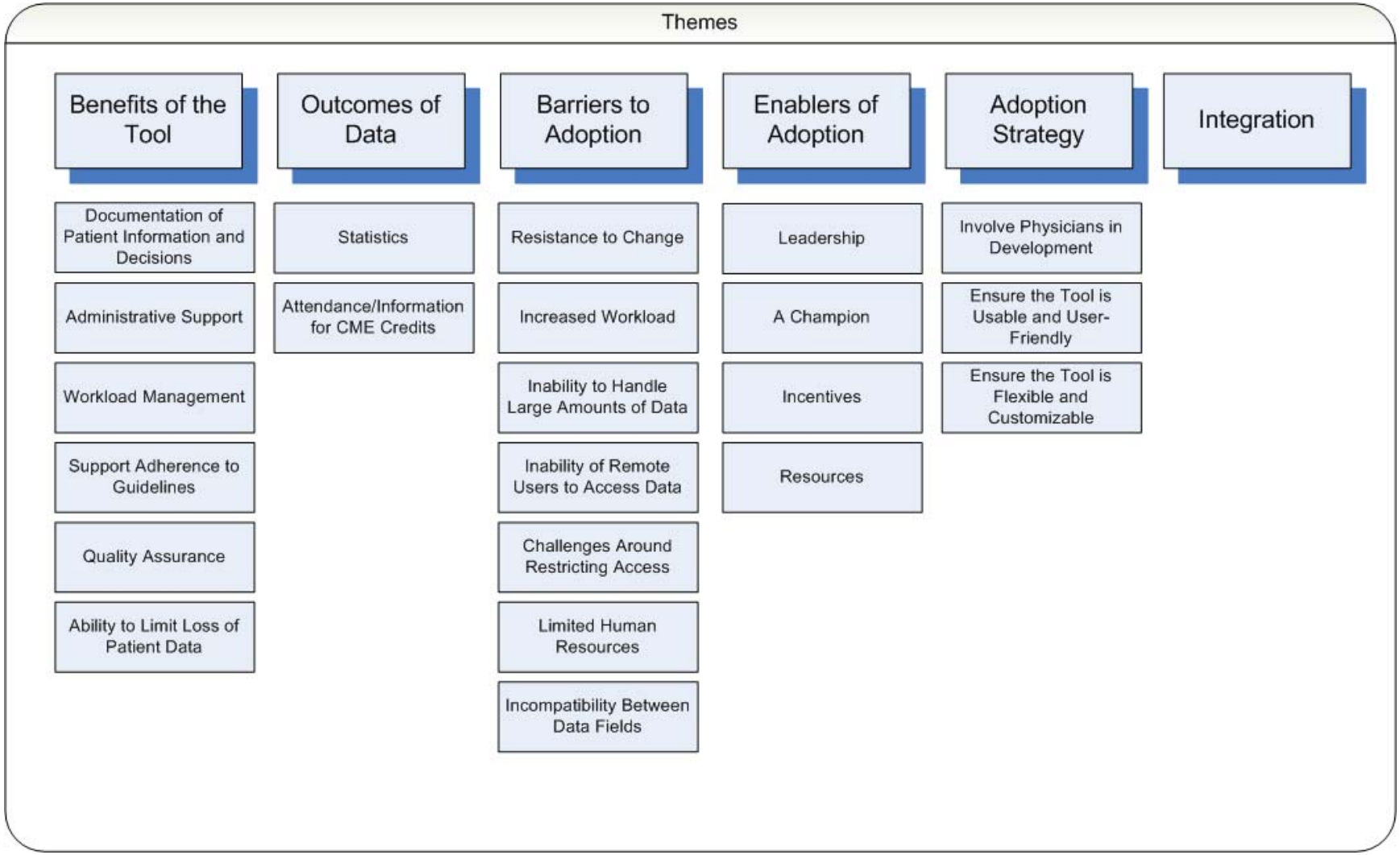
From the 13 interviews held, six central themes emerged around the implementation of technological solutions to support MCCs. These themes are identified and defined in Table 2.

Table 2: Definition of Themes

Theme	Definition
1. Benefits of the tool	The perceived advantages that the tool confers to its users
2. Outcomes of the data	The uses of the data generated by the tool
3. Enablers of adoption	The factors that facilitate the adoption of the tool
4. Barriers to adoption	The factors that hinder the adoption of the tool
5. Adoption strategy	Critical success factors to influence physicians and administrators to implement and use the tool
6. Integration	The degree of integration of data between MCC tools and HIS/EHR systems

Figure 1 illustrates the above central themes as well as their key sub-themes.

Figure 1: Table of Themes



1. Benefits of the Tool

Most participants indicated that the principal advantages of the various meeting support tools included their ability to document patient information and decisions, lend administrative support, and help manage the workload of those involved in MCC meetings. In particular, eight participants noted the ability of the tool to provide broader access to documentation.

> *"You can participate any where. So if you're on the road you can still participate in the meeting because all you need is internet and then your laptop".*

> *"It's not stored in a vault somewhere and…it's available to everybody on the internet."*

Many of these same participants also discussed the benefit of having a tool that streamlines administration during the meetings and automates administrative support.

> *"You enter the data once and then in order to run your MDT you get information out of your database basically as a report."*

Another benefit, highlighted by five sites, was the ability to more systematically manage the workload of clinicians, secretaries, and specialists using these tools. It allows individuals to stagger their responsibilities each week, thereby reducing stress and ensuring sufficient time to prepare for each meeting.

Another five locations, including two from the aforementioned group, mentioned that informing general practitioners (GPs) of treatment decisions made during the MCC was one of its central benefits.

> *"[can] output from the system… a GP or consultant letter; [a] summary letter of the discussion that was had at the meeting"*

Participants from three different sites indicated that a benefit of MCC support tools is the ability to promote the adherence to guidelines. This is accomplished by providing clinicians easy access to local and international treatment guidelines, helping hospitals meet national treatment and wait time targets, documenting cases where guidelines are not followed, and using information from the tool to inform future guidelines.

Other benefits of the MCC tools discussed by participants included:

- Quality assurance capabilities
- Ability to ensure that information and decisions are documented

> *"There are decisions being made and physicians report these on pieces of paper and put them in their pockets, but there is no actual documentation of the discussion."*

> *"In other words, if you pull a case, you will see that the case was discussed on this day, the decision was this…and then you'll see a list of physicians who attended the discussion."*

- Ability to limit the risk of losing patient data

> *"As one can imagine, untraceable sheets of papers cannot provide for the best quality improvement initiatives in healthcare."*

2. Outcomes of the Data

Just under half (n=5) of the sites interviewed discussed that the tools could support the generation of statistics. Indicators and statistics produced by the tools varied by site, but include information about:

- cases being treated according to MCC treatment decisions
- cases meeting national treatment guidelines
- physicians' outcome compared to national standards
- hospital performance against national standards

> *"We…have a meeting once a year… [where] we pool our database and instantly produce everybody's leak rates, death rates, survival rates, complication rates etc., so you can compare people to each other and to national standards and we could not do that in the past."*

Another data outcome identified by four sites was the ability of the meeting support tools to take attendance and track hours for CME credits.

3. Enablers of Adoption

Participants from four sites identified leadership as a key enabler for the adoption of a MCC meeting support tool. The presence of a committed, dynamic, and respected leader helped in the successful implementation of meeting support tools.

> *"Key thing is the group leader. The group leader has to be there, be an inspirational lead and yet get people rallied around."*

Participants also mentioned the importance of having a champion and providing training for clinicians and MCC coordinators.

Interviewees from two sites provided input on factors that facilitate the adoption of central data tracking: the use of national statistics as an incentive and peer comparison of treatment outcomes between hospitals or to national audits. Moreover, one of these sites supported the use of a financial incentive to encourage wider compliance with the requirements of submitting data to a central organization.

Four sites discussed factors that could increase adoption of videoconferencing technology. Three of them stated that strong IT resources, encompassing both equipment and personnel, and a good infrastructure were important. The presence of a champion was also identified as an enabler by two sites.

> *"For sites outside of the center, we [identified] a champion to bring the surgeons into the fold to mobilize the network".*

4. Barriers to Adoption

The barriers to the adoption of MCC support tools varied by site, and included limitations of the tools and problems experienced with or by the staff at the interviewed facilities. Three sites indicated that one of the key barriers to adoption is resistance to change among physicians at their facilities.

> *"Even though…clinicians… understand the [tool] could help them… they're very busy and it's hard to get them to change. They've got systems in place even if they've got bits of paper everywhere; it's a system …and they know it and …its hard work to get them to change".*

Other barriers mentioned included the following:

- increased workload for physicians
- inability of the tool to handle large amounts of data

- inability for remote users to access the tool or the data
- challenges with restricting access to authorized users only
- limited human resources

The barriers to central data tracking were discussed by two participants, who both stated that the incompatibility of data fields between local and national databases could create a notable challenge to adoption. When data fields are ill-aligned between the two data sets, a significant amount of work may be required to change the format of the information before it can be exported.

> *"[We should] have a routine where our database would actually feed into the national one; it doesn't. So what I do is I transfer the data into an Excel format, I then look at the fields and the national database and…re-code them into what the national one [requires] from our database and then turn it into a CSV file [for transfer] to the national [database]".*

These participants also discussed how changes to national data requirements can add work and be disruptive to established processes.

Finally, the factors hindering the adoption of videoconferencing technology differed from those affecting either the MCC support or the central data tracking tools. Five sites noted poor image or audio quality as a challenge facing the uptake of videoconferencing technology. For two sites, the lack of a dedicated room with the necessary Telehealth and PACS equipment was also a considerable barrier to adoption.

> *"We don't have a dedicated room in our facility where we can hold the rounds which has Telehealth and PACS and is a reasonable place to meet"*

Differences in operating hours and the lack of communication between the Telehealth staff and the clinicians were also cited as factors that could restrict the adoption of videoconferencing. Two other sites focused on how cultural and social differences among participants can cause unique mannerisms and videoconferencing etiquette issues. Nevertheless, these were typically overcome by having experienced camera operators and a strong meeting moderator.

5. Adoption Strategy

Interviewees from six sites provided suggestions for an adoption strategy of MCC support tools. Of these, four sites centered their feedback on the importance of having a tool developed by an individual or team that understands the MCC process.

> *"Software [should not be] developed by someone who doesn't have a truly in-depth understanding of how the process works. It needs to be done ideally by a doctor who works in this set-up pretty much all the time."*

> *"We work very closely with the clinicians. So we built the tool around their requirements…So that gives us a good relationship with the clinicians on the ground".*

Participants from four sites, including two of the sites mentioned above, stated that MCC support tools should be user-friendly and practical for clinicians, specialists, and MCC coordinators.

> *"Software needs to be sufficiently user-friendly"*

> *"Some clinicians who aren't good on computers can still …add patients onto the agenda. It's very simple and easy to use …and if you have extra things that you want to add into the system, it's easy enough."*

Participants from two sites discussed the adoption strategy for a central data tracking tool. Similar to the MCC support tool adoption strategy, one of these sites focused on the importance of having a tool that is flexible, customizable, and useful to the end-users.

> *"Give people local control on how to modify things… [if they] own it they would use it"*

The second site also suggested that the tool could highlight the fields containing the data to be sent to the central location in a different colour to make them more visible.

6. Integration

Integration of MCC support tools with hospital information systems (HIS) and electronic health records (EHRs)—a key issue for RCPs and the health care system in general—varied notably by site. Interviewees from five sites provided feedback about the integration of these elements within their facility; however, no consistent approach was identified.

One participant pointed out that attempting to create links between existing hospital systems can be a challenging process.

> *"We tried to get innovative to see if there is a system by which this list can be populated automatically by linking it to other systems in the hospital, like the out-patient clinic… That was a mess; it just doesn't work…. Say [there is] a patient with rectal cancer. [That] patient …is registered in the hospital system as [having] rectal cancer. If this patient came back later on, no matter why, the system still identifies them [as having] rectal cancer. So, [even] if the patient [comes to] the liver clinic…because 10 years post-operatively has metastasis to [the] liver; the system [will] still see him as a rectal cancer patient…and he will be uploaded in the rectal tumor site and not in the liver. So, it just doesn't work; it will not work."*

In this case, the difficulties outweighed the potential benefits, and the initiative was abandoned.

The Jewish General Hospital has linked their EHR with their tumour board file. This was accomplished with support from a local vendor, and depended on strong information technology and human resources at the hospital. Although it took a long time to develop, having an integrated, paperless system permits a significant amount of communication to occur through electronic notes.

Although in different stages, two sites are involved in linking their MCC support tools with national pathology systems. In Queensland, a number of different systems export data to the central oncology registry, which feeds the MCC support tool. As a result, stage, treatment, and death data from other electronic sources can be added to a patients' diagnostic record. The primary laboratory information system supporting Queensland Health, AusLab, will also be linked in to the oncology registry.

> *"Data goes into the backend - so into the oncology repository. We're hoping that it decreases the amount of data entry for…clinicians by having it automatically linked…If you put some information in one system, when you log into the profile of the patient in QOOL, it would automatically be linked in."*

The MCC support tool used in North Bristol Trust is integrated with its eReferral system, which populates demographic information through referrals. The team at North Bristol Trust is also looking to integrate with the main pathology system so that histology and pathology information is automatically populated. This would eliminate the need for clinicians to cut and paste report data into the appropriate fields.

5.3 MCC Technology Profiles

This section includes profiles of six sites and the technologies that they use to support MCCs. These sites were selected to demonstrate the range of technical options available as well as illustrate key impacts, benefits, barriers and enablers.

Table 3: Tool Profile - Sunnybrook

Sunnybrook
Background Information
Name of Site: Sunnybrook Health Sciences Center *Type of Tool:* Customizable Microsoft Access 2003 database, available on a shared drive with different versions for different disease sites. *Developed by:* Dr. Mahmoud Khalifa *Implemented:* April 2005
Before the meeting • Physicians email or fax cases to the Cancer Center secretary, who uploads the relevant information into the list for the meeting. Alternatively/concomitantly, scheduled patients in the "new patient clinic" can also be added by the Cancer Center secretary. • A list is generated in PDF format and sent by the Cancer Center secretary to members of the tumor board prior to the intended session. Patients are listed by their initials. • Diagnostic services (pathologists and radiologists) have the opportunity to enter their findings (images and/or text) prior to the session.
During the meeting • On the day of the MCC, physicians' attendance is recorded for CME credit. • Participants navigate between patients details from an on-screen list while the meeting coordinator documents their discussions and decisions (see Figure 2) • At the end of the discussion on each case, a collective management decision is made and recorded. The presence of attendees at the time of decision making is also documented. • Once the MCC session is over, no one can modify the recorded data. Data can only be seen (read-only) in a report format which also lists the names of physicians who participated in the discussion.
After the meeting • Cases/patients can be looked up by name, hospital file number (HFN), or caring physician who presented the case for discussion. • If a physician wants to discuss a case again due to new findings, any member can re-call the case and have another round of discussion, without modifying the previously recorded data. A new record will be added. • Every time a report is generated on a case, all sessions and discussions are included. • Quality assurance (QA) reports are automatically compiled to monitor cases where MCC decisions did not follow guidelines, indicating the reasons; QA reports can also be run to indicate cases where the multidisciplinary discussions significantly changed the physician's treatment decisions. • The physician most responsible for the patient's care documents the MCC decisions in the patient's chart.

Key Benefits

- Uniform and consistent documentation of MCC meeting discussions
- Built-in queries to measure quality indicators
- Digital data for easy and secure archiving and retrieval
- Record of physician participation in decisions
- Monitoring of care such as the rationale for not following clinical guidelines, proportion of cases where MCC discussions altered diagnosis, cancer stage or treatment plans
- Repository of data for future quality improvement projects
- Record of CME credits for physicians

Ongoing Challenges

Housing the database on the hospital intranet

- Limits accessibility to remote physicians and facilities

Need for skilled data entry

- There is a need for an assigned MCC physician coordinator who is responsible for real-time entering of the data during the MCC meeting.

Inability of Microsoft Access to handle large amounts of data

- The program slows significantly when a large number of records (>2000) is stored.

Security

- Microsoft Access is not able to adequately secure the confidential data when it is installed on the multi-user environment of a shared drive

Changes That Have Been Made To the Tool

Data entry requirements during meetings

- Most open text fields have changed to drop down menus or check boxes. These were added to make data entry more efficient as the system became more sophisticated.

Possible Future Changes

Change format to a secure, web-based, MySQL database

- The new database will contain the same set of variables and will allow for the ongoing addition of virtually limitless number of patients.
- Multiple databases will need to be designed, each with its own variables, to meet the needs of each disease site. Emphasis will be put on uniformity as much as possible.
- The newly introduced MySQL database will import the current patient information which has been stored in the current database.
- This new system will have the following advantages:
    - Increased level of security
    - Provides accessibility to the records of MCC discussions and decisions to physicians within the circle of care who attend MCC by video conferencing from remote sites
    - Easy accessibility by users
    - Higher speed for data entry
    - More practical and efficient operation
    - Increased capacity to accommodate more patients

Sources

- Dr. Mahmoud Khalifa, Telephone interview, September 12, 2008
- Dr. Mahmoud Khalifa. Follow-up Questions. E-mail sent on September 19, 2008

Figure 2: Patient Summary Screen, Sunnybrook Hospital

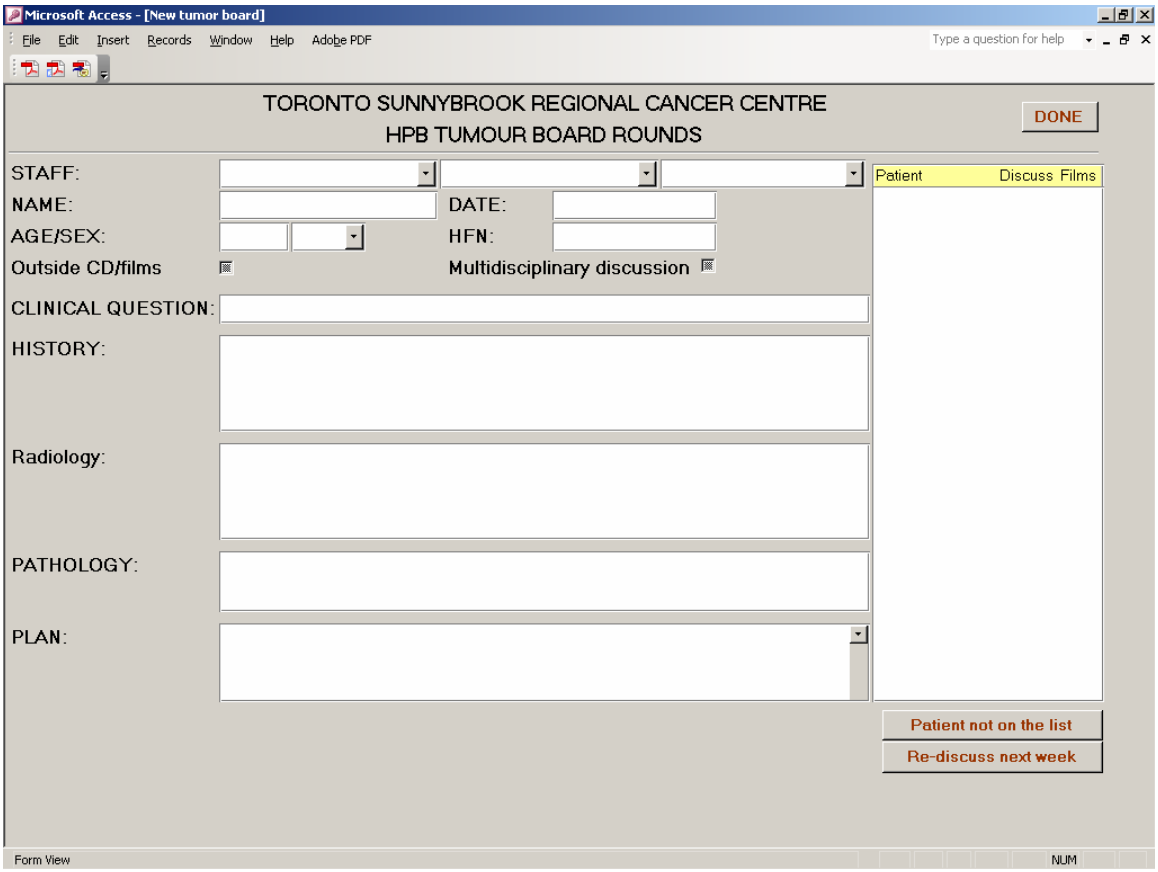


Table 4: Tool Profile - University Hospitals of Leicester

University Hospitals of Leicester
Background Information
Name of Site: University Hospitals of Leicester *Type of Tool*: Patient Analysis & Tracking System (PATS) *Developed by*: Axis Clinical Software Inc. *Implemented*: 1999
Before the meeting • The clerk coordinator receives: o a copy of any patient letter that mentions colorectal cancer (CRC) from surgical secretaries o a copy of CRC histology reports from the histopathology typists o any reports that mention CRC from Endoscopy o a copy of all of their relevant letters from Oncologists • The clerk coordinator enters the information into the software and generates the list of patients to be discussed at the meeting. • The list of patients is printed out and sent to the appropriate pathologists, radiologists, and oncologists. These specialists review the relevant slides, reports, and images in advance of the meeting. • The clerk coordinator logs into the system to ensure that all the necessary information has been received. For example, if a CT scan is pending, they consult the radiology computer to access it.
During the meeting • Participants view a summary page containing demographic patient information, symptoms, date of referral, tumor and histology information, relevant tests, and reason for referral to the MDT. Figure 3 illustrates a sample patient summary view page. • After each discussion, the chairman dictates a summary of the proposed treatment plan, so that participants have a chance to agree/disagree. Once the treatment plan is approved, it is entered into the database. • Surgery and pre-op appointment dates may be set with the oncologists and/or other specialists at the meeting.
After the meeting • Minutes are produced and distributed immediately following the MDT meeting. • A form letter with the proposed treatment plan is sent to the patient's GP the day after the MDT meeting. • A copy of the treatment plan is printed onto a sticker (called an addressograph sticker) and placed in the patient's chart. Stickers are colour coded red so MDT decisions can be clearly seen. • Each year, a meeting is held to review the results of that year's MDTs, and data is uploaded to the national database. • A research meeting is also held each year with presentations about interesting cases.

Key Benefits

- Data only has to be entered once and is kept in one central location.
- Information can be extracted from the database as a report, which can be used to run the MDT meeting.
- Meeting details are made available to all clinicians involved in a specific patient's care.

Ongoing Challenges

Attendance at Meetings

- One of the difficulties is getting physicians to attend the MDT meetings. Although physicians are members of the MDT according to the peer review standards, they come only sporadically.

Entering Follow-up Data

- Once the patient is discharged from the MDT, follow up data is entered into the database with varying degrees of success.
- Tracking follow-up information is difficult because different systems within the Trust are not integrated. Therefore, there is no way to tell whether a patient has returned for further testing, such as an ultrasound, CT scan, or treatment.

Incompatibility between MDT meeting and national database fields

- At present, data from the MDT meetings has to be transferred into an Excel format and the fields manually manipulated to match the requirements of the national database. The Excel file then has to be saved as a CSV file before it is exported to the national database.
- Ideally, the information captured in the Leicester database should match the data requirements of the national database to increase the efficiency of national data collection

Changes That Have Been Made To the Tool

Method of Transmitting Images during Videoconferenced Meetings

- Initially, scans and images were transmitted electronically in real-time to other hospitals participating in the conferences. The image quality was, however, very poor.
- Instead, the camera is rotated towards the video screen at the host site, which is displaying the images and scans.

Sources

- Dr. Michael Kelly, Telephone Interview, Telephone interview, September 16, 2008
- Dr. Michael Kelly. Colorectal MDT, Leicester, England. E-mail sent on September 16, 2008
- Dr. Michael Kelly and Dr. David Sharpe, Telephone interview, September 23, 2008

Figure 3: Patient Summary Screen, University Hospitals of Leicester

Colorectal MDT meeting- Date of meeting - New patients

U number	Patients name Test patient		DoB:		Age at MDT:
Managing Consultant	MJ Kelly	Site of MDT	LGH	GP	
62 Day Breach Date		25 June 2008	29 Days until 62 Day Breach as of the 27 May 2008		
Current MDT Status					
Date of Decision to Refer	24 April 2008	Signs and Symptoms	Rectal Mass		
Priority of Referral	Two Week Wait	General Comments			
Outpatient Appointment Details					
25th May 2008 MJK	5th June 2008 Oncology				
Date of Investigations	Investigation Type and Result		Investigations Comments		
5 May 2008	Flexible Sigmoidoscopy, Primary Tumour Identified		Rectal biopsies. Adenocarcinoma 12cms		
20 May 2008			CT chest no mets CT liver one metastasis MRI T2 N1 M1		

Diagnosis Date (Working)	Details of Working Diagnosis	Tumour Site	Distant Mets At Presentation	Site of Metastases
5 May 2008	Endoscopic			

Date of Decision to Treat	Treatment Intent	Actual First Treatment	Date of First Treatment

Height of Tumour	Margin Threatened	Definitive Tumour Histology	General Histology Comments

Pre-op Radiotherapy	Date of Pre-op Radiotherapy	Type of Pre-op Radiotherapy
Date of Operation	Main Operation	Surgeon

Date of MDT	Reason For MDT	MDT Comments
27 May 2008	05/05/08 Fos 20/05/08 CT MRI	This sixty nine year old man came up on the two week wait to the physicians and has a biopsy positive carcinoma of the middle rectum at 12cms on FOS. CT chest clear, liver one small metastasis in the right lobe, MRI suggests radiological T2 N1 M1. He has been put forward for short course pre op radiotherapy followed by anterior resection with a view to interval liver resection +/- chemotherapy.

Table 5: Tool Profile – Charing Cross Hospital

Charing Cross Hospital

Background Information

Name of Site: Charing Cross Hospital
Type of Tool: Multi-user, automated, menu-driven Microsoft Access database for registering and tracking patient information.
Developed by: Dr. Reza Nouraei
Implemented: 2004

Before the meeting

- The decision to include a patient for MDT discussion can be made by clinicians from one of several different specialties
- The database, which is available to all head and neck stake-holders via a secure, trust-wide, shared folder, produces the weekly MDT list automatically.
- Senior clinicians can register patients directly for an MDT meeting as soon as the decision to include them is made (e.g. in the out-patients clinic or the operating theatre). Figure 4 displays the patient registration screen.
- The database also generates live, interactive worklists for the pathology and radiology departments, as well as the junior medical team. Figure 5 shows a sample of such a worklist.

During the meeting

- The tool has a function to record the MDT's decision for each patient. Typically, these decisions are recorded by the junior doctors.
- The hospital's electronic pathology reporting system can be accessed if necessary.

After the meeting

- The software allows treatment details to be entered. This information is then put in the patient's medical record and also remains available electronically should it be necessary.
- If the patient needs additional radiation therapy or x-rays, the patient is added back to the list for discussion. Moreover, they are also added back to the list again if there is any later recurrence.
- Each year, audit data is uploaded to the national head and neck database.

Key Benefits

- Collects information in a central, accessible location and limits the risk of losing patients administratively
- Streamlines administration at the meeting
- The software can be customized to meet the needs of different teams
- The software can be expanded so that it can be used across a region or country.
- Automated worklists manage workflow and help to reduce stress

Changes That Have Been Made To the Tool

Modifications to account for changing targets

- As government targets changed, the database was updated to ensure that the correct information could be collected and exported.

Possible Future Changes
Expansion of the database • The database is scalable, and an expanded version could be developed, depending on the needs of the user.
Sources
• Dr. Reza Nouraei, Telephone interview, September 18, 2008

Figure 4: Patient Registration Screen, Charing Cross Hospital

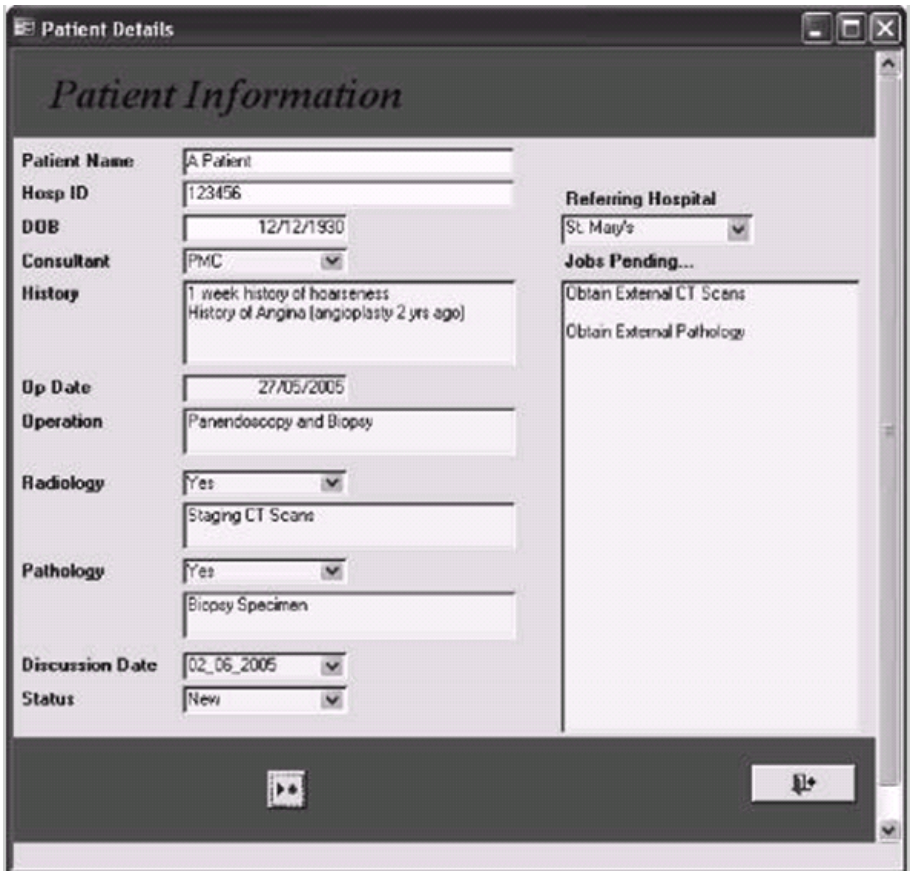


Figure 5: Interactive Worklist Screen, Charing Cross Hospital

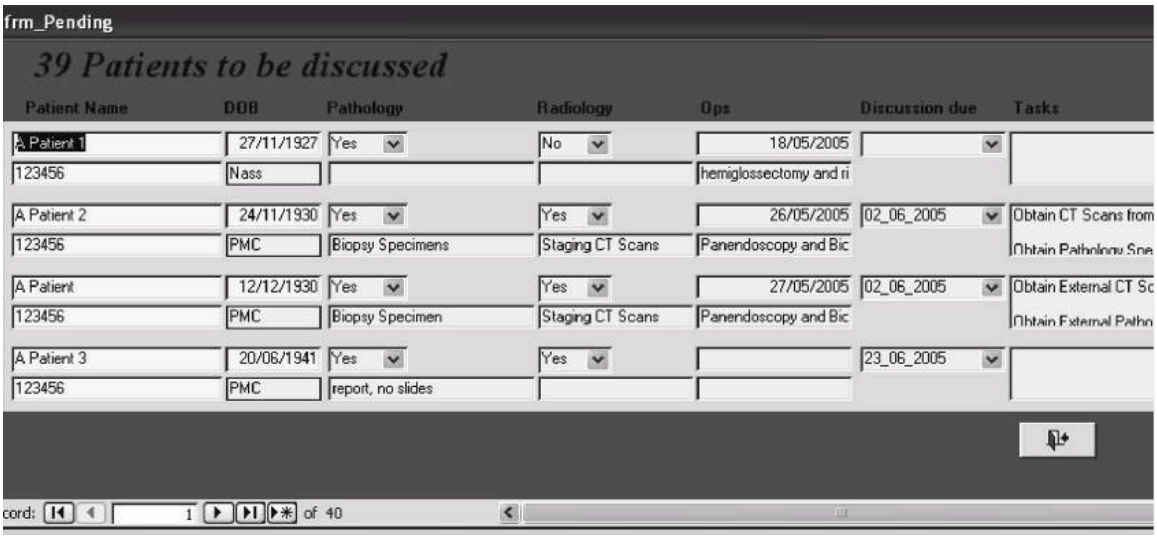


Table 6: Tool Profile – Queensland Health

Queensland Health

Background Information

Name of Site: Queensland Health
Type of Tool: Web-based system on the Queensland Health Network
Developed by: Queensland Cancer Control Analysis Team (QCCAT)
Implemented: Proof of Concept Lung Module implemented November 2006.

- Redevelopment continues for other cancer modules including Head and Neck, Breast, Colorectal, Lymphoma, and Gynaecological, to collect infrequently encountered cancers, such as hepatobiliary and upper GI tract. Delivery of these modules is expected in 2009.

Before the meeting

- The Queensland Oncology Repository (QOR) is the central repository that collects cancer data electronically and automatically produces a unique cancer record for each patient. QOR is used to create an initial list of Queensland cancer patients. Stage, treatment, and death data from other electronic source systems are then added to the diagnostic records.
- When a patient selected in QOOL has a cancer record in QOR, that data will be loaded from QOR into QOOL. Once a QOOL profile is created, no additional diagnostic data is included from QOR for that patient.
- Physicians log into QOOL to search for patients in the Queensland Oncology Repository. Once found, the patient's name is selected and their relevant information is displayed. A button at the bottom of the screen is clicked to refer the patient to a MDT meeting.
- Selecting the "Refer to Conference" button opens a new screen, where the physician can select the conference facility, type, and date. The physician can also view the patient list for that conference.
- Attendance to each MDT can be recorded automatically. If the MDT member is registered in QOOL they are linked to their MDT and a record of their attendance is recorded (or deleted) automatically. MDT members attending the meeting remotely can login to QOOL and view the patient's summaries being discussed.
- The MDT coordinator is notified by email when a patient has been referred.
- The MDT coordinator accepts the referral. An email goes back to the doctor to say that their patient has been accepted. The referral protocols for each MDT will determine the number of patients presented, what to do with overrun, etc.
- Pathologists and/or radiologists log in before 3:00 pm the day prior to the meeting to see which patients have been referred to each meeting. They can then determine the x-rays or pathology slides that have to be examined for the meeting. Pathology reports, on the other hand, are automatically fed into QOOL.
- Physicians who are presenting at the meeting prepare their slides and bring them to the meeting on a memory key.

During the meeting

- On the day of the MCC, physician attendance is verified. If someone is absent, the administrator will delete that individual from the list.
- During the MCC, members can see a summary page containing information about the patient, their symptoms, tumor and histology information, relevant tests, and radiology and pathology findings.
- This page can be updated by the multidisciplinary team administrators during the meeting. A clinical nurse or coordinator also attends to help the administrator with the medical terminology.
- X-rays are not loaded into QOOL, but are projected from the radiology system. Similarly, slides may be projected from microscopes or DVDs.

After the meeting

- A clinical summary that has been signed off by the MDT chair person is printed out and added to the patient's chart.
- Information from the MDT meeting is fed into the QOR, which continually refreshes the cancer data.
- In addition, QOR automatically updates Oncology Analysis Systems (OASys) which makes available detailed and up to date analysis of cancer information (i.e., population based statistics such as incidence and survival, as well as treatment rates, staging, and recurrence).

Key Benefits

- Central data repository; QOR feeds into QOOL
- Online clinical data entry
- Accessible by anyone within the Queensland Health Network
- Statewide clinical registry allows the linking of patient information and the sharing of information between clinicians and facilities
- Produces a clinical summary—a record of the patient's medical record
- Automatically generates a summary of the meeting outcomes
- Development and calculation of clinical indicators and other analysis using OASys

Ongoing Challenges

Lack of resources

- Lack of experienced developers

Change Management

- Difficulty encouraging physicians to migrate to a new system

Changes That Have Been Made To the Tool

Added recurrence and death pages

- Enables the team to record recurrence in the patient profile.
- The recurrence page includes information about diagnosis, whether it is radial or distal, and any treatment that was performed.
- The death page captures whether the patient is alive or dead.

Possible Future Changes

Add a feature to track patient treatment

- A page to enter information about whether the patient underwent surgery, radiation, and/or chemotherapy has yet to be added. Nevertheless, patient treatment information is recorded in the Queensland data repository.

Develop a feature to automatically generate an agenda for the meeting

- A feature that enables an agenda to be automatically generated from the system for each meeting is under development.

Expand access to QOOL

- A project within Queensland Health, which is almost complete, will enable external users to access QOOL via the internet.

Add a feature that will automatically generate letters to GPs

- A feature that enables letters to automatically be generated, informing GPs and specialists of treatment decisions. This is currently in development.

Sources

- Tracey Guan, Telephone interview, September 25, 2008.
- Queensland Health, "Queensland Statewide Cancer Treatment Services Plan, 2008-17" [Online], October 6, 2008. <http://www.health.qld.gov.au/publications/qh_plans/QS_cancer_plan_final.pdf>
- Queensland Health, "Service Improvement Starts Here…" [Online], October 6, 2008. <http://www.cancerinstitute.org.au/cancer_inst/statistics/ppt/COSA2006_ShoniColquist.pps#256,1,Service improvement starts here… QLD Cancer Control Analysis Team Shoni Colquist Danica Cossio 27th November 2006>

Figure 6: Patient Details Screen, Queensland Health

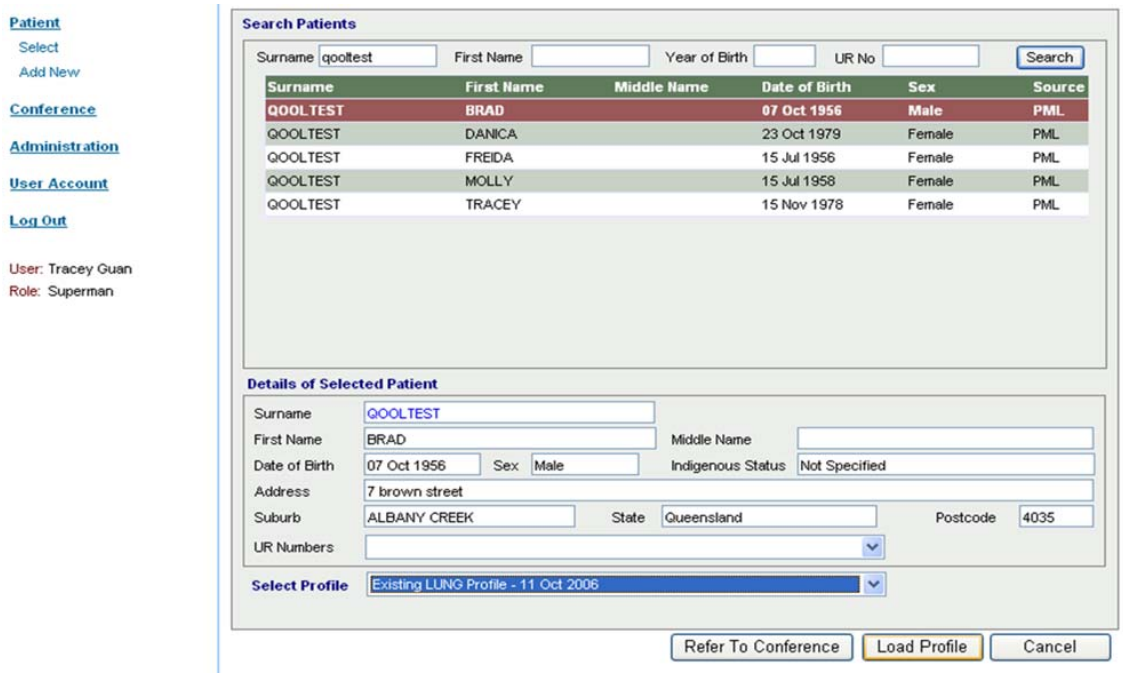


Figure 7: Meeting Detail Screen, Queensland Health

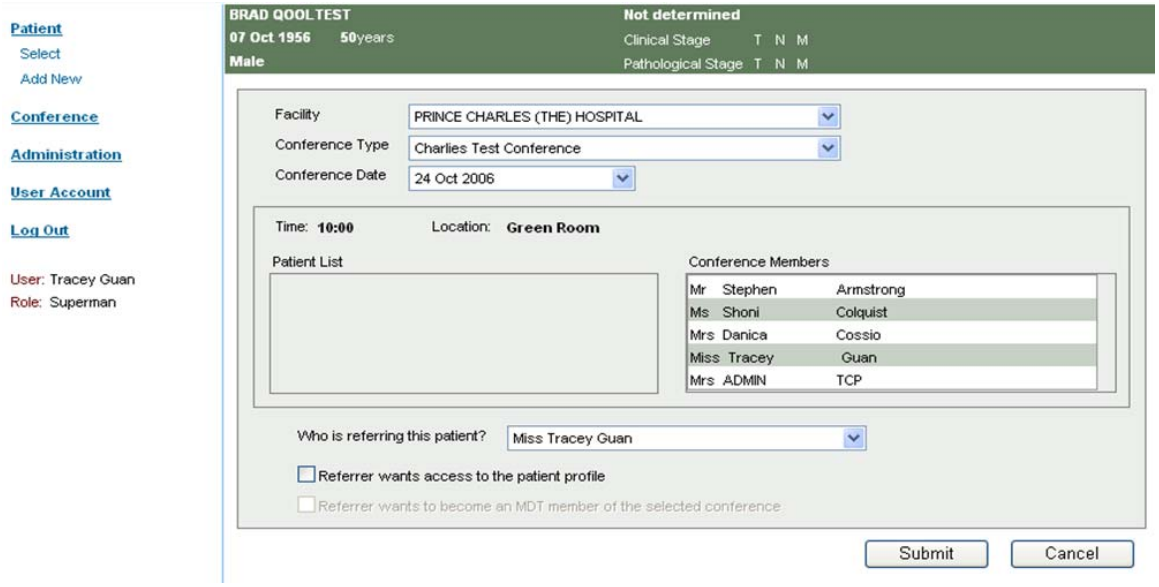


Figure 8: Patient Summary Screen, Queensland Health

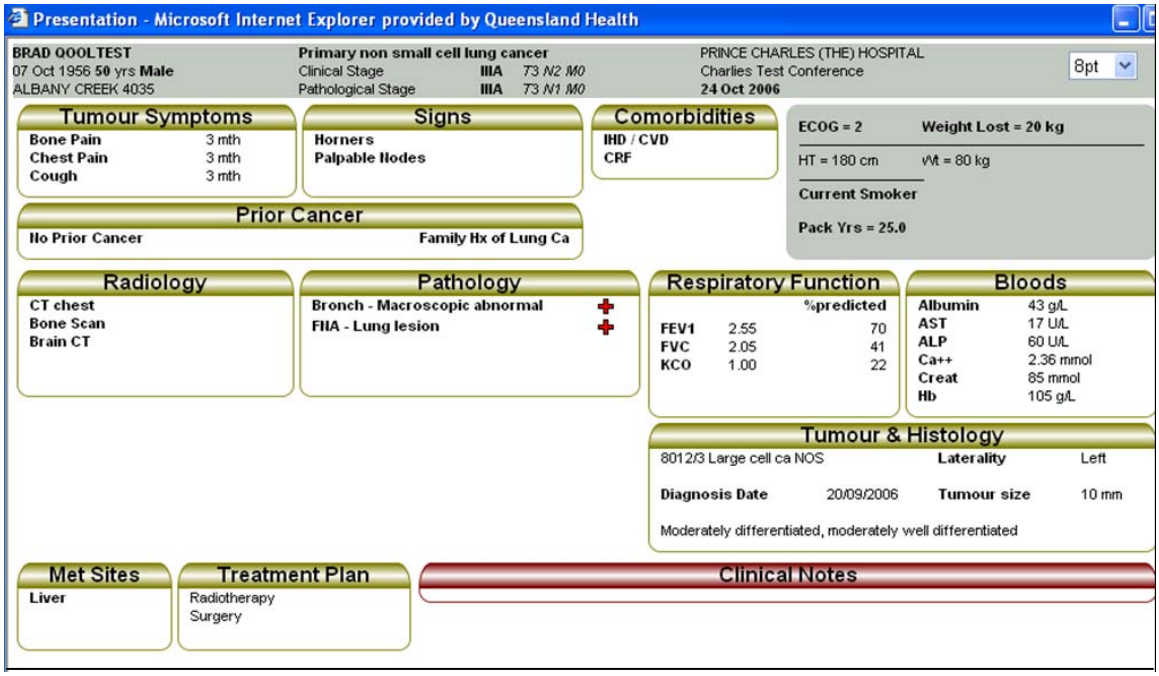


Table 7: Tool Profile – Jewish General Hospital

Jewish General Hospital

Background Information

Name of Site: Jewish General Hospital (JGH), Segal Cancer Center
Type of Tool: An interactive, interdisciplinary, electronic medical record used for the documentation of patient care, decision support and for the design and execution of protocol chemotherapy.
Developed by: VisualMED Clinical Solutions
Implemented: Initial Go Live - April 2008

Before the meeting

- Physicians can log into the VisualONCOLOGY system and enter their patient's electronic medical record. From the record, they can refer the patient directly to a tumour board meeting.
- Patients can be referred by any number of clinicians, including nurses and physicians.
- A weekly list of patients that physicians have referred is automatically generated. This list can be accessed by the person who is running the tumour board. If too many patients are referred in a given week, they are typically held over to the following week.

During the meeting

- The person in charge of running the tumor conference can access the list of patients to be presented.
- Cases are presented by physicians. If they need to refer to anything, the patient's electronic medical record can be retrieved and the relevant data can be pulled up. An interface with radiology allows radiology images to be pulled up in this way. Pathology reports can also be accessed, but without images.
- Web access permits clinicians to access guidelines or relevant clinical research
- Once a consensus decision regarding the treatment of a patient is reached, it is recorded by a clerical person (a physician or a nurse) by hand at the meeting.
- In addition to the recommendations, a brief background summary and the clinical question being asked are recorded.

After the meeting

- The information taken down by hand during the meeting is transcribed into the system. This information is also sent to the patient's chart and to a tumour conference file.
- A form letter with the proposed treatment plan is sent to the patient's GP following the meeting. The letter can be generated in English or in French.

Key Benefits

- Eliminates time spent finding various files and limits the risk of losing patient data
- Information can be shared, allowing people to work together
- Obviates the need for paper-based activities
- VisualONCOLOGY can be accessed at a distance securely exclusively through biometric logon.
- Reduces the risk of human error and adds element of patient involvement.

Ongoing Challenges

Resistance to change

- Implementation can be met with resistance to change from some physicians. This can be overcome with patience and persistence.

Changes That Have Been Made To the Tool

Move to VisualONCOLOGY

- Segal Cancer Center moved towards an electronic health record with the help of VisualMed Clinical Solutions, a local vendor. The initial go live date for this transition was April 2008.
- Using VisualONCOLOGY, the majority of work is paperless; it is completed with electronic notes and text messages.

Possible Future Changes

Recording decisions during the meeting

- At present, a clerical person is responsible for taking notes about the patients being discussed, including treatment recommendations, during the meeting. These notes are later transcribed into the VisualONCOLOGY system. In the future, notes will be added directly into the system at the meeting.

Sources

- Dr. Gerald Batist, Telephone interview, September 18, 2008.

Table 8: Tool Profile – North Bristol Trust

North Bristol Trust
Background Information
Name of Site: North Bristol Trust *Type of Tool*: The Bristol Cancer Solution (BaCCS) is a web-based, community-wide solution based on the Somerset database. BaCCS links into the Bristol, North Somerset, and South Gloucestershire hospital Trust systems. This is based on the Somerset Cancer Register (SCR). *Developed by*: Somerset informatics team *Implemented*: 2005
Before the meeting • Once patients undergoing initial testing receive a diagnosis of cancer, they are flagged by MDT coordinators and added to the list of patients for discussion at an upcoming MDT. • Clinical leads also refer patients to the MDT meeting, and send any relevant information and the reason for referral to the MDT coordinator. • The coordinator collects all of the information and generates the list of patients to be discussed at the meeting. • A pro forma, describing the patient history and status (i.e., presentation, investigations and tests, results), is created for the meeting
During the meeting • Physician attendance is recorded on the day of the MDT. • Two laptops are used during the meeting. One laptop connects to the BaCCS system, allowing participants to see information about the patient, and the other connects to the PACS system for viewing images. Figure 9 displays a patient summary screen. • As each patient's case is discussed, the patient's progress and treatment plan are recorded in the BaCCS tool. • Operational policy guidelines can be accessed electronically during the meeting.
After the meeting • A pro forma indicating the treatment decisions reached at the MDT meeting is added into each patient's chart. • Treatment details are faxed to the relevant tertiary care centers. Most patients are then seen the same day or within a few days of the MDT meeting. Complete details about the treatment are entered once they become available. • A form letter with the proposed treatment plan can be printed off and sent to the patient's GP at any point. • Clinical cancer data is exported to the National Cancer Waiting Times, National Cancer Registry, and Royal College databases. Figure 10 shows the National Cancer Waiting Times pro forma. • A cancer analyst can access data from BACCS to produce reports on the patient's progress.
Key Benefits
• Produces a list of patients in the system who are waiting for treatment, which is used for patient tracking • Online clinical data entry - there is no delay between the discussion and the recording of the treatment decision, allowing patient treatment to progress faster • Regional wide access to the same and single patient record.

Ongoing Challenges

Resistance to change

- One of the preliminary challenges experienced by the team was convincing clinicians that there are benefits to the system and helping them change the way they work.

Changes That Have Been Made To the Tool

- Progressive evolution of solution via functional changes and continued development.

Possible Future Changes

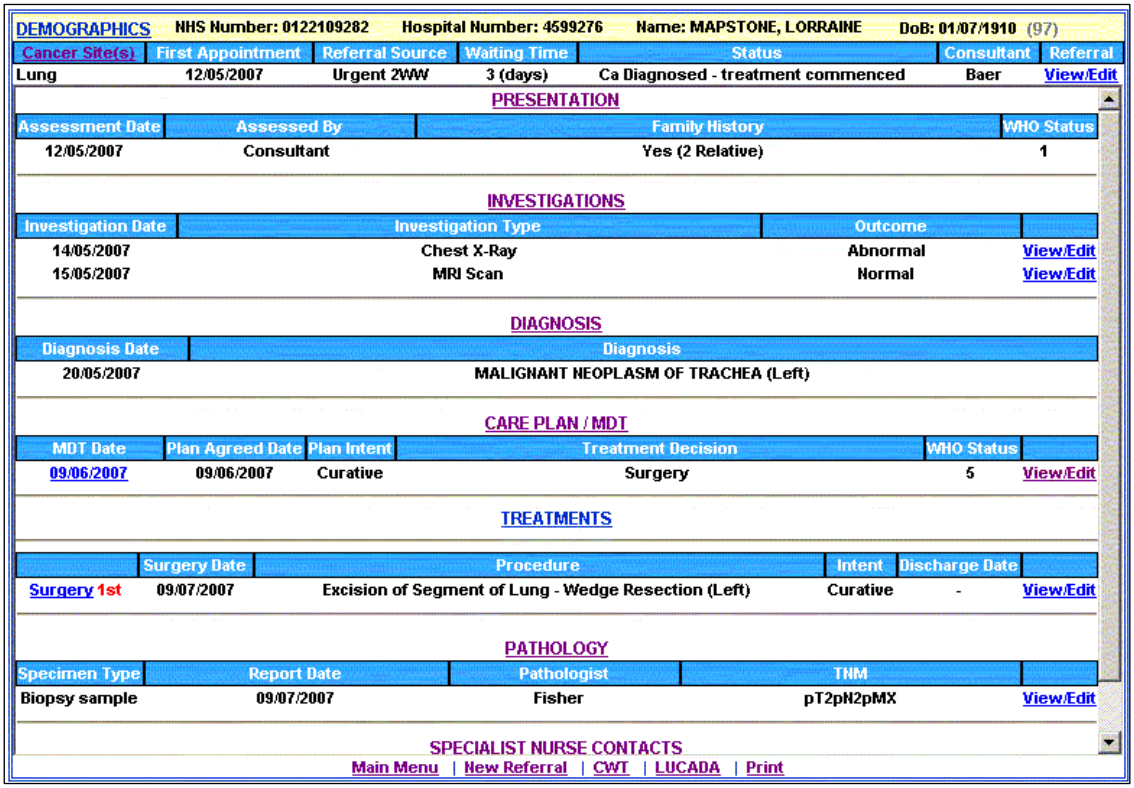
Migration to a .NET system

- Many documents are currently faxed between the hospital and tertiary centers. A .NET system would incorporate emailing to replace faxing as a means to send and receive information. This paperless system will also save time by eliminating the need to copy, paste, and print documents before faxing.

Sources

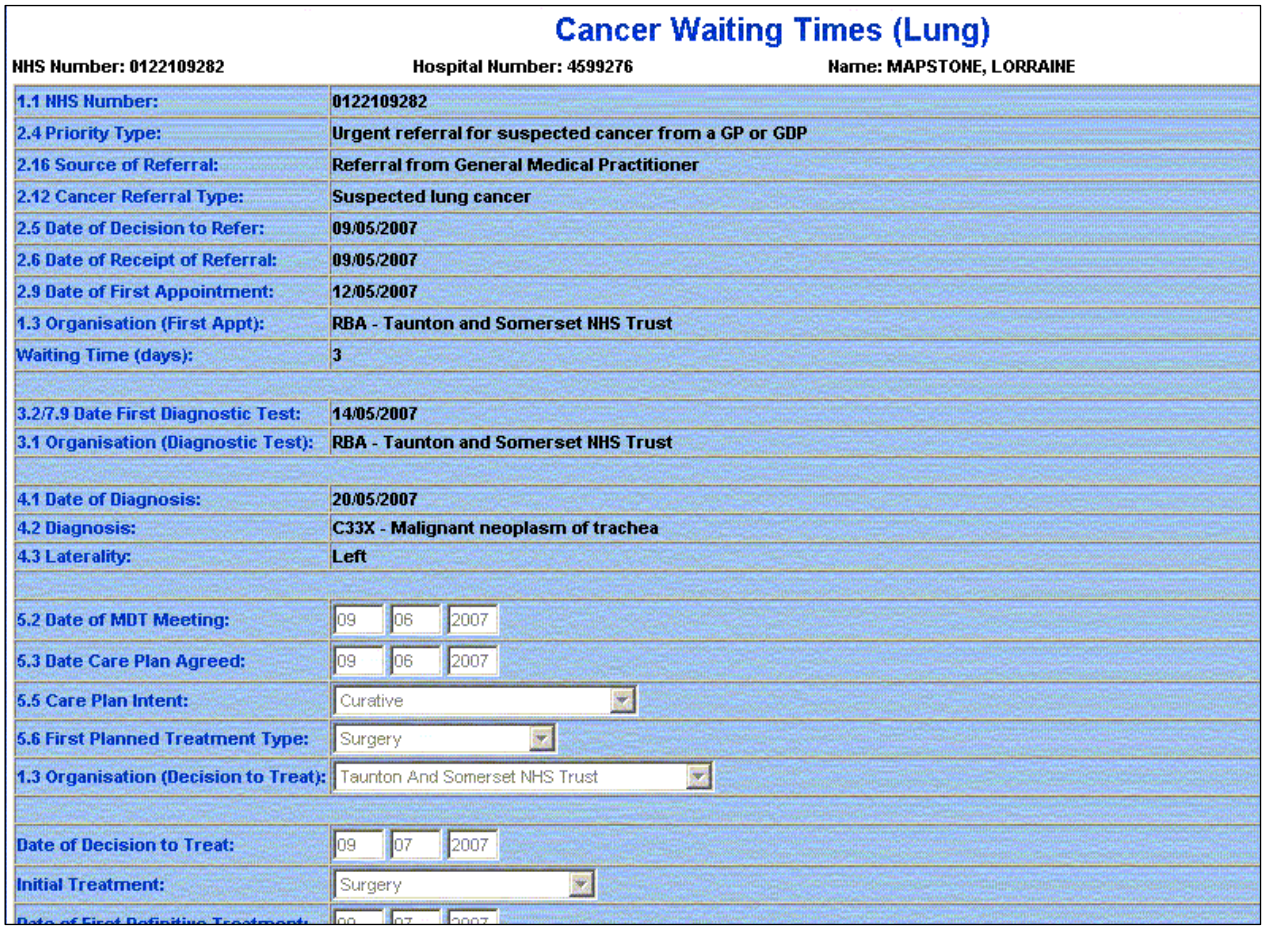
- Dany Bell, Telephone interview, October 3, 2008.
- Martin Bell, Telephone interview, October 6, 2008.
- Martin Bell, Site Profile, North Bristol NHS Trust, England. E-mail sent on October 28, 2008

Figure 9: Patient Summary Screen, North Bristol Trust



*Note: dummy patients shown

Figure 10: Cancer Waiting Times Proforma



Cancer Waiting Times (Lung)

NHS Number: 0122109282 **Hospital Number: 4599276** **Name: MAPSTONE, LORRAINE**

1.1 NHS Number:	0122109282
2.4 Priority Type:	Urgent referral for suspected cancer from a GP or GDP
2.16 Source of Referral:	Referral from General Medical Practitioner
2.12 Cancer Referral Type:	Suspected lung cancer
2.5 Date of Decision to Refer:	09/05/2007
2.6 Date of Receipt of Referral:	09/05/2007
2.9 Date of First Appointment:	12/05/2007
1.3 Organisation (First Appt):	RBA - Taunton and Somerset NHS Trust
Waiting Time (days):	3
3.2/7.9 Date First Diagnostic Test:	14/05/2007
3.1 Organisation (Diagnostic Test):	RBA - Taunton and Somerset NHS Trust
4.1 Date of Diagnosis:	20/05/2007
4.2 Diagnosis:	C33X - Malignant neoplasm of trachea
4.3 Laterality:	Left
5.2 Date of MDT Meeting:	09 06 2007
5.3 Date Care Plan Agreed:	09 06 2007
5.5 Care Plan Intent:	Curative
5.6 First Planned Treatment Type:	Surgery
1.3 Organisation (Decision to Treat):	Taunton And Somerset NHS Trust
Date of Decision to Treat:	09 07 2007
Initial Treatment:	Surgery
Date of First Definitive Treatment:	09 07 2007

*Note: dummy patients shown

Additional Tools

A number of additional MCC tools were identified that, while not as relevant to the current scan and assessment, have been included as they may address the needs of individual RCPs and/or facilities.

Name of Site: Methodist
Name of Tool: Virtual Brain Tumor Board (VBTB)

Overview:
Methodist Hospital hosts a VBTB live Webcast series. During each VBTB, a multi-disciplinary panel of experts including neurosurgeons, pathologists, medical oncologists, radiation oncologists, gathers to review difficult and unusual neuro-oncology cases and create the best treatment plan for each patient. Viewing physicians are able to submit challenging cases in advance for live review and to email questions during each event.

Notes:

- This is an innovative forum that provides real-time collaboration and access to some of the most leading-edge treatments in brain tumor care.
- Methodist Hospital's VBTB could be considered as a forum for the discussion of rare cancers or difficult cases.

Name of Site: St. Jude Children's Research Hospital
Name of Tool: Cure4Kids

Overview:
Cure4Kids is an educational program that provides educational materials and online collaboration tools to physicians around the world at no cost. Cure4Kids also has online meeting spaces that allow various groups to hold web-conference meetings, share documents, and discuss clinical treatments of children with cancer.

Notes:

- The majority of cases presented during online meetings on Cure4Kids are retrospective, and are shared for educational purposes. Few live cases are discussed.
- Cure4Kids is dedicated to supporting the care of children with cancer and other catastrophic diseases.
- Cure4Kids' online meeting spaces may be of benefit to some RCPs that would consider joining their international community to connect with other specialists working in the area of child cancers.

Name of Site: Barwon South Western Regional Integrated Cancer Service (BSWRICS)
Name of Tool: BSWRICS website database

Overview:
BSWRICS website database is a local tool developed to support MCC meetings in Barwon South Western Victoria, Australia. The database is similar in functionality to the tool in use at Sunnybrook Hospital; resultantly, it was not profiled in depth

Prior to the meeting, patient details are added to the agenda via the database, and are checked by the administrator. An agenda is sent to all attendees two days prior to the meeting, allowing the pathologist to collect the slides requested on the agenda. All radiology films are available online. During the meeting, a designated person takes notes on case discussions and records any recommendations regarding patient treatment. These notes are later transcribed into the database.

Notes:

- Notes, including the recommendations and meeting attendee lists are transcribed onto the database and these can be accessed by clinicians who attend the meeting.
- Patient notes are stored on the database and this can be accessed by clinicians who attend

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Name of Site: University of Pittsburgh Medical Center
Name of Tool: iPath

Overview:
The Internet Pathology Suite (iPath) is a web-based telepathology platform that permits the online presentation and discussion of cases within user groups. It also permits distance teaching in medicine. iPath is also used for clinical documentation in multi-institutional tumor studies. The iPath software that was developed for the telepathology network at the University of Basel in Switzerland has since been released as an open source project.

Notes:

- All users are organized in a number of closed working groups, each with its own administrator who can grant access to other users. Cases can be presented inside such a group.
- The iPath platform may be of benefit to RCPs interested in connecting with specialists to discuss rare cancers or difficult cases.

Name of Site: University of Washington School of Medicine
Name of Tool: UW Cores

Overview:
UWCores is a web-based, computerized resident sign-out system that combines patient sign-out and daily ward work information in one central location. The system was designed to increase patient safety and care coordination during "hand-offs"; where residents transfer patient care responsibilities at the end of their shifts.

Notes:

- UWCores includes up-to-date information on a patient's initial diagnosis, medications, diet, allergies, and an action plan for the patient's treatment.
- UWCores automatically downloads patient data (vital signs, laboratories), and prints them to rounding, sign-out, and progress note templates. As a result, the residents do not have to spend much time in the morning on tasks such as looking at the computer and writing down their patients' laboratory values by hand.

Near the completion of the scan and assessment, two additional MCC tools were identified. A short description of these tools is included below. Interested RCPs may wish to further investigate these tools on their own.

Name of Site: West of Scotland Gynaecological Cancer Network.
Name of Tool: Excelicare

Overview:
Excelicare is a Clinical Information and Image Management System (CIIMS) that was adopted by the West of Scotland Gynaecological Cancer Network to support the multidisciplinary clinical decision-making process. The tool enables the multidisciplinary team manager to ensure that all patient details are ready for presentation. It also creates a list of patients to be discussed and automatically sends these lists to all clinicians. As patients details are displayed on a screen, participants are able to review and discuss a treatment plan. These screens are simultaneously seen at each of the participating sites.

Notes:
- Excelicare provides clinicians access to a core patient record, which can be shared during the MDT meetings.

Name of Site: West Anglia Cancer Network
Name of Tool: CEPIA

Overview:
Developed by Dataline Software, CEPIA's MDT module is designed to simplify the organization of meetings, provide access to all relevant patient data, assist in compliance with the National Institute for Clinical Excellence (NICE) meeting recommendations, and allow recording of diagnosis, stage, and care plans, including treatments, trial involvement and meeting decisions.

Notes:
- This tool appears to still be in a developmental phase.
- CEPIA has functionality to schedule a new MDT meeting, view planned meetings, or search for archived meetings.
- The outcomes of discussions are recorded for each patient in a textbox on the MDT Outcome page. This page has links to the patient's care plan and staging activities so that data entered during the meeting can be saved.

5.4 Data Elements

The following tables outline the data elements collected or displayed by the various MCC support tools identified in this environmental scan. Some data were collected by many tools, and can be considered common data elements. Examples of common data elements include patient name, date of birth, and diagnosis. Conversely, some tools collected unique information about the patient. These can be considered unique data elements, and are site or tool specific. Table 9, Table 10, and Table 11 split the data elements into the three process phases (pre-MCC, during MCC, post-MCC).

Table 9: Common and Unique Data Elements, Patient Registration Fields

Before the Meeting – Patient Registration Fields	
Common Data Elements	
Data Element	Site
Patient name Gender Date of birth Patient hospital ID# Name of GP Name of consultant Name of pathologist Patient history (may include allergies) Diagnosis Initial surgical procedures Radiology (Y/N), type Pathology (Y/N), type Discussion date Status of Patient (New patient/Existing patient)	BSWRICS Charing Cross Leicester Sunnybrook Queensland Health
Unique Data Elements	
Data Element	Tool
Referring hospital	Charing Cross
Name of presenter Name of oncologist	BSWRICS

Table 10: Common and Unique Data Elements, Patient Summary View Fields

During the Meeting – Patient Summary View Fields	
Common Data Elements	
Data Element	Tool
Date Patient name Date of Birth Patent age Diagnosis Board# History Pathology List of attendees Tumour Stage Treatment Plan	BSWRICS Sunnybrook Leicester Queensland Health West of Scotland Gynaecological Cancer Network North Bristol Trust
Unique Data Elements	
Data Element	Tool
Followed Guidelines? (Y/N or N/A; reason if no) Reviewed? (Y/N) Re-presented? (Y/N) Rediscuss next week? (Y/N) Clinical Question	Sunnybrook
62 Day Breach Date Priority of referral Date of first treatment Height of tumour Margin threatened Definitive tumour histology Date and type of pre-op radiotherapy	Leicester
Reason for referral/meeting goal (e.g. discussion) Social issues for follow up Eligibility for clinical trials Need genetic counseling?	BSWRICS
Waiting time	North Bristol Trust
Pathological tumour stage Histology images	West of Scotland Gynaecological Cancer Network

Table 11: Common and Unique Data Elements, Patient Record Fields

After the Meeting – Patient Record Fields	
Common Data Elements	
Data Element	Tool
Date for MDT review Initial MDT review comments	BSWRICS West of Scotland Gynaecological Cancer Network
Unique Data Elements	
Data Element	Tool
Metastasis Colonoscopy CT Notes regarding relevant psychosocial issues (psychological and social factors, possible barriers to treatment, family structure, physical distance to center, etc) Family History	BSWRICS
Date of MDT review Date added to MDT list Presenting consultant Hospital of Treatment	West of Scotland Gynaecological Cancer Network

6. Key Considerations

6.1 Considerations Regarding Technology

MCC meetings play a notable role in providing patients with the best possible care. It is, however, important that MCC meetings have access to the necessary resources, are well organized, and well run. To this end, a number of hospitals have incorporated technology to support the operations and activities of their MCC meetings.

Benefits of Using Technology to Support MCC Meetings

Although the application of technology may differ between hospitals due to their unique needs—even between disease sites within a hospital—it confers similar benefits to each. Some of the key benefits of technology noted by interview participants are listed below.

Technology:

- provides structure to MCC meetings
- ensures that important patient information and treatment decisions are documented
- limits the risk of losing patient data by curbing the amount of information recorded on paper
- allows physicians to access information, even when they are off site.
- helps to eliminate the delay between the point at which a patient's treatment is discussed and recorded, thereby allowing treatment to progress faster
- streamlines meeting administration and limits the amount of work that has to be completed by a secretary/coordinator. Some tools accomplish this by generating meeting agendas, recording attendance, informing meeting coordinators if slides, reports, or scans are missing, and automatically creating letters that can be forwarded to GPs regarding treatment decisions.
- tracks hours for CME credits
- enables key MCC members, such as radiologists, pathologists, and meeting coordinators, to manage their respective workloads more effectively. Depending on the tool, this is accomplished by generating worklists, reducing the amount of manual data entry required, and allowing radiologists and pathologists to log in a few days prior to the meeting to see which slides and reports they need to prepare.
- supports adherence to local and/or national treatment guidelines.
- supports quality assurance activities.

- produces statistics that can be used to evaluate patient treatment outcomes. Statistics about the MCC meetings themselves, such as their frequency, length, number of attendees, and number of cases discussed, can also be generated.

Selecting a Tool

Once the decision to adopt technology to support the MCCs at a facility has been made, several items should be considered in order to select the most appropriate tool.

The Needs of the End User
The technology that is selected has to be useful for the intended end-users. Involving someone with an in-depth understanding of the workings of the MCC in either the decision making or design process can help to ensure that this is the case.

Integration
The integration of an MCC support technology and information systems within the hospital environment can facilitate the flow of and access to patient information. Some facilities have integrated MCC support technology with their EHRs, allowing decisions made at meetings to be entered directly into the patient's hospital record. Thus, the way and degree to which the technology integrates with existing hospital systems has to be considered during the selection phase.

Furthermore, if data is to be exported to a central organization or data repository, it is important to select a tool that is suited to this process. Poor alignment between the data fields in a hospitals' MCC technology and in the central database can translate to extra work and/or frustration for the staff member responsible for data submission, and can be a significant barrier to adoption. A similar situation may arise if the data entry fields are inflexible.

Features of the System
The amount of data that is collected, the size of the files that are stored following each MCC, and security requirements such as the ability to restrict access to authorized users, should be taken into account when investigating a technological solution. The tool should also be intuitive and relatively user-friendly. These factors will identify some of the features that the system must posses to adequately support MCCs.

Resource Requirements
Finally, the technical, human, and financial resource requirements needed for the implementation and upkeep of the technology should be kept in mind during the selection process.

A key limitation in this environmental scan is that the search focused specifically on the technologies used for MCCs. As a result, not all technologies that may potentially be useful for MCCs have been captured. For example, any general scheduling software may

support MCC administration and organization, but these would not have been identified in this scan if their listed functions did not refer specifically to MCCs or tumour rounds. Therefore, after the functionality of a technological solution has been decided upon, a request for information (RFI) may be sent out to vendors to find other technologies that could support MCCs.

Implementation

Regardless whether it is purchased or created, there are a few considerations that should be made by the facility once a technology has been selected to ensure that it is implemented successfully.

Stakeholder Engagement & Change Management
Engaging the individuals who will be using the tool is an important aspect of the technology implementation process. It can be difficult to convince clinicians to abandon their current, familiar methods and to migrate to a new technology; however, this process can be aided by:

- developing a change management strategy or project plan
- recruiting leaders or champions
- communicating the need for change and highlighting the ways in which the technology will benefit their work
- enlisting IT support to help MCC team members move through the transition

Training
Training can be offered to familiarize individuals with the technology and to increase the productivity and skills of the employees who will be involved with coordinating or presenting materials at the meetings. Training courses to strengthen physicians' computer literacy skills may also be considered.

Defining Roles
Defining and communicating the role of each MCC participant and outlining how their tasks fit into the overall operation of the MCC will help participants understand their responsibilities with respect to the technology.

Central Tracking
For facilities that will submit data to a central location, the data collection process should be carefully planned and documented to facilitate the implementation of the new technology. The data submission timeline and the method in which the data collection process will be managed should also be defined.

Follow up

End-user satisfaction with the MCC technology can be evaluated periodically to ensure that any challenges are identified in a timely manner. The feedback collected can determine whether any revisions need to be made.

6.2 Additional Considerations Regarding MCCs

Technology cannot be separated from the business context in which it is implemented. The majority of interview participants (n=7) discussed some non-technology critical success factors, suggestions, and lessons learned for the successful execution of MCC meetings that are identified in Table 12 below.

Table 12: Critical Success Factors and Lessons Learned

Additional Considerations Regarding MCCs
Using MCCs as educational opportunities
Running meetings on time and according to clinician's calendars
Ensuring availability of food
Ensuring administrative support
Being responsive to technical challenges
Ensuring appropriate infrastructure is in place
Tracking patient referrals to MCCs
Creating the right atmosphere
Taking advantage of the unexpected benefits of MCCs
Using MCCs as opportunities to increase collaboration between communities

Using MCCs as Educational Opportunities

- Participants from two sites stressed that the inclusion of interesting and educationally relevant cases increased clinician engagement and attendance during MCC meetings. An interviewee from an additional site highlighted the importance of including both successful and failed cases for discussion.

> *"Present metastatic cases; they [are] complicated and encourage them to come*

Running Meetings on Time and according to Clinician's Calendars

- Three participants noted that successful meetings begin and end on time. These meetings are often scheduled early in the morning, and many surgeons have appointments to keep directly afterwards. It is therefore important to ensure that the meetings stay within their allotted time slots.

> *"[Doctors need] to know that it's a well run meeting, that it begins on time and that it ends on time."*

Ensuring Availability of Food

- The same three participants noted that the availability of food contributed to the participation and attendance at their multidisciplinary meetings.

> *"Whenever you're doing multidisciplinary care meetings we all …find that catering is vital."*

Ensuring Administrative Support

- Individuals from two sites discussed the need for an individual who could shoulder the responsibility of attending each meeting and entering information into the tool. One participant stressed that consistent data entry is important, and that ideally a physician should be responsible for it.

> *"Biggest barrier [is] to get a person sitting in the tumour board…entering [information] in a consistent way…[Need] someone during the meeting sitting on the keyboard documenting these things and that person has to be a physician… people who are comfortable enough to sit at the keyboard and document"*

Being Responsive to Technical Challenges

- At one site, a brief survey is sent out following each meeting to poll attendees about technical challenges experienced during the meeting. This was beneficial because it allowed them to suggest and implement changes.

> *"It…has a survey evaluation after the meeting sent by email to the people that attended. The results are stored on the system and it asks; was your meeting a success or did you have audio problems, etc."*

Ensuring Appropriate Infrastructure is in Place

- One participant insisted there be sufficient microphones in the MCC room. This ensures that each of the key participants can be clearly heard.

> *"[If] you have a big room with lots of people, you need a few mics. Have a table in the center of the room where the key people sit…including pathologists, radiologists, medical oncologists, etc. This helps to make sure that they are clearly heard."*

- Another site explored the use of different types of furniture to lend greater flexibility to the set of the room in which MCC meetings are held.

> *"Include stackable chairs and modular tables to keep room set up flexible."*

Tracking Patient Referrals to MCCs

- The same site noted that they track the reasons why a physician has referred their patient to the multidisciplinary meeting.

> *"[I am] Interested in knowing what their particular stumbling blocks with the patient were – what made them refer the patient to the MDT?"*

Creating the Right Atmosphere

- With respect to the type of room in which MCCs are held, one site felt strongly that lecture halls should be avoided.

> *"Sometimes [we have to] hold meetings in lecture theatres – avoid this. It's more like a presentation and doesn't lend well to group discussions."*

- Creating an atmosphere for learning that encourages open discussions was suggested by one participant.

> *"Encourage…open and frank discussion, but avoid any rows or personality clashes, especially between established factions."*

- One participant stressed the importance of ensuring that all of those in attendance at the MCC receive an equal opportunity to contribute to the discussion.

> *"Make sure that the non-doctors get a decent 'crack of the whip'."*

Taking Advantage of the Unexpected Benefits of MCCs

- Another participant highlighted that having a tool makes physicians think about the processes at their facility, which could lead to improvements.

> *"There are opportunities to innovate and to actually re-think some of the forms that you choose routinely; do you really need this. It's caused us to kind of re-think everything, you know."*

Using MCCs as Opportunities to Increase Collaboration Between Communities

- One participant involved in bringing geographically distant sites together noted that MCCs provide the opportunity to build bridges between different communities.

> *"[Meetings provide] an opportunity to build communities. Even if you're working in an isolated country, it's your connection to the rest of the world and you feel like your part of a whole world mission of helping kids around the world and you're not alone"*

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Appendices

Appendix 1 : Interviews Conducted

Table 13 displays the dates of the key informant interviews, the names of the participants, and their respective sites.

Table 13: Interviews Conducted

Participant Number	Date of Interview	Name of Participant	Site
1	September 12, 2008	Dr. Mahmoud Khalifa	Sunnybrook Hospital
2	September 17, 2008	Dr. Yuri Quintana	St. Jude Children's Hospital
3	September 18, 2008	Dr. Gerald Batist	Jewish General Hospital
4	September 18, 2008	Dr. Reza Nouraei	Charing Cross Hospital
5	September 23, 2008	Dr. Michael Kelly	University Hospitals of Leicester
5		Dr. David Sharpe	University Hospitals of Leicester
6	September 23, 2008	Jacqui Hennock	BSWRICS
7	September 25, 2008	Tracey Guan	QCCAT, Queensland Health
8	September 25, 2008	Sharon McGonigle	UHN Telehealth
8		Kambria Ernst	UHN Telehealth
9	September 26, 2008	Dr. Kenneth Gehman	Thunder Bay Regional Health Sciences Centre
10	October 1, 2008	Dr. Michael Anderson	Royal Victoria Hospital
11	October 3, 2008	Dany Bell	North Bristol Trust
11	October 6, 2008	Martin Bell	North Bristol Trust
12	October 6, 2008	Anne Snider	Juravinski Cancer Centre
13	October 6, 2008	Katie Rapp	Methodist Healthcare

Appendix 2 : Interview Guide

Sites Submitting to a Central Organization

The following interview guide was used when speaking to sites that appear to use a central data tracking tool or to central organizations that collect data.

Telephone Questions for Sites Submitting to a Central Organization:

1. What data or indicators do you submit from your MCC to the central site/ database?
2. How do you submit your data?
   - Who is responsible for submitting the data or indicators to the central tracking system (physician, nurse, secretary?)
   - What resources are required or recommended to ensure that the submission of data is successful?
   - Is there any incentive for submitting your data to the central body (funding, annual reporting, etc.)
3. How well does the central tracking system integrate with other hospital systems, and in what way?
   - Other hospital specific MCC technology
   - Hospital Information System (HIS)
4. Did/does the staff at your facility have any specific or ongoing concerns with the method of data submission?
5. What were some of the critical success factors and lessons learned from the implementation or use of the central tracking system?
   - What are the key enablers for using the technology? Key barriers?
   - What are the key benefits of the system?
6. How does the system support the flow or progress of your work or the work of the other staff involved in MCCs?

Telephone Questions for the Central Organization:

1. Can you describe what prompted you to investigate a technological solution for central data tracking?
   - What were the principal challenges or problems?
2. What are the key benefits of the system?
   - How does the system support the flow or progress of the work of the staff involved in MCCs? Of those that use the data?
   - How does the technology facilitate the data collection centrally?
3. What data is collected about MCC activity from each site?

- How did you decide on what data elements to collect?
  - Did you decide this centrally or was there consensus with the hospitals
4. How does the data arrive at the central system? Is there a "requirements" document sent to all submitting hospitals?
5. What were some of the critical success factors and lessons learned from implementing this system?
   - What are the key enablers for using the system? Key barriers?
   - How did you get all the hospitals to buy-in, collect, and record this data?
     - Are facilities funded to provide their data? Or funded based on the data provided?
6. How does technology facilitate the reporting of data or indicators? What kinds of reporting do you do with the data submitted? Do you report indicators on MCCs?
7. What resources are required or recommended to ensure that the technology is successful?
8. Are there any unresolved issues that the system does not address?
9. How was this system rolled out to hospitals? Any lessons learned from this process?

Following the telephone interviews, individuals may receive follow-up questions by email. These questions will center on the basic features of and requirements for the central administrative tracking system. Questions about the type of data collected and submitted to the central system will also be included.

Follow-Up Email Questions:

1. With respect to the system:
   - What kind of system is it? Web-based? Traditional client-server? Other? Please specify.
     - Which database does it use?
   - Does the tool depend on third-party software components or was it developed from scratch?
     - Which application development tool/language was used to build this system?
   - Who developed this system?
2. What are the approximate costs associated with the system?
   - Onetime: development, installation, training, etc.
   - Ongoing: support, maintenance, etc
   - What ongoing resources are required or recommended to operate the technology (e.g. IT resources, personnel)?
3. How is data submitted to the central location?
   - Is the data automatically sent to the central information system from the hospitals' system, or is there manual effort involved?
   - Do multiple sites submit to the central data tracking system?

- Who is responsible for ensuring that all of the data has been submitted correctly?
- Do all submitting hospitals need to use the same technology/program/software for data to be easily and accurately transmitted and used?

4. How is the data used (For example, is it included in annual reports, used for continuing medical education (CME) purposes, used for performance management purposes)? Please specify.
5. Who are the primary users of the data?

Sites Using Tools for Meeting Organization/Administration and Content Storage

The following is a questing guide that was used to interview sites that have developed or implemented technologies to help with tasks prior to an MCC (i.e., planning, creating patient lists and case files, organizing meetings for attendees, etc.), during an MCC (i.e., displaying patient case files/images and/or recording decisions), or following an MCC (i.e., tracking treatment decisions against actual treatment). Some technologies may have capabilities spanning more than one of these areas.

Telephone Questions:

1. Why and when did you implement this technology?
2. What are the key benefits of the system?
    - What does the technology enable you to do that you could not do previously?
    - How does the tool provide support/reduce the workload burden (for example, submission of patients to MCCs, assembling case materials for the MCC meeting, recording MCC discussion and decisions, etc.) for:
        - The meeting coordinator?
        - The referring physician?
        - The other health care professionals involved?

3. How does the tool support pre-meeting functions?
    - How does the technology support the inclusion of patients on the list for discussion during the MCC?
    - How are the cases that will be discussed at the MCC identified?
    - How does it help to put the case files together?
        - Are they sent in by the physicians, nurses, or assistants, or are they automatically sent in from a clinic registration list?

4. How does the tool provide support during the meeting

- How do you use the technology during the MCC meeting?
- How does the meeting function, specifically with respect to the technology used?
- Do you use any technological solutions for improving physician attendance at MCCs?
- If there are participants from multiple sites, can they use or benefit from the technology, and how?
- What are the key pieces of information recorded during the MCC
- Where, how, and by who are these decisions recorded?

5. How does the tool support post-meeting functions
    - What are the key pieces of information recorded after the MCCs?
        - Are initial and follow-up treatments recorded?
        - Where, how, and by who are patient treatment decisions recorded?
    - Does the tool enable you to integrate decisions into the hospital patient record?
    - How do you record instances where patient treatment differs from the decisions reached during the MCC?
    - How is this information used (e.g., research, follow-up care)?

6. What are the key enablers for using the technology? Key barriers?
7. How well does this system integrate with other hospital systems?
8. Are there any unresolved issues that the tool does not address?
    - If you had the choice, would you chose the same technology again, or look for a different one? Why?
        - Moreover, would you keep all of the same features? Add any new features? Remove any features?

Following the telephone interviews, participants were sent follow-up questions by email. These questions centered on the basic features of the technology.

Draft Follow-Up Email Questions:

*Please note that some questions may be eliminated if appropriate responses are given during the initial pre-screening email or the telephone interview.

1. With respect to the system:
    - What kind of system is it? Web-based? Other? Please specify.
    - Was the tool developed using an off-the-shelf software package (e.g., Microsoft Access) or was it developed from scratch?
    - If developed using an existing package, which package was used?

- Who developed this system?

2. What are the approximate costs associated with the system?
    - Onetime: development, installation, training, etc.
    - Ongoing: support, maintenance, etc
3. What ongoing resources are required or recommended to operate the technology (e.g. IT resources, personnel)?
4. Is any patient **identification** data shared or displayed? If yes, how is privacy ensured? **[Note: only relevant when patients are from different hospitals]**
5. What pieces of information are recorded about the MCC themselves (e.g., meeting duration, number of cases discussed, number of disciplines attending, number of attendees/hospitals logging in)? **[Specific to post-meeting tools]**
    - How is this information recorded, and who is responsible for ensuring that the information is recorded accurately?
6. Are any indicators or data presented to the Chief of Staff, Senior Hospital staff, the Board, or put in the annual report or quarterly performance reviews? **[Specific to post-meeting tools]**
    - What type of data is presented?
    - What else do you use this data for (e.g., professional development credits, etc.)?

Sites Using Videoconferencing

The following question guide was used when discussing the benefits and challenges associated with using the videoconferencing services.

Telephone Questions:

1. What are the key enablers for using videoconferencing? Key barriers?
    - Does the set up of the equipment or the room in which the conference is held facilitate or impede the meeting in any way? Please elaborate.
    - How are participants encouraged to participate in videoconferenced MCCs?
2. What are the key benefits to videoconferencing for your MCCs?
3. How well does the videoconferencing system support the various aspects of the MCC meeting, including viewing case files and recording decisions
4. Do you use any other technologies to support your MCC meetings?
    a. Any systems to support planning/organizing meetings
    b. Any systems to support recording treatment recommendations, etc
5. Have you or members of your staff had any technical difficulties while setting up or using videoconferencing for MCCs?
    - If yes, what were the most common technical difficulties experienced?
    - How were these solved?

- How have you worked to avoid a similar problem in the future?

6. How is patient confidentiality maintained if participants are from different hospitals?
7. How would you describe your overall experience with videoconferencing technology?
8. What were some of the critical success factors and lessons learned from implementing this system?

Following the telephone interviews, participants may have received follow-up questions by email. These questions centered on the basic features of the videoconferencing services in use at the facility.

Follow-up Email Questions:

1. What videoconferencing services do you use at your facility's MCCs? [**Only if not OTN]**
2. What are the approximate costs associated with the videoconferencing system?
    - Onetime: development, installation, training, etc.
    - Ongoing: support, maintenance, etc
3. What ongoing resources are required or recommended to facilitate a videoconferenced MCC (e.g. IT resources, personnel)?
    - Are these shared resources shared among departments?
4. On average:
    - How many sites participate in videoconferenced MCCs?
    - How many patient cases are discussed during each conference?
    - How often are videoconferenced MCCs held?

If other technologies/systems are used to support your MCCs (meeting organization, recording decisions, etc)

5. What are these systems?
6. What are the approximate costs associated with these system?
    - Onetime: development, installation, training, etc.
    - Ongoing: support, maintenance, etc
7. What ongoing resources are required or recommended for these systems

Appendix 3 : Literature Scan Table

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
MCC Tools					
England					
1	Sar Nouraei, J Philpott, SM Nouraei, DCK Maude, GS Sandhu, A Sandison, and PM Clarke Reducing referral-to-treatment waiting times in cancer patients using a multidisciplinary database Annals of The Royal College of Surgeons of England 89:113-117, 2007	•Modern delivery of cancer care through patient-centered multidisciplinary teams (MDT) has improved survival by allowing patients to benefit from the experience of a range of specialists •Head and neck MDT inquiries require coordination between multiple surgical specialties. •Coordinating the input of multiple specialties can represent a notable organizational challenge. •Bottlenecks in the MDT process can add to the time between referral and treatment	•Appraised MDT process to identify potential delays and assess how performance could be improved. •Findings were used to design a trust-wide database to coordinate and track new and existing patients	•A systems analysis of the MDT process was performed through direct observation and through stake-holder surveys. The audit occurred over an 11 week period •A new process for coordinating the MDT meeting and a new data management application were developed using Microsoft Access •This was a multi-user, automated, menu-driven database for registering and tracking patient information. •The database also generated live interactive worklists for the pathology and radiology departments. •MDT decisions for each patient could be recorded. •Senior clinicians could register patients directly for the MDT meeting as soon as the decision to include them was made	•The development of a trust-wide database reduced delays within the MDT process for a notable proportion of patients by opening a channel for communication across specialties •The database simplified the process of registering patients for the MDT meeting and produced real time worklists for pathology and radiology •Patients with head and neck cancer often present with advanced disease, therefore the reduction in referral-to-treatment wait times could improve outcomes •Improvements in the administrative structure of the MDT can reduce delays and be achieved with minimal capital. •The integrated database can reduce the risk of errors leading to patients being delayed or lost in the system.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
				• The performance of the MDT was reassessed during the 10 weeks following the implementation of the database. • Over the full 21 week audit cycle, 413 patient episodes occurred, 187 following the introduction of the database.	
2	M Soukop, A Robinson, D Soukop, CL Ingham-Clark, and MJ Kelly Results of a survey on the role of multidisciplinary team coordinators for colorectal cancer in England and Wales Colorectal Disease 9:146-150 (2006)	• Over past six years MDTs have been established and play key role in the delivery of cancer care in the UK • No published data on the role of coordinators	• To seek the views of colorectal multidisciplinary teams coordinators (MDTCs) on what they do and how they do it	• Questionnaires sent colorectal MDTC or equivalent in all 180 NHS hospitals in England and Wales where colorectal cancer surgery performed • 90 of 128 (70%) respondents indicated they had a designated colorectal MDTC and all of these completed the questionnaire fully • 30% has not such person and about half of these supplied full details while the remainder supplied only minimal data	• 85% of all trusts maintained some type of database • Large variation in the nature and detail of the information collected • Many of the databases recorded were in-house or local variants with only two systems (Association of Coloproctology and Infoflex) being used with any frequency by 24(22%) and 13 (12%) of the centers, respectively • Information was recorded manually at the MDT meeting either by the coordinator or another member of the team and then entered into the database • Only five centers enter information directly into the database • Most frequent method of communicating decision to primary care was letter or fax

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					• Videoconferencing was available at 32 (30%) of the trusts with a further 10% planning to acquire facilities. Only 17 sites used the facilities for colorectal MDT • 39 (43%) of MDTCs indicated a need for further training with 35 identifying 56 areas of deficiency (data systems and IT received the most mentions (13)) • The article mentions that the database at Leicester allows data items to be keyed in just once and then downloaded and uploaded to local and national databases without extra secretarial input • The article also notes that the Leicester database is cast in a format to permit painless transfer to the (National) Association of Coloproctology of Great Britain and Ireland (ACPGBI) database and that Leicester provides a substantial proportion of the total number of patients
3	Iris Bangs, Lynne Baldwin, Malcolm Clarke, Linda Hands, Russell Jones, and Wendy Mahaffey.	• Healthcare provision in the UK is fragmentary in nature. This has implications in terms of the speed and accuracy of care at both the primary and secondary	• To introduce Advanced Informatics Distributed Medical Access	• A review of a study of 6 patients with pressure ulcers who participated in a vascular teleclinic over a period of 8 months	• At the consultation, decisions about whether to refer the patient for surgery or to treat them locally are made, potentially saving the patient from unneeded travel.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	A Technology-assisted Approach to Integrating Healthcare in the Community. Telemedicine Journal and e-Health 9(2) 215-221, 2003	level, and may present problems for many patients with vascular disease •Under the current system, patient referrals can represent a lengthy and complicated process. •Patients with vascular disease may require many visits to primary and secondary care facilities and may have to undertake a great deal of travel. There is a need to minimize travel to restrict referrals only to those patients who need it. •There is no mechanism allowing patients to interact with a local nurse, doctor, or health practitioner at the same time as a specialist or consultant •In the current National Health Service (NHS), information is stored in various places and access is restricted.	Network (AIDMAN), an information technology system that combines store-and-forward and real-time video •To describe how AIDMAN can support an integrated, nurse-led clinical team in charge of the peripheral vascular ulcer care program at the primary care level. •To demonstrate how AIDMAN can be used in the treatment of patients not referred to the hospital specialist or consultant at the secondary care level.	•When a patient has a deteriorating wound, information and digital photographs are placed in an electronic referral form. All information is stored electronically and can be forwarded to a specialist or consultant. These can be accessed during a teleconsultation by the local physician and the specialist at the hospital. •Specialists can request additional information prior to the teleconsultation.	•If the patient is a candidate for surgery or further testing, appointments can be immediately booked. •Initial research suggests that patients are pleased with the AIDMAN system; particularly the reduction in travel and the number of visits to the hospital.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
USA					
4	Mark J Halsted, Laurie A Perry, Timothy P Cripe, Margaret H Collins, Rex Jakobovits, Corning Benton, David G Halsted Improving Patient Care: The Use of a Digital Teaching File to Enhance Clinician's Access to the Intellectual Capital of Interdepartmental Conferences. AJR 182: 307-309, 2004	•Clinically useful information is discussed at interdisciplinary conferences. Much of the information presented is not, however, recorded. •Better communication at multidisciplinary tumor boards would avoid the loss of intellectual property by creating a record of the board findings and could improve patient care.	•Describe a simple method for creating teaching cases from clinical data, radiologic images, surgical images, and images from pathologic slides that are presented at tumor board conferences.	• A radiology department digital teaching file based on MyPACS teaching file management software was adapted. This allowed clinical, radiographic, and other data to be recorded, organized, and sorted	•This study discusses MyPACS for creating teaching files from tumor board conferences. •A template is created for each case. Text and images can be entered directly into the teaching file data by the oncologist, radiologist, pathologist, and surgeon independently of one another. •Case entry in the new system is no more time-consuming than in the past and conferences have run more smoothly. •After diagnostic and staging information is entered, details about the disease are provided. The therapeutic plan and prognosis are then discussed. •The system accepts common graphics formats, including PNG, JPEG, BMP, GIF, and TIFF. •Each presenter can see the work of the others while they make up their section, improving case organization. •The case is presented directly from the teaching file with a digital projector. •The software automatically standardizes image size and format, but these can be changed if necessary

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					• At the end of the presentation, the finished file remained as a permanent part of the teaching file and was made available to anyone with access to the hospital intranet • While this group used the MyPACS teaching file, the same ends can be achieved through other means, such as with a Microsoft Access database. • Some commercial database products like Apple Computer's FileMaker Pro can be used to improve Web publishing capability. Others can be Web-enabled using commercial products like Front Page, Active Server Pages, or Cold Fusion.
5	Edward Weinberger, Rex Jakobovits, and Mark Halsted MyPACS.net: A Web-Based Teaching File Authoring Tool AJR 179: 579-582, 2002	• A growing number of hospitals are allocating resources towards creating online teaching file collections. • Collections are either static web sites with cases stored as HTML or dynamic web applications. Images are first saved to server's hard drive in a format that can be viewed using all browsers (such as JPEG or GIF). Other images had to be translated with	• Develop a Web service that would allow radiologists to create their own online teaching file cases from any Web browser	• MyPACS was designed to be web-based; there is no software to install. • Users can begin authoring cases immediately by uploading text and images from any web-connected computer. • Teaching files can be retrieved by searching date, title, pathology, anatomy, etc, and includes a toggle between basic and advanced searches	• The authors created the MyPACS file authoring tool, which is available online (http://MyPACS.net) • Radiologists from over 45 countries have logged on to create their own online teaching file collections to share with students and interesting cases with remote colleagues. • MyPACS can be used as a teaching file as well as a tool during inter- and intra-departmental conferences. This tool can also store and retrieve cases

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
		DICOM retrieval software such as eFilm or image manipulation software like Photoshop • Some facilities have developed database-driven teaching file repositories. Web pages are generated dynamically from records stored in a database in response to browser requests. This is costly, and entering new cases requires knowledge. • A user-friendly tool would permit radiologists to create and maintain own databases		• The author controls how images and case studies are used. Cases are stored on a professionally-hosted, high bandwidth Web server, and are backed up daily. • Each stored case receives a unique case number. Physician can chose to track case numbers and patient identifiers. The MyPACS server can be installed on a facilities intranet if patient identifiers are to be stored in the case to avoid violating the Health Insurance Portability and Accountability Act • The server can be integrated with the facilities PACS via DICOM interface or by prefetching images saved to a local file repository • The hosted database-driven teaching file application was built using Web Interfacing Repository Manager (WIRM). This tool handles images, manages user sessions, regulates access, and creates context-sensitive interfaces that adapt to different classes of end user.	for upcoming publications or presentations.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
6	Rex Jakobovits, Stephen G. Sonderland, Ricky K. Tiara, and James F. Brinkley Requirements of a Web-Based Experiment Management System Proceedings, American Medical Informatics Association Fall Symposium, pp. 374-378, 2000	•Due to advances in technology, an increase in data formats for storage and organization, a reliance on the interoperability of uncoordinated software applications, and more consortium-based projects have lead to growing information management problems for research laboratories.	•Provide detailed analysis of informatics requirements of an Experiment Management System (EMS) •Propose a new type of middleware called an EMS-Building Environment (EMSBE) which enables the rapid development of web-based systems for managing laboratory data and workflow •Describe the Web-Interfacing Repository Manager (WIRM), which is being used to manage several ongoing experiments •Metadata	•Software geared toward the laboratory – Laboratory Information Management Systems (LIMS) or EMSs – are needed. This is difficult to develop because of the diverse nature of experiment data and interface requirements. Also each EMS has to be custom built for a single problem domain •This study describes EMSBE and describes a working EMSBE called WIRM.	•A tool called Web-Interfacing Repository Manager (WIRM) is described. •WIRM is web-based and can be accessed from anywhere, is based on an object-relational model, uses a high-level Perl scripting language, supports customizable "context-sensitive" view definitions, and EMS built with WIRM can be freely distributed •The key requirements of an EMS were described as a uniform interface, transparent data management, and a means to buffer the user from the details of the software. •An EMS should manage a range of heterogeneous software tools used in the acquisition, processing, and management of experiment data. The EMS should also provide an interface for browsing the data by either providing a central data warehouse or by mediating queries to external sources. •Typical experiments may include images, sound, and video types, binary data, and ASCII dumps of tables. An EMS database should have built in support for managing file types and

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
			management, query support, user interface construction, and application interfacing have to be addressed for successful experiment management. • There are commercial repository systems available (such as SAP/R3); however, they are geared towards business data and require notable personnel resources.		handling image conversion. • EMS should have multiple interfaces for different user classes (surgeons and radiologists would, for example, be interested in different aspects of the patient record). Unnecessary details should be hidden from some users while others are emphasized based on predicted needs. The enforcement of privacy can also be considered an aspect of the adaptive user interface. • One of the key benefits of WIRM is the ability of users to design their own schema online using forms in a Web browser. • WIRM has high level rapid-prototyping ability and intuitive modeling power. Its extensible architecture will allow the EMS to grow as experiments evolve.
7	Rex Jakobovits, Cornelius Rosse, and James Brinkley WIRM: An Open Source Toolkit for Building Biomedical				

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	Web Applications Journal of the American Medical Informatics Association 9(6):557-570, 2002				
8	Rex Jakobovits, James Brinkley, Corenelius Rosse, and Ed Weinberger Enabling Clinicians, Researchers, and Educators to Build Custom Web-Based Biomedical Information Systems Proceedings, American Medical Informatics Association Fall Symposium, pp. 279-283, 2001				• This study Discusses WIRM and provides more information about other WIRM based applications. The paper also provides more information about MyPACS and discusses FATHOM. • WIRM automatically generates a web application that enables end-users to import, organize, query, and visualize domain data • WIRM includes facilities for supporting arbitrarily complex data types and their associated metadata • WIRM provides tools for handling images, managing user sessions, regulating access control, and creating context-sensitive interfaces that adapt to different end-user classes • WIRM was used to build MyPACS, a web based service that enables radiologists to manage their own image repositories • FATHOM is an experiment

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					management system for natural language processing.
9	Ayse P Gurses and Yan Xiao A Systematic Review of the Literature on Multidisciplinary Rounds to Design Information Technology Journal of the American Medical Informatics Association 13(3): 267-276, 2006	•Multidisciplinary rounds (MDR) allow health care professionals from different specialties to meet, communicate, make joint decisions, and manage responsibilities. •MDR can be named for their: primary purpose (e.g., discharge or daily rounds), clinical unit (e.g., medical or surgical rounds), location (e.g., bedside rounds), and time frame (e.g., morning or postadmission rounds)	•Describe the information tools used by health care providers in MDR •Assess the evidence regarding the impact of information tools on the communication processes of MDR and outcomes •Identify the information needs of care providers in MDR •Identify measures that can be used for evaluating	•Literature published from 1990 to June 2005 was searched. •MEDLINE, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Current Contents and Science Citation Index, and the American Medical Informatics Association symposium proceedings were searched. •Keywords included the following: round$, multidisciplinary round$, medical round$, "patient rounds", ward round$, work round$, "patient care team" •MDR were defined as regularly scheduled meetings of health care providers from different disciplines involved in the care of the same patients or management of the same unit. •Papers were pulled regardless of the type of rounds studied	•16 articles reported use of information tools (computerized and non) in MDR •Patient-centric information tools included nursing flow sheets, medical records, and medication lists. •One study reported use of patient-centric information tools during MDR showed a preference for entering information into the patient medical records immediately and processing requests during rounds. •Another study reported that decisions made during rounds were entered directly into patient records to avoid inputting duplicate information afterwards •UWCores is a centralized, web-based computerized rounding and sign-out process-oriented tool designed by a team of physicians, informatics researchers and a computer systems developer in a large university center. This tool organized information pre-rounds and printed it in a condensed

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
				providing they were multidisciplinary. Editorials and letters, papers related only to the teaching aspect of MDR, and papers on shift change and sign-out rounds of residents were excluded. •Of 403 papers identified in the preliminary search, 44 met inclusion criteria. The bibliographies of the 44 papers identified an additional 7 papers •Literature was analyzed based on "Donabedian's structure-process-outcome model". •Structure includes information tools (computerized or non) used by care providers in MDR, such as patient medical records notes, flow sheets and to-do lists. •Process includes gathering and assembling information pre-rounds, communicating before and exchanging information and building shared awareness about patients during rounds, and coordinating and executing care plans after rounds. •Information tools were separated into patient-centric, process-	format. Other tools have been developed to ensure consistent communication and information sharing. •Mobile platforms including personal digital assistants (PDAs), wireless PCs and wireless computer carts are preferred computing platforms for information tools. •One PDA-based tool described included up-to-date patient lists and active diagnoses with annotation function. In another study from Ohio, wireless tablet PCs were used to quickly access clinical information during rounds. •Studies support the use of information tools in MDR to improve communication processes and outcomes. These tools can support collaborative work in health care settings. •Computer-based tools can extract relevant information from existing clinical information systems automatically, eliminating the need for care providers to copy information manually. Information is also more likely to be updated. •The review found 5 groups of features

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
				oriented, and decision-support tools. •Outcomes include clinical outcomes, efficiency, and satisfaction (patient, health care providers, families)	useful in computerized information tools to support MDR. (1) Automatic summary of up-to-date information on patients and unit work status (2) supporting multiple users (3) supporting MDR in a mobile, noisy, and interruption-prone work environment, (4) using checklists extensively, and (5) supporting informal communication space •The review also found gaps that could be a focus for future research: how information and communication technology can be used to support MDR and communication (the characteristics of collaborative work need to be studied in detail), what the key barriers and facilitators to MDRs are, how MDR efficiency can be improved, the potential negative effects of information tools on the quality of care, and the lack of intervention studies to identify the design features of effective tools
10	Brent K Stewart, Sherrilynne S Fuller, Judith A Ramey, William B Lober, David Chou, Suzanne	•The Next Generation Internet (NGI) is a federally funded research and development program. The National Library of Medicine Biomedical	•The focus of Phase 2 of the project is to develop collaborative	•3 teams were formed to develop the software – Technical Infrastructure, Context Inquiry and Design, and Telepresence and Collaborative Work	•Software developed for collaborative tumor conferences between different sites in Seattle is highlighted •Lessons learned were discussed. These

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	J Weghorst, Steve G Langer, Kelly P Martin, Debra S Ketchell, Tristan A Robinson, Robyn Maberry, and Hao Li Tumor Conferencing Tools for Regional Collaborative Cancer Care Using the Next Generation Internet Proceedings of American Medical Informatics Association Fall Symposium, p.836, 2001 [Presentation Abstract]	Applications of the NGI is a 3-phased program. •The focus of the work is collaborative tumor conferencing	Internet tools for tumor board conferences held among different sites of practice	•With the software, clinicians prepare for conferences by uploading images, documents, or URLs through a web interface •Stored data includes pathology, radiology, scanned documents, digital slide presentations, and links to a variety of web pages (NCI study descriptions, NCI CancerNet searches, and MINDscape, the University of Washington Medical Center Web based electronic medical record •Each location views the same images and documents using pcAnywhere and high contrast LCD projectors •Open source software was used whenever possible. The server was Apache 1.3.12 running on Debian Linux 2.2.15. •Client side software uses HTML, Java, and JavaScript	are: (1) a user-centric design process is aided by scenario-based simulation evaluation with key primary users (2) the prioritization of future enhancements can be aided by rolling evaluation of the usability, content, and utility of the system and (3) the gradual introduction of new technologies allows users to master each transition towards the final targeted design.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
11	H Li, WB Lober, LJ Trigg, MR Dockrey, D Chou, and B Stewart Iterative Development of a Web Application to Support Teleconferencing of a Distributed Tumor Board Proceedings of American Medical Informatics Association Fall Symposium, p.1081, 2002 [Presentation Abstract]	•Commercially available teleconferencing products often do not integrate well with information systems •There is a lack of sustained eye contact between participants due to switching between video display of presentation materials and participants. •To address limitations, a clinical case teleconferencing system was implemented to permit the delivery of information in a variety of formats. •A web-based information management system with a database backend was also developed	•To study the impact of a web-based information management system using subjective and objective measures	•The information system stores images and other objects, including Word documents, PowerPoint presentations, URLs, and patient and conference metadata •Tumor conference sessions were taped. The group of physicians involved were surveyed to assess the impact of the information system on their professional practice	•Web-based interface allows clinicians to organize conference data and display that information at the tumor boards. •The article noted that success was achieved success in developing a novel, image-based information system to supplement videoconferencing over high-speed networks •Their system has helped clinicians to manage and present clinical data in all hematology-oncology conferences at the medical center •A max. projection resolution of 1024x768 via high bandwidth Internet connection preserves image quality. •The authors believe that their infrastructure can be a useful platform for further development of clinical teleconferencing information systems
France					
12	D Mutter, G Bouras, and J Marescaux Digital technologies and quality improvement in cancer surgery	•Surgical training is undergoing a revolution. New methods of training have to be established in minimally invasive surgery (MIS) •Multimedia computer-aided learning will introduce changes			•Videoconferencing allows students to observe an expert perform a procedure. •High-quality, real-time surgical images with interactive sound transmission are viewed. Multiple images from the OR and from other teaching sources are viewed.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	European Journal of Surgical Oncology 31:689-694, 2005	to training. This includes application of computer technology, the internet, surgical simulation, and robotics. • At their center, the authors have developed surgical multimedia and computer-aided learning including video-conferencing, virtual reality, and computer-assisted simulation to optimize education			• Surgical simulations facilitate training and provide surgeons information for pre-operative planning. This will be aided through developments in computer technology, robotics, and virtual reality (VR). • Decision making in cancer treatment often requires a multidisciplinary approach. Communication and the transfer of medical information are important. • By watching live transmissions, surgeons can gain competence in procedures from the cutting edge of surgery. Communication between surgeons is also improved. • The original software of this type (PIN 3 of France Telecom R&D) has a virtual environment where participants can communicate and interact. This allows cooperative work in 3D. Participants are represented by dummies that can have dialogues, and all participants can manipulate and navigate images and simulate proposed treatments. • Diagnostic and therapeutic decision-making were optimized by the simultaneous participation of specialists through interactive

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					networking of 3D reconstructions in real-time. •VR enhances the interpretation of medical imaging. 3D images can be evaluated and manipulated in real-time. VR also enables pre-operative planning and simulation of surgical procedures. •VR images from CT reconstruction of patients can facilitate the simultaneous participation of experts from various locations through secured cooperative experimental working platforms using broadband internet connection (DSL high speed internet links) •New modalities in representing patient data can improve diagnostic accuracy and inter-specialty communication.
Germany					
13	R Cherkerov, C Denkert, D Boehmer, A Suesses, A Widing, R Ruhmland, A Giese, A Mustea, W Lichtenegger, and J Sehouli	•Tumour board meetings are common procedures for treatment planning, follow-up care, and education. They can optimize clinical cooperation, can increase recruitment rates for clinical trials, and can act as a quality assurance instrument for	•The group developed a novel, online tumor conference in 2004 as a pilot project. •This tool enables gynecologists,	•This study includes all patients with adjuvant or recurrent gynecological cancer discussed in the online board meetings over a 20 month period. •Specialists from Charité University Hospital, 34 additional external	•Over the 20 month period, 39 meetings took place and 144 cases were reviewed. On average, 4 cases were presented per meeting. To the time of publication, 667 professionals participated in the meetings (the ranking list of participants can be found here: www.online-

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	Online tumour conference in the clinical management of gynecological cancer: experience from a pilot study International Journal of Gynecological Cancer 18:1-7, 2008	patient care. •Tumor board meetings require significant preparation time, and participation of general practitioners is limited by time resources and distance. Therefore, many institutions have abandoned tumor conferences, believing that the cost and preparation time involved outweigh the clinical benefits.	surgeons, radiologists, oncologists, and pathologists from across Germany to present their patients' cases, define therapy options, and participate in discussions.	gynecological hospitals, and 41 general practicing gynecological oncologists were involved. •The concept of the online tumour conference is based on an audiovisual communication approach. To be involved in online discussions, physicians log in to online sessions via the Internet. •All patient data is prepared on PowerPoint slides and presented during the session on the tumor conference home page. Connected physicians can follow the meeting from their own computers. An interactive discussion follows the presentation. •A tumour conference manager – a physician in training to gynecology and obstetrics – organized the meetings, reviews all documents, and enters relevant data into the electronic documentation tool using a screening questionnaire. The conference manager also oversees the screening process of new cases and the monitoring	tumorkonferenz.de). A median of 17 participants logged on per session. •From all patients, 29 received recommendations for treatment in clinical trials. 17 of these were included and successfully treated in trials. Organizational difficulties, such as distance, prevented the other patients from enrolling. •Getting patient data for heavily pretreated patients is the main time-consuming procedure •In follow-up surveys, 72% found technical support good. 80% found the software easy to operate. 84% found described the interface as good. 84% evaluated service management as good. •78% of individual recommendations were partially accepted and implemented •The authors demonstrated a high acceptance and feasibility of using web-based technology for tumor conferences •The key advantage of the tool was identified as the easy participation by private practices and clinicians via Internet without the necessity to physically join the meeting

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				of updates of international guidelines and standards. • An approved oncologist (an investigator trained in teaching evidence-based medicine) reviews and approves all patient documents and prepared slides • Data on patients, publication sources, and relevant clinical trials are stored in a n online accessible database for all members of the network • Web-based software was developed for the project with Alcedis GmbH. The software permits efficient data submission and management. It can process and convert different formats of patient documents into one that can be displayed on a conventional web browser. • Within 48 hours, protocols are generated and distributed to all participants. • The cases of the included patients and therapy compliance were reviewed using a structured questionnaire after 6 months and one year	• Many physicians have limited time in daily clinical practice to increase their medical knowledge. Because the authors' systematic approach of discussing current guidelines and recent study results, it could be used as a tool for continuing education. • The authors noted that longer observation time is required to evaluate patient survival. Also, further analyses should focus on the cost-efficacy and effects on study recruitment.
South Africa					

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
14	Kurt Brauchli, Hermann Oberli, Nina Hurwitz, Klaus-Dieter Kunze, Gunter Haroske, Gernot Jundt, Gerhard Stauch, Lech Banach, Mark Wirdnam, Michael Mihatsch, and Martin Oberholzer Diagnostic telepathology: long-term experience of a single institution Virchows Archive 444:403-409, 2004	•iPath (http://telepath.patho.unibas.ch) is an internet-based telepathology system that is used for pathological telediagnosis for hospitals and for second-opinion consultations. •A multi-purpose telemedical system can be used in tumour boards, health networks, field studies, and distance learning. •Challenges to telepathology include the creation of minimal standards to enable interaction between different systems and the organization of workflow.	•Review the development of the application of telepathology in a department of surgical pathology between 1991 and 2003 •The study aimed to determine the essential features of a modern, user-friendly telepathology system	•A telepathology system (iPath) was designed as a client-server system centered on a regional database. •Clients interact by transferring questions, which include both text and images, to a record (case) in the database on the server and transferring answers to the same record.	•iPath implements characteristics of a collaboration tool and a content management system, and is centered on a database that collects all data transferred between partners. This serves as an archive of past collaborations and consultations. •iPath has a web and email interface. For real-time conferencing, an online chat function can be used. •An iPath-Server can be installed using open source software tools (like Apache) and run on Linux •A tool that was designed to give non-experts a means of communicating with experts remotely is described in this study. iPath combines computer resources with a database, organizing their practical use, and designing the system as a modular content management system. •The paper highlighted that a modern telepathology system should have the following features: (1) cooperative systems that permit information exchange at any time without delay, (2) a server to manage connections between clients. The server can be placed in the Internet when connectivity beyond the local network

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					is needed, (3) a modular structure to quickly create new connections or adapt an existing system to new user needs. The most important module is the Internet. •iPath has applications in tumour boards, field studies, and distance learning.
Framework					
England					
15	JM Whelan, CDM Griffith, and T Archer Breast cancer multi-disciplinary teams in England: much achieved but still more to be done The Breast 15:119-122, 2006	•Evidence suggests that breast cancer patients cared for by MDTs have an improved 10 year survival rate •The Cancer Services Collaborative 'Improvement Partnership' (CSC'IP') has recognized that team decisions regarding treatment after surgery at the MDT meeting is one of the most important parts of the breast cancer treatment path.	•Look at the national coverage, composition, and discussion of breast cancer multi-disciplinary teams (MDTs) in England	•The breast cancer units in England that see breast cancer patients presenting symptoms through their GPs or those detected in the NHS National Breast Screening Programme were contacted •Units were found through the British Association of Surgical Oncology (BASO) and the CSC'IP' database. •The lead surgeon was sent a questionnaire	•134 breast units responded, 70% of which submitted National Cancer Wait Times data. •The majority of units had weekly meetings; most as a commitment during normal working hours •Most units discussed all patients during MDT discussions •Most units indicated that an MDT coordinator is essential to organizing and running the MDT meetings. 34 units did not have access to an MDT coordinator. This represents an area for improvement • More units could use IT support for the meeting (to display radiology and pathology image), to communicate diagnosis and treatment plans to primary care, and to book

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					appointments for continuing treatment (surgery, radiotherapy, and chemotherapy
16	Anne Fleissig, Valerie Jenkins, Susan Catt, and Lesley Fallowfield Multidisciplinary teams in cancer care: are they effective in the UK? Lancet Oncolgy 7:935-943, 2006	•Coordination, communications, and decision making between health care team members are aspects of cancer care that could be improved by multidisciplinary team (MDT) working. •Barriers to the successful implementation of this care method (ex. professional and institutional resistance, manpower, and logistical difficulties) need to be overcome •The organization of MDT meetings (MDMs) is left to local discretion.		•A review that discusses the practical barriers to the successful implementation of MDT working.	•This article discusses several key requirements for successful MDT working. These include good leadership, positive team dynamics, adequate administrative support, good-quality and complete information, sufficient staff time, and funding. Also highlighted are several barriers to MDT functioning •These requirements and barriers can inform the focus of this technology scan and/or the framework for analyzing the tools identified •MDTs need a leader to encourage full participation of the members, and shared objectives should be made clear. •Clerical support is required before, during, and after meetings to ensure good coordination. An MDT coordinator should arrange meetings, ensure availability of patient information, and record decisions

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					about patient management and member attendance. Accurate documentation would help to implement decisions made during MDMs •All team members require time to travel to and attend meetings. •The use of telemedicine has been introduced to improve communication between team members at remote sites. Preliminary results indicate that telelmedicine is easy to use and can help to establish professional relationships. A technician may be needed to enable other health professionals to concentrate on clinical issues. •Attendance at MDMs can be variable. Surveyed surgeons have suggested that providing more time for MDMs could increase attendance. Staff shortages were also cited as a reason for lower attendance at some sites. If problems are due to geographical distance, then teleconferencing or videoconferencing may improve attendance. •The lack of clerical support is another problem. A study of colorectal teams suggested that 62% had difficulty running their MDMs and 32% had no

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					dedicated clerk. • More evidence for the effects of MDTs, particularly benefits to patients' wellbeing and recruitment into clinical trials, are needed. This represents an area for future discovery. • Although telemedicine can help MDTs in some cases, additional resources are also required to support these groups.
Ireland					
17	Bridget Kane, Saturnino Luz, D Sean O'Briain, and Ronan McDermott Multidisciplinary team meetings and their impact on workflow in radiology and pathology departments BMC Medicine 5:15, 2007				

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
Videoconferencing					
Scotland					
18	N Barry, P Campbell, N Reed, M E Reid, D J Bower, J Norrie, and G D Currie Implementation of videoconferencing to support a managed clinical network in Scotland: lessons learned during the first 18 months. Journal of Telemedicine and Telecare 9 (2) S2:7-9, 2003	•Published by the Scottish Executive in July 2001, Cancer in Scotland: Action for Change emphasized the formation and expansion of managed clinical networks (MCNs) •Concerned with the diagnosis, treatment, and management of, and research into various disease groups, MCNs are built of health care professionals from the acute and primary care sectors. •Videoconferencing has been used for upwards of 40 years; however, literature about its use for healthcare remains dominated by studies on feasibility.	•To allow multidisciplinary teams to discuss individual cancer diagnoses without the extensive traveling previously required.	•Videoconferencing was implemented simultaneously at 5 sites. Commercial equipment was installed in 2001. •About 2 years later, image capture software (Excelicare) was installed, permitting the transfer of images into the cancer database •Videoconferencing equipment was set up in seminar rooms, ward areas, laboratories, and lecture theatres to facilitate multidisciplinary working and to expand the potential user base.	•The videoconferencing and live PC links allowed multidisciplinary teams to discuss cancer diagnoses without extensive traveling. •Following the implementation phase of the project, the system was used routinely for Gynecological Oncology Network meetings •Other groups are giving consideration to the use of the system. •To permit successful integration of videoconferencing into clinical routines requires the project team to identify benefits to all users. •Infrastructure presented challenges for the IT staff at participating sites.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
Australia					
19	G Delaney, S Jacob, R Iedema, M Winters, and M Barton Comparison of face-to-face and videoconferenced multidisciplinary clinical meetings Australasian Radiology 48: 487-492, 2004	•Multidisciplinary care is standard in large hospitals but harder to achieve in smaller facilities •Videoconferencing may improve access of clinicians and patients to multidisciplinary clinics. •Liverpool hospital holds weekly multidisciplinary breast care meetings with case presentations. These are attended by few specialists working at other hospitals in the area.	•Test whether improving access to multidisciplinary clinical meetings via videoconferencing would result in increased meeting attendance by doctors at peripheral hospitals. •Explore technical, organizational, and social factors that could impact the success of videoconferences •Determine whether new communications technologies affect the ways in which doctors work together, interact, exchange information, and solve problems.	•12 weeks of multidisciplinary face-to-face breast clinical meetings were studied from Feb to April 2000. Then, 12 weeks of videoconferences were observed. •Videoconferencing equipment used at the 3 sites was PictureTel room systems. The sites were linked by an external bridge facility. •Pretrial questionnaires were sent to 27 specialists involved in breast cancer treatment to determine their attitudes towards multidisciplinary clinical meetings, barriers to attendance, and interest in attending videoconferenced meetings. 16 clinicians responded. •A post-trial questionnaire was given to all clinicians who attended the videoconferences to determine their satisfaction with face-to-face meetings and videoconferences. 14 clinicians agreed to participate •All data was analyzed using SPSS	•Anthropological analysis of the face-to-face meetings showed these were less formal and attendees were willing to openly discuss uncertainty. There was interactive enthusiasm, and confirmed familiarity through joking •Anthropological analysis of videoconferences showed that clinicians adopted a more formal, public manner. Doctors were less willing to display uncertainties, and addressed the cameras rather than each other. Questions about politics and power were introduced. •Results about increased attendance were mixed. Participants at one of the district hospitals declined future videoconferences, citing time constraints. Participants at the other hospital wished to continue despite similar constraints. •New communication technologies may affect that ways in which doctors structure professional relationships (e.g., increased formality). •Technologically mediated interaction limits the number of modes of communication doctors can and will use.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
				• 3 face-to-face meetings and 3 videoconferences were taped for later analysis by an anthropologist	• Although more people attended videoconferences, most participants preferred face-to-face meetings • Face-to-face meetings were informal and conductive to open discussion, while videoconferences were more formal and regimented. • Videoconferencing may improve access of clinicians and patients to multidisciplinary care but it is important not to overestimate the capacities of videoconferencing to compensate for an individual's absence. • Videoconferencing introduces social changes, which need to be addressed to encourage attendance. For example, changing seating arrangements so participants can face one another rather than the camera and providing training prior to the conferences may reduce formality and encourage participation among the physicians. • In the 2 years following the trial, results from this trial have been applied to the management of videoconferenced trials in south-western Sydney. Weekly multidisciplinary meetings have proved popular. Lessons from the trial

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					that were applied in these meetings include the following: the video screen is incorporated into a round-table format to facilitate discussion, a central controller allowing participants to move the camera from their seats was provided, and participants received initial training on the equipment. •Improvements in technology, changes in the format of the room, and participants' growing familiarity with the technology have resulted in videoconferencing being used more frequently and with greater advantage than the original trial; the original formality is now avoided, and the clarity of X-rays and videoconferenced images has improved substantially.
20	SF Wilson, R Marks, N Collins, B Warner, and L Frick Benefits of multidisciplinary case conferencing using audiovisual compared with telephone communication: a randomized control	•Multidisciplinary teams have used telephone conferencing for years to avoid unneeded travel •Recent introduction of a videoconferencing link between 2 hospitals was received with enthusiasm as a replacement for telephone conferences.		•100 patients were randomized to either a videoconferencing or audioconferencing group •Effectiveness of the intervention were evaluated in terms of the number of conferences per patient, the average conference length, length of treatment, number of occasions of service, degree of multidisciplinary involvement, recorded level of	•The mean number of audioconferences held per patient was significantly higher than videoconferences (3.3 compared to 1.9). The average conference length was also significantly different. •There was more file entry in the patient's case notes after videoconferences than audioconferences (96% compared to 91%)

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	trial Journal of Telemedicine and Telecare 10:351-354, 2004			communication, quality of management plan, and staff satisfaction • All results were analyzed using SPSS	• Referral to at least one other health professional occurred in 26% of videoconference cases compared to 18% of the audioconference group • Digital photographs were viewed for 12 patients in videoconferences. 34 photographs of patients in the audioconference group were not viewed by the remote team. • All staff interviewed thought that videoconferencing should continue. All but one felt that videoconferencing provided a better patient management plan • This study highlighted the benefits of videoconferencing over traditional audioconferencing. These included a reduction in the number of conferences held per patient and average conference length. • Evidence suggested that video-conferencing resulted in a greater likelihood of the conference being recorded into the notes. This could be important to ensuring that MCC treatment decisions are stored. • A longer study would be required to determine if the greater uptake of multidisciplinary care is significant

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
USA					
21	[Press Release] Video Consultations Effective for Stroke Treatment Washingtonpost.com August 3, 2008			•222 adult stroke patients at 4 remote sites in California were randomly assigned to telemedicine and telephone consultations to assess their suitability for treatment with thrombolytic drugs	•Correct decisions were made in 98% of telemedicine conferences and 82% of telephone conferences •After 3 months, both groups had similar rates of stroke recurrence or death
Canada					
22	G Bauman, E Winquist, and J. Chin A pilot study of regional participation in a videoconferenced multidisciplinary genitourinary tumour board *Canadian Journal of Urology* 12 (1): 2532-2536, 2005				
23	Anna Gagliardi, Andy Smith, Vivek Goel, and Denny DePetrillo		•To asses the feasibility of using videoconferencin	•The pilot study Tele-Oncology Rounds Ontario (TORO) included a needs assessment and technology planning,	•Indirect needs assessment: half of the respondents indicated that access to surgical oncologists for consultation would be useful. Frequently mentioned

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	Feasibility study of multidisciplinary oncology rounds by videoconference for surgeons in remote locales BMC Medical Informatics and Decision Making 3:7, 2003		g to involve community-based surgeons in interactive, multidisciplinary oncology rounds that is usually only available in academic centers	implementation, and evaluation. • A needs assessment was conducted using direct and indirect methods. • The direct method involved a survey of surgeons at the sites to determine the most convenient days of the week and times to offer videoconferencing rounds, as well as interest in specific topics. • In the indirect assessment, responses to a previous poll of provincial surgeons were examined, the Royal College of Physicians and Surgeons of Canada WebDiary database was analyzed to find the most commonly undertaken cancer-related, self-directed projects, and open-ended unstructured telephone surveys were conducted with 3 cancer surgeons from different parts of Ontario • Based on identified topics of interest, physicians from 2 tertiary care centers were invited to participate as panelists in 6 videoconferenced rounds.	resources requested included oncology rounds, regional meetings, continuing education (CE), and guidelines for when patients need to be referred to formal cancer centers. • Direct needs assessment: respondents suggested a variety of topics. There was a clear preference for session time at the end of the working day. • 6 oncology rounds were organized. A median of 22 physicians participated in each round, and a median of 8 sites participated per session. • Overall, 74.6% of respondents agreed that they were satisfied with the event. 75% agreed that the session topic was relevant to their practice. • High scores were given for the fact that the sessions stimulated critical thinking, encouraged interaction, and were led by a presenter who could establish a rapport with the audience • The study found that respondents of the direct needs assessment indicated a strong preference for sessions held at the end of the working day. • Respondents were invited to provide general comments about the conferences and describe specific changes to practice and perceived

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
				• NORTH network handled the communication and videoconferencing bridge service. • Several weeks before each session the presenting oncologist developed a patient scenario involving cancer surgery. The panel reviewed and edited the presentation. 1 week before, the patient scenario was distributed to participants by fax and posted to the project website • An evaluation was developed to determine participant satisfaction with the format and content of the videoconference, the presenter, and the extent to which the participants found the discussion useful to their practice.	barriers to implementing change. • Strategies for improving the conferences included: "more didactic teaching" and "less opinion, more facts". One respondent suggested that presenters be "encouraged to speak more loudly" and be more observant of "raised hands" of other participants.
Telemedicine					
England					
24	AG Davison, CD Eraut, AS Haque, S Doffman, A Tanqueray, CW Trask, A Lamont, R Uppal, and A Sharma			• Over 1 year, 28 MDT meetings were held. 62 patients were presented to a tertiary care facility 80km away. • Both sites had videoconferencing systems and a CCD camera to	• The annual resection rate increased by 30% • Mean time from being seen in the clinic to surgery was reduced from 69 to 54 days • Telemedicine was found to be user-

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	Telemedicine for multidisciplinary lung cancer meetings. Journal of Telemedicine and Telecare 10: 140-143 (2004)			transmit images of chest radiographs, CT scans, bronchoscopy pictures, lung function data, and electrocardiograms (ECGs)	friendly and the usual close professional relationships were quickly established •Estimated that telemedicine meetings saved over 3 weeks of thoracic surgical time during the year •Article provides some enablers of telemedicine. For example, during the study a proforma was introduced that that authors write was invaluable for making sure case presentations were concise and complete •Decisions were recorded on the proforma and one copy was filed with the patient's case-notes •A technician was required to adjust the camera and sound and change the radiographs otherwise medical staff were unable to concentrate •Found images from a CCD video-camera to be sufficiently good for diagnostics and management decisions •Digital CT images could be transmitted to a viewing station but this had to be planned and conducted before the meeting. The video-transmission was immediate and could be integrated into the videoconferencing easily

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
Scotland					
25	Ian H Kunkler, Paul Rafferty, David Hill, Maureen Henry, and David Foreman A pilot study of tele-oncology in Scotland Journal of Telemedicine and Telecare 4: 113-119, 1998	•In the UK, demand for cancer services from district general hospitals has been increasing; however, there has not been an increase in consultant posts to meet the growing demand. •Tele-oncology presents an opportunity for a more cost-effective service to remote hospitals •In Scotland, cancer centers linked to district general hospitals provide specialist facilities. Some are a long was from district general hospitals. Specialized services at the hospitals are commonly delivered by a travelling clinical oncologist. •Telemedicine may complement current oncological services to district general hospitals.	•To examine tele-oncology linking a cancer center with a rural district general hospital in the UK.	•Two desktop teleconferencing units were placed in the office of a clinical oncologist in Edinburgh and in a consultant's office at the Dumfries and Galloway Royal Infirmary (DGRI) •The oncologist could speak to patients and medical staff from a distance •The nature of the conference was explained to the patients involved, and verbal consent was obtained. •Relevant case notes were faxed to the clinical oncologist in advance. Patients were accompanied by a senior doctor or oncology nurse during the consultation •An audit form was completed by the staff involved following each conference. Key details (date, time, duration) about the conference were recorded, in addition to opinions about whether the purpose of the conference had been served. •The study was too small to	•18 videoconferences were conducted (median duration = 17 minutes) covering a variety of topics. Participants included a mix of physicians and patients. •All staff agreed that the video link was easy to establish. •Teleradiology images were reported to be of adequate quality. •Patients who were involved in the conferences indicated they were satisfied with them •Clinicians overwhelmingly felt that videoconferencing was advantageous, especially if a tele-radiology component was added to the face-to-face link. •9 respondents indicated that video consultation was more helpful than a phone call. •The article noted that the addition of a teleradiology system to teleconsultations was important for decisions about patient management. Many decisions on oncological management require radiographs or CT magnetic resonance scans to be viewed. Radiographs were transmitted using a tripod mounted video-camera,

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
				investigate the effects of patient age and gender on the acceptability of tele-consultations.	and a radiologist at the DGRI moved the camera to highlight relevant images to the oncologist. •The authors recommended that in the future, a less cumbersome system should be investigated, such as a PC-based tele-radiology system •The limited bandwidth employed in the study produced jerky images. This did not, however, impair the quality of the communication because participants were seated. •Networking videoconferences to the relevant sites in the hospital could help to ensure participation by relevant parties, and would support clinician access to oncologist and radiologists. •At the time of publication, information about the cost-effectiveness of telemedicine was limited. The paper suggests that a nurse could be trained to examine some patients in outreach clinics to make more cost-effective use of the oncologist's time.
26	IH Kunkler, RJ Prescott, RJ Lee, JA Brebner, JA Cairns, RG Fielding, A Bowman, G Neades,	•Despite widespread use of multidisciplinary team meetings (MDTs) in the UK, evidence of their clinical effectiveness is sparse	•The TELEMAM trial aims to assess the clinical effectiveness and costs of	•A multi-center cluster randomized controlled trial (TELEMAM) was carried out to demonstrate equivalence in clinical effectiveness between	•Similar, high quality decision making was found in telemedicine as in "in-person" meetings •Levels of satisfaction of MDT members for the 3 measures of quality

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	ADF Walls, U Chetty, JM Dixon, ME Smith, TW Gardner, M Macnab, S Swann, and JR Maclean TELEMAM: A cluster randomized trial to assess the use of telemedicine in multi-disciplinary breast cancer decision making European Journal of Cancer 43:2506-2514, 2007	•The feasibility of linking MDTs at cancer centers and remote cancer units has been demonstrated for breast cancer •There are no randomized trials in telemedicine and no level I evidence on the clinical effectiveness and costs of telemedicine delivered MDTs for breast cancer	telemedicine in conducting breast cancer MDTs	telemedicine delivered MDTs between 2 district general hospitals (DGHs) and a university cancer center compared to face-to-face DGH meetings. •Each facility was equipped with a fully integrated videoconferencing suite •Over 12 months, 473 MDT patient discussions were cluster randomized •Primary outcome measures were clinical effectiveness (satisfaction of MDT members with quality of decisions and compliance with best practice guidelines for breast cancer), and infrastructure costs of service delivery •Clinical effectiveness in terms of disease free status and overall survival were not realistic given the time horizon of the trial	of decision making (decision sharing, consensus, and confidence in decision) were slightly lower in the telemedicine delivered arm (not statistically significant) •The reduced need of cancer professionals to travel may benefit their productivity •Telemedicine offers greater flexibility in timing MDT meetings •Fewer than predicted patient cases were discussed in the telemedicine arm; it is, however, believed that this would be increased by more consistent performance of the teleconferencing network •New telemedicine services may incur significant capital investments and operating costs. •Positive return on investment would be more difficult to demonstrate if there are service delays regardless of greater efficiencies in staff or patient or care giver resource use.
27	RG Fielding, M Macnab, S Swann, IH Kunkler, J Brebner, RJ Prescott, JR	•Multidisciplinary team meetings (MDTs) have been held separately at cancer centers and regional hospitals	•Determine attitudes of breast cancer professionals	•Semi-structured interviews were conducted face-to-face or by telephone with breast cancer professionals at 3 facilities	•Respondent scores indicated satisfaction with standard MDT meetings, regardless of role and base hospital

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
	Maclean, U Chetty, G Neades, A Walls, A Bowman, JM Dixon, T Gardner, M Smith, MJ Lee, and RJ Lee Attitudes of breast cancer professionals to conventional and telemedicine-delivered multidisciplinary breast meetings Journal of Telemedicine and Telecare 11 (2): S2:29-34, 2005	• Visiting oncologists often travel long distances to attend meetings, which can be costly for the NHS • Feasibility of using telemedicine to links MDTs in centers and hospitals has been investigated	about face-to-face and telemedicine delivered breast MDT meetings.	• Questions were designed to collect qualitative and quantitative data on attitudes to current MDT meetings and the future use of videoconferencing in breast cancer management • The respondent group included individuals from two district hospitals and a regional cancer center. As a result, the views expressed may not be representative breast cancer professionals in the UK as a whole. • Small numbers limit the comparisons between respondent subgroups	• Positive attitudes towards videoconferencing were more common among those with previous telemedicine experience • The highest mean score, indicating support for telemedicine, was among research staff • Nurses and allied health professionals were least supportive of telemedicine

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
USA					
28	Kevin Billingsley, David L Schwartz, Susan Lentz, Eric Vallieres, R. Bruce Montgomery, William Schubach, David Penson, Bevan Yueh, Howard Chansky, Claudia Zink, Darla Parayno, and Gordon Strakebaum. The Development of a Telemedical Cancer Center within the Veterans Affairs Health Care System: A Report of Preliminary Clinical Results Telemedicine Journal and e-Health 8(1): 123-130 (2002)		•Describe the organization and function of the telemedical cancer center and to report preliminary clinical results	•Regional cancer center with a telemedical outreach program to 4 outlying facilities was developed •The outreach effort functions through the use of a multidisciplinary telemedicine tumor board.	•Over 1 year, 85 patients were evaluated in the telemedicine tumor board. •The paper outlines some success factors and considerations for telemedicine, including dedication of program coordinators at cancer and referring site, essential to have telemedicine link established at appointed time, some types of clinical decision-making need to see hard copies of radiographs (e.g., head and neck, hepatobiliary surgery) to appreciate the anatomical detail necessary for operative planning •Preliminary results demonstrate the program is feasible and improves access to multidisciplinary cancer care •Potential benefits include improved referral coordination and less patient travel.

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
Canada					
29	Ibrahim Qaddoumi, Asem Mansour, Awni Musharbash, James Drake, Maisa Swaidan, Tarik Tihan, and Eric Bouffet Impact of Telemedicine on Pediatric Neuro-Oncology in a Developing Country: The Jordanian-Canadian Experience Pediatric Blood Cancer 48:39-43, 2007	• Twinning experiences using telemedicine between institutions in industrialized and developing countries (DCs) have been limited. • There are challenges to developing pediatric oncology programs in developing countries, including poverty, lack of education and compliance, and lack of cross-talk among disciplines resulting in delayed treatment • Telemedicine can help with the exchange of expertise between institutions.		• A computer, visual presenter, camera, and a videoconference unit were used to present the data • Agendas were set beforehand and emailed to a distribution list of participants in Jordan and Toronto. After the conference, minutes were sent to the same distribution list	• 20 sessions of videoconference were held between the King Hussein Cancer Center and the Hospital for Sick Children to discuss 72 cases of 64 patients with different brain tumors • In 23 patients, major changes from the original plan were recommended on different aspects of care. These were followed in 21 patients. • The most common recommendations included a review of neuropathology. In 10 patients, this resulted in a change in diagnosis or tumor grading with consequences in terms of management • Twinning between cancer care sites in developing and industrialized countries via videoconferencing had a potentially significant positive impact on patient's care • After May 2005, minutes and attendance were taken at the conferences. The minutes were later emailed to participants in the hope that decisions and feedback would positively influence their practice. • Participation in videoconferences lead to significant changes in the treatment of 21 patients, which saved resources and long-term treatment related

#	Author, "Title", Journal, Date,	Background	Objective	Study design/Limitations	Findings
					toxicity. •The paper noted that the videoconference also acted as an educational tool and involved technical discussions about various surgical options, timing for surgery, chemotherapy and/or radiation, and debates between oncologists.
Sweden					
30	Joacim Stalfors, Ingela Bjorholt, and Thomas Westin A cost analysis of participation via personal attendance versus telemedicine at a head and neck oncology multidisciplinary team meeting Journal of Telemedicine and Telecare 11(4):205-210, 2005				•This paper features a cost analysis of telemedicine vs. personal attendance at multidisciplinary team meetings •Direct medical (e.g., physician working hours, capital costs), direct non-medical (travel expenses) and indirect non-medical costs (any lost production cost for patients and companions by attending meeting) were included in the analysis

Appendix 4 : Google Scan Table

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
MCC Tools					
England					
The InfoFlex toolset Chameleon Information Management Services (CIMS) http://www.infoflex-cims.co.uk/indexflash.htm	CIMS is an information services company that provides services including information consultancy for system design, system implementation, interfacing, data conversion, data analysis and information management training. The company's InfoFlex toolset was designed specifically for the modeling of information and workflow processes across departments and organizations. InfoFlex has a number of core features (e.g., data entry, reporting, query design manager) and additional modules (e.g., scheduler, image capture, interface mapping tool). CIMS lists that InfoFlex provides users with organization wide integration information systems based on national, regional, and local information requirements. The company states that many NHS trusts and cancer networks have adopted the InfoFlex Cancer module as the standard for cancer data collection and reporting.	InfoFlex toolset	CIMS describes the benefits of the InfoFlex Cancer Module as the following: • Supports Patient Tracking and Monitoring including Cancer Waiting Times and the 18 Week Patient Pathway. • Supports MDTs • Clinical operational system designed to work with local clinical work processes. • Configurable to meet all local information requirements. • Data is available for reporting and analysis. • Audit trail facility. • Integrates with 3rd Party Systems. • Company provides training and implementation consultancy provided.	• Kent & Medway • North London • Thames Valley Cancer Networks	Company contact info Available Online

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
	The cancer module includes a fully integrated patient-based Information Management System, and can be used for Multidisciplinary Team meetings (MDTs). InfoFlex can be implemented incrementally from single PC use to organization-wide or across organizations.				
DAWN MDT 4S Dawn Clinical Software http://www.4s-dawn.com/index.htm	4S was founded in 1984, and has been involved in medical applications since start-up. Currently, the company has over 300 clients in 15 countries worldwide. An estimated 500,000 patients are managed using the DAWN MDT software. This tool can be used to organize patient meeting reviews, record decisions and conclusions, organize meeting follow up actions, and record meeting attendance The company offers software solutions for a number of areas, including the management of patients with anticoagulation disorders, rheumatology, or anemia, clinical performance analysis, and MDT meeting management.	DAWN MDT Web-based meeting software. Currently, DAWN MDT software is a meeting administration system that complements existing patient record systems, meeting audio-visual communication systems, and /or statistics reporting systems.	4S Dawn Clinical Software states that DAWN MDT's capabilities include the following**:** • Organizing patient meeting reviews, records of decisions and conclusions, meeting follow up actions, and meeting attendance • Manage MDT meetings by creating patient lists, setting up new and recurring meetings, checking for outstanding information needed for meetings, record agreed diagnosis, staging, and treatments, record attendees and trial involvement • DAWN MDT also has searching and reporting features, and an auditing tool.	• NHS Clients	

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
United States					
MyPACS.net Mckesson Medical Imaging Group - Seattle Technologies	MyPACS.net is a free service that is offered to the international radiology community by Mckesson Medical Imaging Group - Seattle Technologies. MyPACS allows clinicians to share knowledge through the use of content management technology. This service is funded in part by a Small Business Innovative Research grant from the National Institute of Mental Health. MyPACS has four key functions: • Teaching file management • **Rounds and conferences** • Diagnostic decision support • Sharing cases with colleagues This tool allows imaging specialists to spend less time manually preparing and searching for documented reference cases for clinical rounds, conferences, training and research projects. MyPACS is built on top of the Mckesson Medical Imaging Group - Seattle Knowledge Management Framework	MyPACS.net	MyPACS is a hosted teaching file authoring tool that allows easy uploading of images and descriptive information from any computer with Web access. MyPACS is further described in the following article: MyPACS.net: A Web-Based Teaching File Authoring Tool (authored by Edward Weinberger, Rex Jakobovits and Mark Halsted) Using MyPACS.net, imported images and multimedia are stored in a protected document repository, and case data is stored in a high-speed relational database management system. Cases are displayed in a PACS-like viewer, offering users the ability to zoom, pan, scroll through series, and adjust windows/levels. Key images are accessed by thumbnails under the text. Cases can be organized in folders, certified and published to the web, and can be exported to	The MyPACS Enterprise customer list is available online	Contact available online

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
			PowerPoint. The application is purely web-based; therefore no client software needs to be installed, other than a standard web browser. MyPACS is built on top a highly scalable, efficient platform for building web-based multimedia clinical applications. MyPACS can therefore be customized for different institutional requirements.		
University of Washington https://secure.cirg.washington.edu/tb/projectpage.html#tele http://secure.cirg.washington.edu/TBManual/UserManual.pdf	Dr. Brent Stewart of the University of Washington (UW) was awarded a US National Library of Medicine (NLM) phase I contracts to conduct a study designed to show how the Next Generation Internet (NGI) could be used in innovative medical projects to include: "virtually error-free service, security and medical data privacy, 'nomadic' computing, network management, and infrastructure technology for 'collaboratories.'	UW Net Tumour Board Information System - Online Collaborative Tools for a Distributed Tumour Board	Adds conferences, patients and cases, relevant studies, embedded Power Point slides / JPEG images / URLs, has searching functionality	N/A	

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
Australia					
Queensland Co-operative Oncology Group (QCOG)	QCOG was established under the auspices of The Cancer Council Queensland and it is open to all cancer clinical specialists in Queensland. Its aim is to improve access and outcomes for patients with cancer in Queensland. QOOL is an information system that brings together information from various locations and disciplines. This tool can be used for MDTs.	Online MDT tool	• Patient and conference tracking • Upload patient information for discussion at the meetings • Record discussion and decisions made at the MCCs • Post-meetings analysis	Queensland, AUS	
Canada					
Mount Sinai Hospital:	A group of 25-30 clinicians and trainees from departments involved with the Centre meet weekly to review medical information on all newly diagnosed breast cancer patients. Known as the Tumour Board, this group optimizes medical treatment by ensuring multiple physicians have input into each patient's care. The Board reviews each case and makes recommendations on the course of treatments. These recommendations are communicated to each patient by their treating physician.	RAOT conference and attendance tracking online tool	Round attendance tracking	N/A	
Sunnybrook Health Centre	The Medical Oncology/Hematology Program at the Odette Cancer Centre provides consultation, diagnosis and treatment services for a wide variety of cancers. Each major cancer site or organ system has its own team and its own Multidisciplinary Cancer Conference (MCC) or tumour board. Cases are discussed at these	Dr. Khalifa developed a home grown tool for multi-institutional lung cancer MCCs.	Dr. Khalifa's tool for multi-institutional lung cancer MCCs captures MCC attendance information, patient information, pre-MCC management plans, and changes to diagnosis, tumour staging	N/A	Dr. Khalifa Mahmoud.Khalifa@sunnybrook.ca

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
	weekly conferences and an individualized plan of management is developed		and management after MCC review in an Access database. Two PCs are used during the MCC; one displays patient images, while the other records decisions. There is a clinical trials prompt, and decisions are stored on a hospital shared drive for easy review.		
Telemedicine, Videoconferencing					
England					
Research Councils UK http://www.rcuk.ac.uk/escience/news/canctreat.htm	The Telemedicine Project is funded by the UK Core e-Science Programme and Macmillan Cancer Relief. Under the NHS Cancer Plan, which was published in 2000, each cancer patient's treatment must be agreed at a multidisciplinary team (MDT) meeting attended, typically, by an oncologist, radiologist, pathologist, nurse and, occasionally, another consultant to give a second opinion. Attending such team meetings is time-consuming when the members are geographically spread. The Telemedicine project saves members' travel time by allowing them to attend virtual meetings from the comfort of their own workplaces.	Videoconferencing solutions.	• Successful videoconferencing. • Medical images and data, stored in distributed computers, can be accessed for viewing at all sites, giving all the MDT participants access to high quality information. • Live images of samples viewed through a microscope at the pathology lab, can also be displayed for all MDT members to see.	N/A	

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
Scotland					
Scotland Telemedicine Initiative http://homepages.ed.ac.uk/twg/sstn/ http://www.telemedicine.scot.nhs.uk/	The South Scotland Telemedicine Network started off in 2002 by linking eight hospitals from Tayside to Dumfries and Galloway with videoconferencing, telepathology and teleradiology facilities. This network has now been built on with additional videoconference units being added, both at the original hospitals and at other sites. The network's main function has been to enable cancer multidisciplinary and management meetings to be carried out with greater equality of access, and to save travelling time for all those attending.	Telemedicine used for MDTs. More information about the technology used and the TELEMAM pilot study can be found in this article: A pilot study of tele-oncology in Scotland (Ian H Kunkler, Paul Rafferty, David Hill, Maureen Henry, and David Foreman)	N/A	N/A	
United States					
Veterans Affairs http://www.acponline.org/clinical_information/journ	The Veterans Administration Palo Alto Health Care System (VAPAHCS) is a large, new tertiary care facility with seven outpatient satellite clinics that serve patients scattered over hundreds of miles.	Videoconferencing and VistA imaging software are used during MCCs	N/A	N/A	Leonard Goldschmidt, MD Goldschmidt.Leonard@Palo-Alto.VA.gov

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
als_publications/ecp/octnov98/telemed.pdf					
Telesynergy http://telesynergy.nih.gov/components.html http://www.allirelandnci.org/pdf/publications/ar04/InformationTechnology.pdf	Telesynergy is a video-conferencing system with a variety of medical imaging devices attached. The system is used in USA and Ireland. This system is HIPAA compliant, and can work with non-Telesynergy institutions	Telesynergy	N/A	N/A	
Canada					
Ontario Telemedicine Network www.otn.ca	This is funded by the Government of Ontario	Videoconferencing	N/A	• Ontario hospitals	
Australia					
Cancer Institute	The Development of a co-coordinated and multi-disciplinary approach to patient care across geographical areas in NSW is an important program to the NSW Cancer Plan 2007-2010 (Cancer Plan 2007-2010).		Full details of the 23 multidisciplinary team grants that were awarded can be found here: http://www.cancerinstitute.org.au/cancer_inst/profes/mdt_grants.html	N/A	Details of the NSWOG meetings can be obtained by emailing NSWOG@cancerinstitute.org.au

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
	A patient-centered approach via multidisciplinary team (MDT) meetings provides an effective platform to deliver coordinated patient care across multifaceted treatment programs and various treatment centre locations. The site lists MDTs in New South Wales (NSW) undertaking the Cancer Institute NSW MDT Development Projects: http://www.cancerinstitute.org.au/cancer_inst/profes/mdt_projects.html The site also has a link to a recent summary of MDTs in NSW, including potential future directions: http://www.cancerinstitute.org.au/cancer_inst/profes/pdf/2008-04-29_executive-summary-profile-of-multidisciplinary-teams-NSW-19_September_2007.pdf		Details of activities to further the development of multidisciplinary teams in NSW can be found here: http://www.cancerinstitute.org.au/cancer_inst/profes/mdt.html		
Organizations that use technology to support MCC – More Information Required					
England					
North Bristol Trust http://www.avon.nhs.uk/imtconsortium/inquirer/inquirer/i_archive2006/story92_nbt_cancersystem.htm	Hospitals in the UK have held MDTs for some time and they have experience with different processes and tools.	BACCS – Bristol Cancer Solution	MDT coordinator runs the weekly meetings. Two laptops: one logged into PACS, one logged into BACCS. Coordinator records discussion into BACCS during the meeting. Analyst can produce reports after on each patient's progress.	• NHS hospitals	

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
United States					
Decatur Memorial Hospital	There is information available in their 2007 annual report (page 5). Forty-three CME approved Cancer Conferences were held in 2007.	N/A	N/A	N/A	
Carle Cancer Hospital:	Carle Cancer Center offers some of the most advanced cancer treatments in east central Illinois. They provide leading-edge radiation technology, more than 100 clinical trials, and the area's only oncology-specific licensed social workers.	N/A	N/A	N/A	
Medical University of South Carolina	The Medical University of South Carolina has an On-Line Tumor Board System	On-Line Tumor Board System	A Google search led to their Brain Tumor Program, which has a multidisciplinary Brain Tumour Board that meets every Wednesday at 4:45 pm. This Board consisting of physicians and nurses who review the progress of the patients being treated and to make further recommendations.	N/A	Nurse Coordinator (Darlene Campbell – (843) 792-4180; or e-mail campbed@musc.edu).
Methodist University Hospital	This is a Virtual Brain Tumor Board by MUHs Neuroscience Institute to reach out to physicians around the world to collaborate on challenging neuro-oncology cases in the traditional Tumor Board style. They invite physicians everywhere to submit cases for live review during the Webcasts.	Virtual Brain Tumor Board	Virtual Brain Tumor Board - web-based conference occurring on the first Wednesday of each month, pilot for 5 months Available to physicians around the world, physicians can earn CME credits, physicians can submit	N/A	

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
			challenging cases for discussion in advance for live review, physicians can email questions to be answered during the live event, physicians can get a fast-paced case evaluation in real-time, with each event archived for later viewing		
Society of Surgical Oncology Washington Hospital Center	The breast oncology fellowship program at the Washington Hospital Center includes multidisciplinary breast conferences. A conference is held each Wednesday and is attended by members of all levels of the oncology community including surgeons, medical oncologists, radiation oncologists, pathologists, radiologists nursing specialists and students and residents/fellows in training. The fellow is in charge of the weekly conference, and is responsible for journal article reviews. Working together with the other specialists, the fellow will present ongoing, interesting patients to the conference for discussion and debate. In addition to leading the weekly meetings, the fellow also maintains a database of all patients presented.	N/A	They hold a multidisciplinary Brest cancer conference each Wednesday. Every six weeks Journal Club is held in conjunction with the conference. The fellow is responsible for over-seeing the Journal Club, directing its participants and periodically presenting new and interesting articles from current resources.	N/A	Program Director: Marc Boisvert, M.D. Phone: (202) 877-2427 Fax: (202) 877-8113 marc.e.boisvert@medstar.net

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
Australia					
Northern Sydney Central Coast Health Cancer Services – Multidisciplinary Cancer Services Centre	At Northern Sydney Central Coast Health Cancer Services, the patient is cared for by an expert team of health professionals in order to provide a complete treatment with less chance of recurrence. The Centre uses "state-of-the-art technology to present the patients' diagnosis, radiology, pathology and treatment regime".	N/A	N/A	N/A	info@cancercare.org.au
Background information on MCCs – May Provide Access to Technologies					
England					
The Cancer Services Collaborative 'Improvement Partnership' From Soukop	From April 2008, the Cancer Services Collaborative 'Improvement Partnership' has merged with Diagnostics Service Improvement, the Heart Improvement Programme, and Stroke Improvement to form a new national improvement programme in England, "NHS Improvement". Formed after a national review, NHS Improvement (www.improvement.nhs.uk) has brought together over eight years practical service improvement experience and will work with clinical networks and NHS organizations to transform, deliver and sustain improvements across the entire pathway of care in cancer, cardiac, diagnostics and stroke services. This resource provides a link to national clinical leads	N/A	N/A	N/A	Contact Available online

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
	and national managers in the UK. For example: http://www.cancerimprovement.nhs.uk/View.aspx?page=/tumour_groups/head_neck.html The site also includes a link to an MDT resource guide: http://www.ebc-indevelopment.co.uk/mdt/, which discusses the top 12 challenges of achieving the standards set for multidisciplinary team working, and suggestions for best practices.				
Ireland					
NICan **Northern Ireland Cancer Network** http://www.cancerni.net/	This 2004 Board report highlights the resources required to support MDTs. These include administrative resources, as well as the technology needed for the presentation of patient information, tele or videoconferencing, data collection support for recording decisions, and training. Furthermore, the MDT Support Personnel Forum facilitates peer-peer support and communications between MDT support personnel within the Cancer Network				Email: admin@nican.n-i.nhs.uk
Other					
England					
The Association of Coloproctology of	The ACPGBI is a professional society representing more than 1,000 colon and rectal specialists dedicated	The ACPGBI database.	Potential uses of the ACPGBI database and risk model for		Contact information Available here

Organization/ Web site	Overview	Technology found	Key features	Vendor Clients (if applicable)	Key contacts
Great Britain and Ireland (ACPGBI) See also the National Bowel Cancer Audit Site http://www.nbocap.org.uk/	to advancing and promoting the science and practice of the treatment of patients with diseases and disorders affecting the colon, rectum, and anus. It is also known as The Association of Bowel Specialists. The ACPGBI performed national audits of bowel cancer in three studies between 1998 and 2001. The ACPGBI has developed a bowel cancer data set to underpin these studies – the National Colorectal Cancer Database.	The database, designed and built by ClinIT, is available at: http://www.cancer uk.net/software/acp/	colorectal cancer are in the process of informed consent, comparative audit, clinical governance, evaluative research, and managing health services		
Australia					
Cancer Service Networks National Demonstration Program, (CanNET):	Developed by Cancer Australia to link regional and metropolitan cancer services. CanNET involves the Australian, state and territory governments working collaboratively with consumers of cancer services and primary, secondary and tertiary health professionals to improve outcomes through better coordination of existing services.		An overview of their Multidisciplinary care system included a Clinical Networks literature review. This review provides an overview of the theoretical/conceptual and empirical literature underpinning multidisciplinary care and teams. A Multidisciplinary Care and Managed Clinical Networks resources is also available. These resources were scanned for the literature review		Contact information available here