What is a virtual multidisciplinary team (vMDT)?

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Background: Multidisciplinary team meetings (MDTs), also known as tumour boards or multidisciplinary case conferences, are an integral component of contemporary cancer care. There are logistical problems with setting up and maintaining participation in these meetings. An ill-defined concept, the virtual MDT (vMDT), has arisen in response to these difficulties. We have, in order to provide clarity and to generate discussion, attempted to define the concept of the vMDT, outline its advantages and disadvantages, and consider some of the practical aspects involved in setting up a virtual MDT.

Methods: This is an unstructured review of published evidence and personal experience relating to virtual teams in general, and to MDTs in particular.

Results: We have devised a simple taxonomy for MDTs, discussed some of the practicalities involved in setting up a vMDT, and described some of the potential advantages and disadvantages associated with vMDTs.

Conclusion: The vMDT may be useful for discussions concerning rare or unusual tumours, or for helping guide the assessment and management of patients with uncommon complications related to treatment. However, the vMDT is a niche concept and is currently unlikely to replace the more traditional face-to-face MDT in the management of common tumours at specific sites.

Our purpose here is to stimulate and inform discussions about an idea that has, hitherto, been somewhat ill-defined – the concept of the virtual multidisciplinary team (vMDT). By drawing attention to the concept, we hope to encourage further research into the development of virtual teams in the management of patients with cancer.

Multidisciplinary team (MDT) meetings (also known as tumour boards or multidisciplinary case conferences), in which new patients with cancer are discussed on a regular basis by a group of specialists with the expertise relevant to their clinical management, are an integral part of modern cancer care. The MDT meetings are costly in both time and money. This has led to the emergence of an ill-defined concept: the 'virtual MDT' (vMDT). The question of what a vMDT might be arises in response to a series of other questions. How can the beneficial effects of MDT working be preserved while reducing some of the financial costs, disruption, and inconvenience associated with regular MDT team meetings? How might the advantages of the MDT approach be extended to the management of patients with rare or unusual

problems related to malignancy or its treatment? Are there effective alternatives to face-to-face MDT meetings?

The concept of the cancer MDT was formally introduced into UK practice in the 1990s. A major impetus was the publication of the Calman-Hine report in 1995 and the consequent drive to ensure that all patients with cancer, no matter where they might live, and to whom they might have been referred, would have equal access to a high and uniform standard of care (Haward, 2006). If ubiquity is a criterion for success, then the concept of the MDT meeting must be judged successful. There are at least 1500 cancer MDTs currently active in the United Kingdom, and the annual cost, in staff time alone, is over £100 million (Taylor *et al*, 2010).

There is some evidence that MDT meetings have improved outcomes for patients with cancer (Forrest *et al*, 2005; Stephens *et al*, 2006; Back *et al*, 2007; Bydder *et al*, 2009; MacDermid *et al*, 2009; Friedland *et al*, 2011; Kesson *et al*, 2012; Saini *et al*, 2012). There is a reasonable belief that MDT working has achieved what it was supposed to achieve; it has helped to ensure equality of access to high-quality care for all patients with cancer in the United Kingdom.

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These improvements have, however, not been without costs, both direct and indirect, and there is also evidence that some teams function more effectively than others (Fleissig *et al*, 2006; Taylor *et al*, 2012). One of the main problems with current practice is the need for members of the team to meet regularly in order to discuss patients. There is an opportunity cost here: surgeons discussing patients are not operating and radiologists presenting the results of previous imaging investigations are not at their workstations (Kane *et al*, 2007). Consequently, it is worth exploring new ways of MDT working that are more efficient in the use of health professionals' time and that might allow the benefits of the MDT approach to be extended to a wider variety of patients and clinical problems.

The concept of the vMDT is gradually finding its way into the design of pathways for cancer care, but the expression means different things to different people. Part of the reason for this confusion is that there is no real definition of what is, and what is not, a virtual team. In order to address this fundamental problem, this paper will identify the aspects of virtuality that might be useful in the context of the cancer MDT and classify them in such a way as to produce a preliminary taxonomy.

A POSSIBLE TAXONOMY FOR A VIRTUAL MDT

The assumption underlying this approach to defining and classifying vMDTs is that it is not always possible for all the essential members of the team to be present in the same room; they are, in the jargon, not colocated. Table 1a and b defines and demonstrates the characteristics of conventional (face to face) and completely virtual teams.

An MDT that, for reasons of convenience or geography, chooses to use some form of teleconferencing is not a fully vMDT. The approach is not particularly novel and has been well described in the literature (Axford *et al*, 2002; Kunkler *et al*, 2007; Hazin and Qaddoumi, 2010). Asynchronous communication is one of the defining features of a vMDT and has been used in a series of projects (AFIP, iPath, UICC-TPCC, Virtual International Pathology Institute; http://www.diagnomx.eu/vipi/home.php) in diagnostic pathology. This approach, reviewed by Kayser *et al* (2011), was specific to the discipline of pathology. It provided expert opinion at a distance, but could not be considered multidisciplinary.

A completely vMDT should have all of the characteristics summarised in the second column of Table 1a. Hybrid forms of MDT, between the conventional face-to-face MDT and the fully vMDT, are possible but it is reasonable to regard only those MDT meetings that are asynchronous as truly virtual. This leads to the following definition of a vMDT:

A vMDT meeting involves participants who may, or may not, be part of a permanent team and who interact with each other non-simultaneously using shared clinical data. They may operate at a local or a national level and their remit is not necessarily confined to tumours presenting at a particular anatomical site.

This definition deliberately excludes any specification of the form of communication. Communication could include: text-based comments; images with annotations; short segments of audio or video, any or all of which could be uploaded onto a web-based system used to host the vMDT.

Table 1a. Typical characteristics of nonvirtual and virtual teams		
Characteristic	**Traditional (face-to-face) multidisciplinary team (MDT) meeting**	**The fully virtual MDT**
Timing	Synchronous	Asynchronous
Composition	Constant	Constant or variable
Geographical remit	Local	Unbounded
Platform	Sound and vision	Text, images, video, virtual microscopy
Scope	Tumour specific	Not tumour specific, problem-specific approach
Location	Single place	Many places

Table 1b. Definitions of characteristics of teams
Timing
Synchronous: participants all available at the same time, the virtual aspect is that they are not in the same place.
Asynchronous: participants available at different times, dropping in and out of a continuing discussion.
Composition
Constant composition: membership constant over time, team as a whole is permanently competent to deal with all issues that might arise.
Composition might vary: could be constant or employ a pick-up band approach. A core membership with the ability to co-opt additional temporary members as needs and specific problems might dictate.
Geography
Local: provides a service for a district or region. Problems not necessarily rare or complex. Workload relatively consistent and predictable. Meetings can be scheduled regularly.
Unbounded: provides a local, regional, national, or international service; by implication would deal mainly with rare, but highly complex, clinical problems. Need for flexibility, responsiveness, and adaptability. Workload unpredictable, meetings scheduled as required rather than according to a predetermined timetable.
Platform
Sound and vision: participants are able to see and hear each other in real time (live): video conferencing; web conferencing. The virtual aspect arises simply from the fact that the participants are not physically present in the same room. In theory, this approach could be used for an asynchronous MDT but the practicalities would be cumbersome and the gains (in terms of ease and clarity of communication) would be minimal.
Text, images, video, virtual microscopy: interaction is via written text and the transmission of selected images. This is impractical for a synchronous MDT but feasible for an asynchronous meeting. Given current developments in information technology and the availability of increasing bandwidth, it should be come possible to include annotated images, segments of video, and virtual microscopy.
Scope
Tumour specific: The team members have expertise in the diagnosis, investigation, and management of tumours of a specific histological type (e.g., sarcomas or lymphomas) or arising at a specific anatomical site (e.g., breast cancer or colorectal cancer).
Not tumour specific: this meeting is concerned with problems, such as late consequences of treatment or the investigation and management of patients with malignant disease in whom there is no obvious primary site, for which a wide variety of expertise might be required. The range of knowledge and experience could be well beyond that encompassed by a traditional site-specific MDT. The team of variable composition is particularly suited to this type of problem.
Location
Single place: this implies that the meeting takes place at a single specific place.
Many places: participants in the meeting may be scattered far and wide (are not necessarily colocated).

TECHNOLOGY FOR VIRTUAL MDT

The cardinal principle should be that the technology is subservient to the needs of the team, and not vice versa. There are various ways in which technology can help people to work together. One way to classify the technology is to consider the information that can be transferred and then consider it within the context of a fully vMDT.

- *Data-only* systems, such as email and messaging services, allow the exchange of text and images. These systems are easy to implement for a vMDT but may not provide the richness of content that is likely to be necessary.
- *Decision Support Systems* are a particular subtype of data-only systems in which the input (data) are used to provide an output that is usually in the form of a suggestion or recommendation. Decision support systems (Patkar *et al*, 2011) could be seamlessly integrated into the processes used to support the v MDT. Simple examples could include: the use of such automated systems to screen patients for eligibility for clinical trials and thereby identify which patients might be suitable for enrolment into clinical studies (McNair *et al*, 2008); linkage between the clinical information entered into the system and clinical guidelines – this could automatically generate a guideline-based recommendation as a point of departure for further discussion (Patkar *et al*, 2012); and integration of data on molecular profiling of patients' tumours so that specific targeted therapies could be suggested for each individual (Blackhall *et al*, 2013).
- *Audio-only* systems, such as telephony and voicemail, transmit the spoken word. They involve, as in a conference call, participants all being available at the same time. Consequently, these systems will have limited utility for a vMDT.
- *Video* systems allow the transmission of both sound and vision. In the context of a vMDT, a short video segment in which a patient discussed his/her current state of knowledge, concerns, and expectations, would add an important extra dimension to the online discussions.

There is, increasingly, a blurring of the boundaries between the classical route for the electronic delivery of information, telephony, and information transfer via the Internet. Many organisations now used web-based telephone systems that, to the user, seem identical to older, wire-based, systems. *Groupware* is the generic term used to describe software, usually web-based, that can be used to facilitate meetings and interactions between geographically dispersed individuals.

There are several important factors that need to be considered when choosing the technology to support a virtual team (Table 2).

WHAT IS ALREADY KNOWN ABOUT VIRTUAL TEAMS?

Virtual microscopy (Fonyad *et al*, 2012; Kayser, 2012) is an application that has already been used in health care and its conceptual basis is very similar to that of a virtual team. Virtual microscopy could be incorporated into the vMDT, enabling detailed discussions of pathological findings to inform the conclusions reached by the vMDT.

There is a wealth of information available on the role of virtual teams in the industrial and commercial sectors. Standard texts (Lipnack and Stamps, 2000; Duarte and Snyder, 2006) contain accounts of disaster as well as of success. The topic has spawned its own jargon, the result of which is that different terms are often used to describe very similar and very obvious concepts. Recent reviews have, however, pointed out that there is remarkably little empirical fieldwork in this area (Baltes *et al*, 2002;

Table 2. Factors for consideration in choosing technologies to support a virtual multidisciplinary team (vMDT)

Factor	Exegesis
Permanence	Is a permanent retrievable searchable archive of team discussions required?
Symbolic meaning	The medium is the message: will people feel disrespected if, for example, they receive an email rather than a phone call?
Training and support	How much training and support will participants need to use the system effectively?
Access	Will participants be able to access the system, or will firewalls and other security measures prevent them from participating?
Bandwidth	Will participants have access to sufficient bandwidth so that frustration (as, e.g., when large files are downloaded) is avoided?
Image quality	Will any images used in the virtual meeting be of sufficient quality to ensure reliable interpretation and assessment by team members?
Automatic notifications	Would participants wish to be notified automatically if there was a topic that required their input, or would they prefer to monitor the system themselves?

Kirkman *et al*, 2002; Axtell *et al*, 2004; Powell *et al*, 2004; Hertel *et al*, 2005; Curseu *et al*, 2008; Ebrahim *et al*, 2009). Most studies deal with artificial laboratory simulations, often oversimplified, some using 'teams' of only two members. What follows is an identification and clarification of the key concepts that are relevant to vMDTs for the management of cancer and its consequences.

When people meet around a table they are aware of each other. They are, whether they like it or not, socially connected. The term *social presence* is used to describe the extent to which a virtual system facilitates this type of personal connection between team members. When discussions take place, information is exchanged. In a face-to-face meeting, this communication is both verbal and nonverbal. Body language provides additional information about team members' feelings, such as boredom, frustration, anger, or anxiety. *Information richness* describes the amount and variety of information that a virtual system can handle, including data, images, tone of voice, facial expression, body language, or environmental cues. Sometimes there is simply too much information and participants become distracted by peripherals (that tie is really horrible, why does he make that horrible slurping noise as he drinks his tea?). This is, in the world of virtual teams, referred to as *surplus meaning*, there is too much information richness or social presence and the result is that team members become distracted and lose concentration.

A vMDT for the management of cancer or its consequences should combine a high degree of social presence with sufficient information richness while avoiding surplus meaning. The process of setting up any virtual team must respect the fact that different teams will have, or will develop, different cultures and that, provided the teams function well, this cultural heterogeneity is to be welcomed rather than feared.

POTENTIAL BARRIERS TO IMPLEMENTATION OF A 'VIRTUAL MDT'

Technology. The chief barrier to the implementation of a fully vMDT is the fact that, in oncological practice, there are very few precedents for this way of working and, given the innate conservatism of many professionals, it may be difficult to persuade

participants that the effort involved in learning the skills required is a worthwhile investment. This problem will be exacerbated if the technology is unreliable or inefficient.

Team members do not need to understand the technology in order to use it. Anyone who is aware of how teenagers use Facebook knows that web-based communication tools can be used creatively and effectively by those who neither understand, nor ever wish to understand, the technology involved.

Communal memory is an important aspect of MDT working. The virtual team should not lose this attribute and, depending upon the technology employed, communal memory may even be enhanced – a searchable repository of problems and outcomes could be an invaluable resource. One feature of the vMDT is that there can be automatic capture of the extent to which individuals have participated and contributed. This can provide a tool for collective recall, although some participants might feel threatened by this and there is a moral question concerning the extent to which our working lives ought to be monitored.

The sociologist Richard Sennett has recently described some of the problems he experienced while trying to work within a virtual team using the, now defunct, Google Wave system (Sennett, 2012). The team members found that the architecture of the software limited and distorted their ability to communicate. Sennett attributed this to the fact that the software was unable to accommodate a conversational approach and hence forced participants into a more assertive form of communication, point followed by counterpoint, and, as a result, the flow of ideas was linear and hierarchical rather than lateral and inclusive. Cancer

MDTs are already sufficiently hierarchical and it would be a retrograde step if we were to adopt an approach to the vMDT that restricted, rather than broadened, discussion. Furthermore, any technical support that is required needs to be instantly available. Asking team members to log a problem with a help desk and then expecting them to wait for days for a reply will not encourage participation.

Tribalism. Tribal allegiances and social identities may, just as in a traditional MDT, cause problems with the effectiveness of a virtual team (Au, 2010). In the context of the cancer MDT, tribes may be *disciplinary* (e.g., endocrinologists; vascular surgeons) or *institutional* (clinicians at teaching hospital A; clinicians at district general hospital B) or there may be *tribes within tribes* (endocrinologists at hospital A *vs* surgeons at hospital B). The vMDT automatically captures all input and, by classifying contributions at both the individual and the group level, it should be possible to identify tribal behaviour and, by demonstrating its existence, discourage its persistence.

Lack of incentive. If participation in a vMDT is not in an individual's job description, then there is a problem with credit, reward, and recompense. This will apply at the individual, departmental, and institutional levels. Participation costs time, time costs money, and if the money cannot be charged or recouped, then full and enthusiastic participation is unlikely.

Leadership. The performance of a MDT is critically dependent upon the quality of its leadership (West *et al*, 2003; Ruhstaller *et al*,
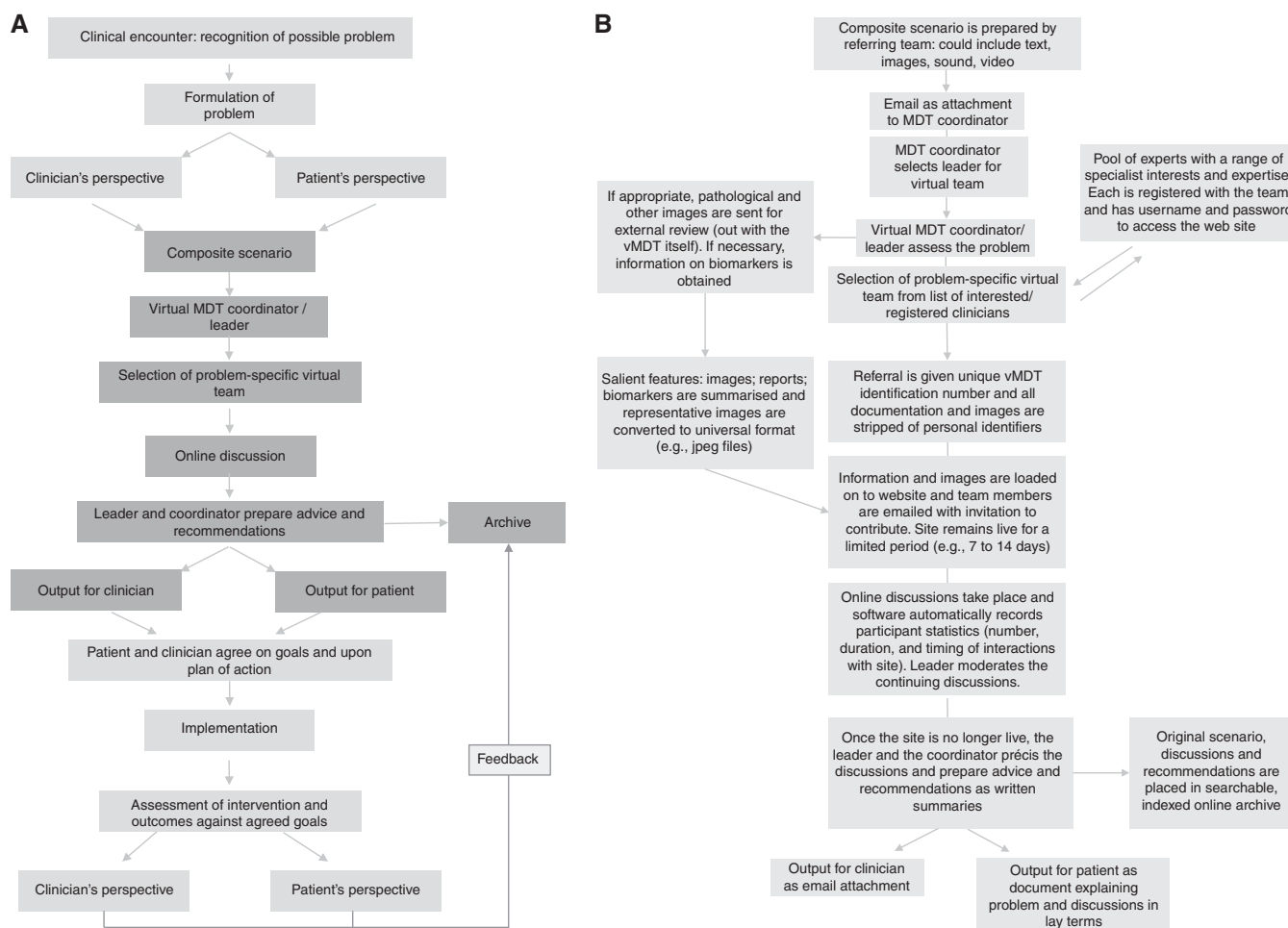

Figure 1. (**A**) Flow chart for a vMDT illustrating processes from referral to feedback. (**B**) Detail of processes involved in setting up vMDT discussion.

Table 3. Advantages and disadvantages of a virtual multidisciplinary team (MDT) compared with traditional MDT meeting

	Traditional MDT (face to face)		Fully virtual MDT—dispersed & asynchronous	
Criterion	Advantages	Disadvantages	Advantages	Disadvantages
Team				
Membership	Likely to know each other and already have established working relationships.	Old enmities may poison the atmosphere.	Can be flexible and adapted to the task in hand.	If members have never met it may be difficult to establish trust and confidence.
Attendance	Team leader can easily assess whether or not the relevant team members are present.	Key members may not always attend meetings.	Lack of fixed place and time may improve participation.	If members of the virtual team are silent it may be difficult to work out why: uninterested; lack of expertise; failure of information technology (IT)?
Leadership	Leader is usually known personally to team members and can capitalise on relationships established out with the MDT to minimise conflict within the meeting.	Leader may already be known to team members (and not respected by some of them). Extrinsic conflicts may be brought inappropriately to the team meeting.	May not be necessary to have a permanent leader – leadership can be adapted to the specific task.	Leader of virtual team needs all the qualities of the leader of a traditional MDT but, in addition, will require familiarity with IT systems and the ability to mediate online discussions.
Team working and culture	Regular meetings mean that team works out its own dynamics and resolves tensions.	Regular meetings mean that team perpetuates counterproductive behaviours and practices.	The lack of face-to-face interaction means that discussions may be less pressured and will be less influenced by extraneous factors.	The lack of face-to-face interaction means that it may be difficult to build a sense of identity within the team; lack of visual cues (e.g., body language) may lead to misunderstandings that jeopardise team cohesion.
Personal development and training	Good opportunity to develop interpersonal skills, leadership qualities, and improve knowledge.	Destructive team dynamics, rigid hierarchies, and neglect of 'lesser' professions and specialties mean that, for some members, educational value may be very limited.	Opportunity for team members to interact with experts from beyond their immediate working environment. System will generate a searchable, indexed, knowledge repository.	Team members may be alienated by the technology and frustration with the medium might lead to lack of interest in the message.
Infrastructure				
Working environment	If well designed will facilitate constructive interactions.	May be shoehorned into unsuitable space that inhibits dialogue and discussion	Not dependent upon a specific venue, the virtual architecture can be modified to accommodate the needs and preferences of team members.	The virtual team has no place to call home.
Technology and support	Available on-site with local IT responsibility from named individuals.	Equipment may be faulty and temperamental – longer spent on sorting the IT than on discussion.	A standard IT approach could be applied to multiple teams each involving team members at multiple locations.	The whole concept involves a dependence upon technology, and associated technical support, that may not be sufficiently reliable.
Organisation and logistics				
Scheduling	Fixed place and time – can be incorporated into job plan.	May be scheduling conflicts (clinics, operating sessions, and so on).	Can be fully flexible, discussions only occur when they are required, team members can chose the times at which they participate.	Lack of fixed commitment may lead to the perception that the activity is unimportant, email notifications of virtual meetings may become irritating.
Preparation	Fixed commitment, therefore preparation time can be appropriately allocated and scheduled.	Time needed by pathologists and radiologists to prepare material means that it may not be possible to deal with all patients in a timely way.	Can easily be carried out off-line and the lack of a scheduled commitment allows pathologists and radiologists to work more flexibly.	Unpredictability of work flow may cause problems with participants finding adequate time to prepare materials for discussion.
Moderating discussion	Easily identified leader who can ensure discussions are courteous and to the point.	Conflicts between individuals may hijack the debate – other members disengage: 'not Tweedledum & Tweedledee again…'.	Team members have time to think before they upload their thoughts and opinions – discourse is more likely to be temperate and considered.	Discussion may drift as the visual and auditory cues that channel face-to-face discussions will be absent – there is no online equivalent of the yawn.
Subsequent coordination of service	Fixed point at which patients and other clinicians will know that a recommendation will be made.	Inflexibility may lead to protracted wait for recommendation even for straightforward problems – 'the next meeting won't be for another fortnight'.	The service can rapidly respond to need, there are no artificial constraints imposed by meeting schedules, documentation can be generated automatically by the system.	Clinicians and patients may be reluctant to act upon recommendations made by a virtual team of strangers.
Patient-centred decision making				
Whom to discuss	All patients diagnosed since the previous MDT – inclusive and fair	Repetitive discussion of straightforward problems with no time left to give more complex problems the time that is warranted.	The vMDT concept expands the scope of MDT discussions – enabling patients with uncommon problems to be discussed by an expert team.	The vMDT approach is (in current implementations) unlikely to be able to cope with the workload that a conventional MDT can handle – therefore, not suitable for common tumour sites.
Patient-centred care	Patients' interests represented by clinicians who are physically present in the room.	All too often, there is noone who has ever met the patient present in the room.	Patients can be involved from the very beginning of the process – for example, by helping to draft the scenario upon which the team discussions will be based.	In theory, patients might participate in online discussions but may be intimidated by both the technology and the technical nature of the discourse.

Table 3. (Continued)				
	Traditional MDT (face to face)		Fully virtual MDT—dispersed & asynchronous	
Criterion	**Advantages**	**Disadvantages**	**Advantages**	**Disadvantages**
Clinical decision-making process	Open discussion of options and consequences leads to a robust recommendation.	Dominant individuals may impose their views on the rest of the meeting – recommendations therefore biased.	Transparent and unhurried, can involve geographically dispersed experts working together effectively.	Unproven approach to clinical decision making.
Team governance				
Organisational support	MDT coordinator has sense of ownership and responsibility for local site-specific team(s).	Lack of adequately trained and motivated staff to support multiple MDTs.	MDT coordinator can operate flexibly and control workflow without having to adhere to a fixed schedule of face-to-face meetings.	The role of the MDT coordinator will be more complex – IT needs to be mastered as well as knowledge concerning expertise and availability of team members.
Data collection analysis and audit	Data can be collected in real time as discussions take place, clarification can be provided on the spot.	Data may be missing – annual leave, distractions during meeting; data may be wrongly entered – mis-heard or misinterpreted.	Data can be captured and analysed automatically. Audit trail is clear and transparent.	Incompatible software may cause problems with exporting results to hospital management systems.
Clinical governance	The MDT process is well understood and lines of responsibility are clearly established.	Medicolegal aspects of MDT team meetings have not been fully tested. Individuals' contributions to discussions are not easily identified in retrospect. The team may be held responsible for a recommendation in which many members had little or no say.	Individuals' contributions to discussion can be readily identified and will form part of a permanent record.	May be hard to accommodate within existing governance arrangements, medicolegal aspects may cause concern – team members may be inhibited about contributing if they know that a permanent record is kept and that they might, in the future, have to justify their opinions in a court of law.

2006; Lamb *et al*, 2012a). Those who would lead a virtual team must have qualities over and above those normally associated with a good MDT leader. The virtual team leader needs to have some familiarity with the uses and limitations of the technology. They require both the inclination and the time to deal with work that is not packaged into a single period of time but which will ebb and flow unpredictably over a period of days. Leading a virtual team may be a fairly thankless task. There are none of the immediate boosts to the ego that the leader of a face-to-face team might enjoy. Identifying good leaders for virtual teams will not be easy; retaining their interest and goodwill may be even harder.

Communication style. There is a risk that communication within the vMDT might become stilted. For most people, talking is easier than typing and electronic communications are characterised by terseness and spelling mistakes. There is also the risk of the opposite – younger clinicians, brought up on Facebook, may forget that the vMDT may be part of the clinical record and start using an overly informal style. Mentoring and modulating the style in which the vMDT communicates is one of the responsibilities of the team leader.

TOWARDS AN IMPLEMENTATION STRATEGY FOR A VIRTUAL MDT

The previous discussion of barriers to implementation has already given some idea of the issues that need to be resolved if a vMDT is to be effective. Any attempt to set up a vMDT has to start with the involvement of the team members themselves. Imposed solutions are unlikely to succeed. Participation, from the beginning of the process, will bring a sense of power and ownership (Kerber and Buono, 2004; Cordery and Soo, 2008). The technology should be appraised and selected after, but not before, team members have agreed about how they would wish to work together. The vMDT should be set up so that it will replace, rather than be an addition to, existing working practices.

The size and composition of a virtual team are crucial to its success. If the team is too large, communication becomes difficult as the number of potential interactions between participants will increase exponentially. If the team is too small, it may lack expertise and breadth of opinion, particularly if it is being asked to deal with complex problems. One solution is to have a core team who are able, as required, to call on the expertise of additional clinicians. The idea of a problem-based MDT, whose membership changes according to the nature of each individual problem that is discussed, is appealing but it might be difficult to maintain the interest of potential participants. The presence of a defined goal for a defined group will improve the sense of social cohesion among group members.

The easiest way to decide upon the membership of a vMDT is to base the virtual team upon an existing MDT. This has several advantages: members know each other and their foibles, and as they have established patterns of working together, a degree of social cohesion already exists; they are likely to regard the approach as supportive – adding to their capabilities, while making it easier for each individual to contribute; and it is reasonably straightforward to establish what is acceptable and what is not. However, there are some disadvantages associated with converting an existing team to a virtual team: dysfunctional relationships and working practices may already be entrenched and the move to a virtual team may exacerbate the problems; the problems that need solutions may not have a team available or an existing team may not have the full repertoire of skills or expertise available for the task; and the approach involves consolidation rather than innovation, when it may be innovation that is required.

Setting up a virtual team from scratch has its difficulties. It is not easy to turn a collection of strangers, who may never meet face to face, into a cohesive social unit. It is particularly difficult when the team members and coordinators are also trying to come to terms with unfamiliar technology. It is naive to assume that such adversity will somehow bring the group together. The effect could be quite the reverse – creating a group of individuals who are resentful of being used as guinea pigs. There are clear advantages to setting up a completely new team: there are no historical grievances and the team members can be selected so that all the expertise that is required will be available. An initial face-to-face meeting, in the

Table 4. Domains for assessing virtual multidisciplinary team (vMDT) performance

Process measures

Evidence that referrals are processed and loaded onto system within 7 days of receipt

Evidence that all relevant members of the team contribute to discussion

Evidence that relevant information is accessed and used appropriately

Evidence that discussions are temperate and effectively moderated

Evidence that the technology functions effectively and reliably

Outcome measures

Recommendation made to referring clinicians within 2 weeks

Evidence that recommendation was acted upon

Evidence that the process and its recommendations were acceptable to and useful to patients

Evidence that costs were within budget (which should be set at less than that for any existing face-to-face MDT)

Evidence of improved outcome for patients (patients' perceptions of decision making; patient satisfaction; quality of life; survival)

Evidence that team participants found the process acceptable, useful, and nonstressful

form of a retreat or an away day, can help ease some of the problems that arise when a group of geographically dispersed strangers are asked to work effectively together.

Data protection and confidentiality are important issues. There are wide variations in policies between trusts and, if a vMDT is to work across several trusts, the procedures will have to comply with the criteria set out by the most restrictive of the participating units. One way round this potential problem is to strip all distributed data and images of personal and institutional identifiers. This involves extra work initially and at the end of the process where the recommendations are fed back to the referring clinicians, but does mean that the salient features of each problem can be discussed openly and without elaborate security procedures.

Figure 1 illustrates one approach to the organisation of work flow through the v MDT. A key feature is that patients' views can be incorporated into the process from the very beginning. The initial scenarios are prepared using direct input from each patient. At the end of the process, each patient is given a summary of the online discussions that explains, in simple language using lay terms, the nature and provenance of any recommendations.

Any changes to the organisation and delivery of MDT discussions should not be allowed to compromise the effectiveness of the existing process. A document published by the National Cancer Action team (NCAT) outlines the characteristics of an effective MDT (NCAT, 2010), and this provides a framework within which some of the potential advantages and disadvantages of a wholly vMDT might be considered. Table 3 summarises an analysis based on this approach.

Evaluation of the effectiveness of each vMDT should be built in from the very beginning (Lamb *et al*, 2012b). Those that are successful provide an example to others, and those that fail provide counterexamples and lessons for learning. Table 4 summarises some of the domains that need to be considered when assessing the performance of a vMDT. With an increasing emphasis on ensuring that patients are involved in decisions made about their care (Coulter and Collins, 2011), it is important to incorporate patient-related outcome measures (PROMs) into the evaluation of the vMDT. These measures should go beyond the traditional measures of quality of life (de Haes *et al*, 2000) and should include patient satisfaction (http://www.nhssurveys.org) (Jean-Pierre *et al*, 2011; Kamo *et al*, 2011) and patients' perceptions of the extent to which they felt that they were involved in the decision-making process (Elwyn *et al*, 2005; Kriston *et al*, 2010).

CONCLUSIONS

The potential role of the vMDT will be to extend the advantages of the MDT approach into areas that are currently underserved. These could include: the treatment of rare or unusual tumours; the assessment and management of patients who have unusually severe late effects following previous treatment; the investigation and management of patients who present with tumours of unknown primary site; the management of recurrent disease in patients previously discussed by a traditional MDT at their original presentation. Current arrangements for re-discussion are highly variable and the breadth of expertise that the vMDT could offer might be of particular benefit to patients with unusual or difficult problems.

Any recommendations that the virtual team makes should be as appropriate and as robust as those made by a traditional team. The process of engagement and participation should be as easy, and certainly no more difficult, than that associated with a conventional team. Convenience should be increased because of lack of need for a fixed time and place of meeting, and costs should be less. There should be evidence of the ability to expand into clinical areas where locally based expertise is unavailable. The vMDT should be judged by all the standards that apply to conventional MDT, but with the following additional outcomes: proof that team members have embraced the technology; proof that team members find the vMDT more convenient than the traditional MDT and that this convenience translates into more frequent attendance and deeper engagement; proof that the approach is affordable.

The truly vMDT, non-colocated and asynchronous, offers a potential means for dealing with some of the limitations and difficulties associated with conventional MDT meetings. However, vMDTs should not be introduced unless and until:

- there is an established framework for their constitution, organisation, and function;
- there is proof that the technology and IT systems are acceptable to team members;
- mechanisms are in place to ensure that technical and IT support is available at all times;
- there are processes to ensure that each individual team is evaluated from its inception.

Data on team organisation and performance should be pooled for all teams and should be available in real time so that we are able to assess not only how well or how badly each team is doing, but whether or not the overall approach is improving the management of patients with cancer. Given all these considerations, it is highly unlikely that existing site-specific MDTs can be effectively replaced by vMDTs.

There is promise here, but clarity and preparation are required in order to maximise the potential that the approach will deliver on its promises. Otherwise, a decade from now, there will be only scattered accounts of a few hopeful experiments. Clinicians will still not know whether or an MDT that is fully virtual can offer significant advantages over traditional methods such as face-to-face meetings or video conferencing. If vMDTs are to make any useful contribution to the management of patients with cancer, then a nationally coordinated and planned programme of research is required. The *ad hoc* development will not lead to meaningful progress.

The MDT meetings were introduced somewhat precipitously into cancer care in the United Kingdom in the mid to late 1990s. There was little initial planning and structure, and virtually no prospective assessment of performance or outcome. This all came later (Kee *et al*, 2004; Fleissig *et al*, 2006; Lanceley *et al*, 2008; Lamb *et al*, 2011a, b, 2012a) and, as a result, despite nearly two decades of

MDT team working, the extent to which this approach has directly contributed to improvements in cancer care in the United Kingdom is still unclear. We should not allow ourselves to be seduced by the apparent charms of the 'vMDT' into making the same mistake again.

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