

Virtual tumor boards: community–university collaboration to improve quality of care

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Objective To develop and implement virtual interactive multidisciplinary cancer tumor boards (VTBs), created through telemedicine links between the University of California, Davis Cancer Center and community-based cancer care providers. The goal of this project was to facilitate communication among community and academic cancer specialists.

Materials and methods Four geographically remote sites were selected to participate with established disease-specific tumor boards of the UC Davis Cancer Center. Telemedicine links were created using dedicated T1 lines, and PolyCom HDX 9000 was used by the center for teleconference hosting. Participants were then surveyed on their perception of the benefit of VTBs.

Results The results across disease-specific virtual tumor boards show that most of the participants reported that the right amount of clinical information on the cases was presented and that new information was discussed that helped providers manage the care of the patients.

Conclusions Teleconferencing of disease-specific tumor boards allowed providers in a geographically remote group of providers to make prospective, case-based treatment decisions that increased their knowledge of treatment options and facilitated their decision making. This transfer of knowledge and experience speeds up the dissemination of rapidly evolving cancer care, which could lead to higher quality patient outcomes.

It is widely believed that multidisciplinary care of cancer leads to optimal patient care and that cancer conferences and tumor boards are an excellent method of achieving multidisciplinary input for treatment planning. The standards set forth by the American College of Surgeons Commission on Cancer require cancer conferences and believes them to be integral to improving the care of patients with cancer. National Cancer Institute (NCI)-designated cancer centers have a responsibility to share new prevention, diagnostic, treatment, palliation, and survivorship knowledge with their own clinicians as well as with community-based physicians. This outreach to community physicians, engaging them in relevant evidence-based cancer interventions, and informing pa-

tients and the community that collaborating community physicians provide care that promotes better survival and/or quality of life for the patient can substantially reduce the rate of cancer mortality.¹ One challenge in accomplishing this dissemination of information is geographic separation of academic health care centers (AHCs) from community physicians, which creates a barrier to attending cancer conferences and tumor boards away from their practices for both groups of practitioners. Telemedicine methods can facilitate the linkage of distant sites for the coordination of cancer care through patient-centered tumor board discussions.²⁻⁵ The purported benefits observed include improved referral coordination and minimization of patient travel and treatment delays.

The adoption of new evidenced-based cancer care treatments has been neither timely nor widely implemented in community settings.⁶⁻⁷ Deficiencies in timely access to care and implementation of

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quality of care are most evident in populations of low socioeconomic status, those located in isolated rural or remote regions regardless of income, and populations that access practitioners who have no ready means to incorporate state-of-the-art care.⁸⁻¹¹ Best practices in cancer therapy are increasingly complex, as the selection of, and interplay among, various treatment modalities of surgery, chemotherapy, and radiation are better understood. Bidirectional communication between academic and community oncologists in cancer care could improve the process of cancer care delivery as well as cancer-specific outcomes for patients. Academic oncologists can engage community physicians with relevant evidence-based cancer interventions, and inform patients and the community that by collaborating, community physicians can promote better survival and/or quality of life.¹² Community-based oncology practices can inform AHCs about the real concerns of the majority of cancer patients and their families, a form of community-based translational research.

We report on a demonstration project, virtual interactive multidisciplinary cancer tumor boards (VTBs), that were created through telemedicine links between the NCI-designated University of California, Davis Cancer Center (UCDCC) and community-based cancer care providers. The goal of this project was to facilitate communication between community and academic cancer specialists and thus narrow the gap between current and best practices. The VTBs were also developed as a mechanism to increase enrollment in phase 2 and 3 clinical trials at the community sites and to facilitate referrals to the AHC for phase 1 studies. Communities would have access to advanced oncology expertise and inform academic physicians of the challenges faced in community care settings. Patients would have access to a second opinion regarding their diagnosis and a care plan developed between their private physician and leaders in the field.

Methods

Site selection, pre-initiation visits, and ground rules

Four sites, all of them in California, were selected (Figure 1). Two of the sites, in Yuba City and Merced, are formal members of the UCDCC network. A third site, in Truckee, is a formal affiliated teaching site of the UC Davis School of Medicine rural education track, and the fourth site, in Pleasanton, is unaffiliated. Yuba County has the highest county cancer mortality rate in California and is significant for the number of migrant workers in the region. Although the mountain border region of California and Nevada surrounding Lake Tahoe has an incidence of cancer similar to that found in the rest of the Sierra Nevada region, the incidence of cancer within the city of Truckee far exceeds



FIGURE 1 Geographic map of the 5 participating sites of the UC Davis Virtual Tumor Board project.

that for the region. In the winter season, Truckee often experiences severe weather, which limits patients' ability to travel for medical care. Merced is in the heart of the Central Valley, an impoverished area that serves a diverse population. Pleasanton was chosen because unlike the other 3 sites, it is more of a suburban location with easier access to specialty consultation and established clinical trials infrastructure.

In anticipation of the 4 remote sites joining the UC Davis Cancer Center VTBs, several aspects of their participation were reviewed and formalized. The leadership of the project (FJM, RJB, SC, RDVW) visited the sites to present the mechanisms and goals of the VTB. At each meeting, the rules of engagement were presented. They included: only patients prior to the initiation of therapy would be presented; presentation would use a standardized template for presentation; the presentation would be prepared and submitted to the host site in advance of the VTB; "civility despite passion" was demanded at both ends of the connection; and attendance was encouraged, but not required, even in the absence of a presentation by the community site. After a 6-month initiation phase, case discussions of patients who had already initiated therapy were allowed.

Disease-specific implementation of VTBs

After the implementation of the necessary technologic infrastructure (details provided below), the VTBs began in September 2008. Twelve disease-based tumor boards are in place at UC Davis, and 4 were expanded to VTBs based on community request for disease sites. E-mail notices went out weekly as reminders to sign up to present cases and to invite participation. Initial disease-site specific tumor boards of UC Davis expanded into VTBs including genitourinary (GU) and breast tumor boards,

with thoracic and gastrointestinal tumor boards added after 6 months by which time the technology and the process had been tested and refined. Each subspecialty tumor board meets weekly. Physicians at UC Davis and the community were asked to submit cases 2 days before the meeting for prereview and collection of radiographs and pathology. A standardized PowerPoint presentation was used for all cases.

Outcomes

At the end of 2009, all of the participants for 3 of the 4 disease-specific VTBs were asked to complete a summative evaluation survey covering a variety of aspects of the anticipated goals of the VTBs as well as the potential effect on clinical practice. Areas included in the survey spanned topics from information disseminated to satisfaction with participation as well as whether community-based physicians would report that telemedicine-enabled tumor board discussions would have significant benefit to their clinical practice and patient care decisions. The survey was developed by one of the authors (MVF) based on the input of the project leaders (RJB, FJM). The Gastrointestinal VTB was excluded as it was initiated late in the time period and insufficient responses were anticipated. Participants were surveyed weekly over a 5-month period (July to mid-December, 2009). Given repeated requests for completion of the surveys, respondents were likely surveyed multiple times though responses were anonymous other than specialty identification and thus not allowing the identification of exact responders. Responses were obtained from 10 offsite physicians and 18 UC Davis physicians, as well as ancillary personnel including nurses, trainees, and clinical trials staff.

Results

Development and use of technology

Initial criteria for both software and hardware were developed based on our previous experience with telemedicine through the UC Davis Center for Health Care Technology.¹³⁻¹⁵ This included videoconferencing equipment and software application allowing conferencing via the Internet. The VTBs are held in a separate room in the UC Davis Cancer Center auditorium capable of holding more than 30 people and that became the technology hub of the VTB operation. The HDX 9000 (Polycom, Pleasanton, CA) was chosen for the UCDC location for its ability to host up to 8 sites simultaneously (internal MCU) while maintaining overall HD quality. This was crucial as it eliminated the need for a costly videoconferencing bridge that would have otherwise been necessary for this project. The HDX 9000 series also had features such as standard connectors and AUX inputs/outputs to

allow for easier audio/video integration. Ceiling mount microphones and speakers for improved sound quality were installed in the VTB conference room that improved sound quality of the voice acquisition in a large conference room.

Due to the bandwidth requirements for the transmission of HD video, broadband connectivity was required. Although all locations had sufficient Internet speeds to support the application, it ultimately proved to be too unreliable for this project. T1 circuits were eventually established to all the sites from UCDC to ensure reliable connection and improved video quality of the conversations. High-definition content such as MRI, X-ray, and pathology images, and PowerPoint presentations were critical aspects of the VTB. Although this could have been done through the content sharing feature of the videoconferencing equipment, it would have required all the sites to have HD capable equipment. Instead, videoconferencing was hosted using Adobe Connect software (Adobe Systems Inc, San Jose, CA). This was not only cost effective, but also provided sites the ability to use standard definition videoconferencing equipment though T1 circuits were critical for Internet connection.

VTB implementation and coordination

In 2009, 20 different types of health care practitioners (physician specialists and ancillary health care personnel) were represented at 1 or more of the VTBs including physicians, nurses and clinical trials personnel (Table 1). Most of the responses were obtained from physicians representing medical oncology, pathology, radiation oncology, radiology, and surgery. The physician providers at UC Davis were most often specialists and attended only 1 of the 4 disease-specific VTBs, while the community oncologists were more often generalists and participated in all 4 VTBs.

In all, 115 completed evaluation forms were obtained from participants of the Breast Cancer VTB session; 258 forms were obtained from participants of the GU VTB; and 39 forms were obtained from participants of the Thoracic VTB. The results across all 3 disease sites showed that most of the participants agreed that the VTBs provided new information that would help providers manage the care of the patients presented (range, 90.3%-95.8%) and that participation in the VTBs would change how the providers care for and manage other patients with cancer (range, 78.5%-85.8%), and that they were interested in attending more VTB meetings (ranges, 85.1%-94.8%; Figure 2A). Furthermore, most of the

TABLE 1 Total attendance of specialties participating in all virtual tumor boards in 2009

Specialties	Type of tumor board		
	Breast (n = 115)	Genitourinary (n = 258)	Thoracic (n = 39)
Anesthesia	0	1	0
Clinical trials	1	0	0
Gastrointestinal	2	3	0
Interventional radiology	0	9	0
Medical student	0	1	1
Medical oncology	52	95	21
Nuclear medicine	0	13	0
Pathology	14	31	2
Pulmonary	0	0	1
Radiation oncology	20	23	3
Radiology	9	24	4
Registered nurse	1	0	1
Surgery	15	6	4
No response	1	38	2

respondents reported that they were more familiar with available clinical trials (81.0%–93.1%) after participation in the VTBs, more likely to enroll patients in clinical trials (range, 67.0%–77.4%), and that they were satisfied with the information they received related to clinical trials (94.8%–99.2%; Figure 2B).

Negative evaluations of the VTBs (either “somewhat disagree” or “strongly disagree”) were uncommon responses; though, was the difference between the Breast VTB and the GU and Thoracic VTB respondents with regard to clinical trial familiarity and likelihood of future enrollment. Only 4.4% of Breast VTB participants disagreed with the statement “VTB participation increased familiarity with clinical trials,” whereas 23.8% of GU and 14.0% of Thoracic VTB participants disagreed with this statement. This would indicate that GU and Thoracic VTB participants already had a strong familiarity with clinical trials in which VTB participation did not increase this knowledge. Furthermore, only 2.6% of Breast VTB participants disagreed with the statement that they were more likely to enroll patients in clinical trials, whereas 19.1% of GU and 14.8% of Thoracic participants disagreed with this statement. Given the significant accrual by UC Davis Cancer Center to cooperative group GU and Thoracic clinical trials, we interpret these findings to suggest that this group is unlikely to increase their already high clinical trials accrual.

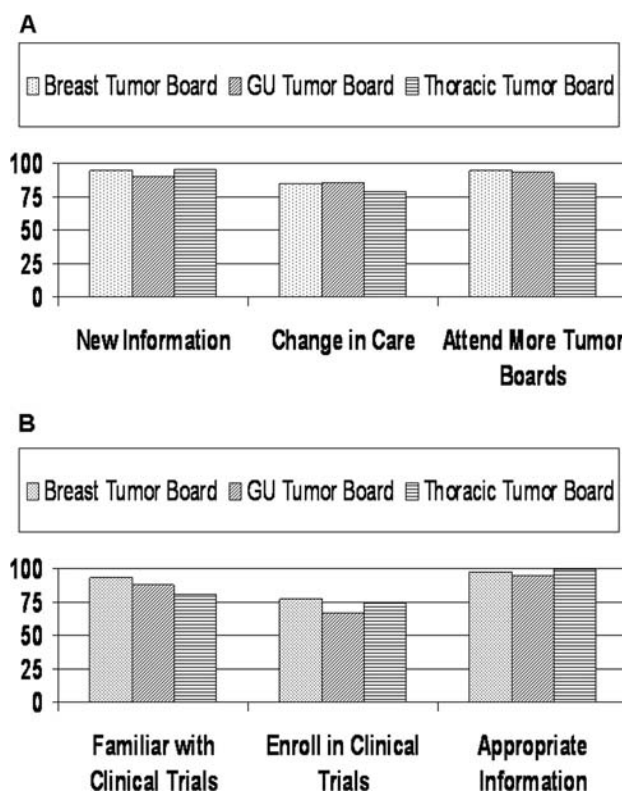


FIGURE 2 A. Percent of respondents (broken down by disease site) who agreed with the statements that VTBs provided new information that would help providers manage the care of the patients presented, would change how the providers care for and manage other patients with cancer, and reported an interest in attending more VTB meetings. B. Percentage of respondents (broken down by disease site) who agreed with the statements that they were more familiar with available clinical trials, more likely to enroll patients in clinical trials, and they were satisfied with the information provided related to clinical trials.

Discussion

The significance of the project is the ability of community oncologists to discuss their patients’ cases before initiation of treatment, thereby allowing patients who reside in rural communities access to telemedicine consultation with academic oncologists and to receive appropriate therapy at a center close to where they live. The community sites benefited by having access to information (eg, about recent clinical trials results) and services (eg, clinical trials) that is not available to other community sites that offer cancer care. Furthermore, because of the personal relationships developed during the participation in the VTBs, a sense of trust and infrastructure was developed that we intend to use to hasten the dissemination of information about advances in cancer care to community practitioners. This sense of trust was manifest by more open discussion among all 5 sites rather than just UC Davis attendees and a single community site. Three of the 4 sites were already

affiliated with UC Davis and actively participated in patient presentations and discussions; the nonaffiliated site had the lowest attendance and least frequent submission of cases for presentation. Therefore, pre-existing partnering of the community hospital with the AHC may be a predictor of more successful interaction at VTBs. With about 85% of cancer patients treated at community cancer centers and hospitals, virtual tumor boards offer access to multidisciplinary input on patient cases that is not readily available otherwise. Further study is needed to demonstrate actual changes in clinical behaviors; however, it is difficult to control for confounding variables and as pointed out by Dickson-Witmer et al, it is difficult to carry out a randomized prospective trial to demonstrate such results.¹⁶

The initial implementation in January 2009 identified several technical challenges such as erratic broad band connectivity related to the data transfer of radiologic and pathologic images. This was resolved through the use of dedicated T1 circuits for internet connections. The use of the Polycom HDX 9000 platform allowed for simultaneous hosting of all 5 sites with maintenance of HD quality. This latter component was critical for all sites to simultaneously view critical details of both radiologic and pathologic shared images. The strategy of presenting only new cases did prevent second guessing at either end of the connection and most importantly prompted frequent changes to initial treatment planning. The schedule of the VTBs was essentially adopted from the disease-specific tumor boards of UC Davis, which was not always convenient for the community sites but participation was consistent. Furthermore, each of the 4 disease-specific tumor boards of UC Davis had a different “flavor” in the balance of trainee education, patient-directed treatment planning, or clinical trials accrual that required the development of a consistent agenda to offer uniformity to the community partners. Learners were initially reserved about their participation, especially trainees (ie, residents and postdoctoral fellows). Better orientation of trainees to the process of telemedicine should have been anticipated.

There are several notable lessons learned following the implementation of the VTBs. Potential barriers to participation included: changes in schedule by the community oncologists since the tumor boards were already in place at the AHC based on prior consensus of availability; requirement for preparation of presentation in advance of the VTB; change to a more formalized, patient-driven agenda; mandate of a standardized presentation format; perception of “criticism” from a trainee by community oncologist or vice versa; and ongoing perception of academic compared with community expertise. Much of the format, meeting time, and style (ie, rules of engagement)

were dictated by UC Davis at the initiation of the project and might have contributed to barriers of participation by community-based providers. Some of these barriers can immediately be overcome once they have been identified, but others might require additional time during the development of relationships with virtual consultants.⁹ An important change occurred during the course of these VTBs that helped maintain participation: after an initial 6-month roll-in, the requirement for all patients to be presented using the standardized PowerPoint template was loosened, allowing more impromptu presentations. Given that there was resistance by some in terms of the mandated presentation format, a smoother transition to VTBs could have been accomplished using a hybrid agenda in which time was set aside for more formal presentations using the standardized format and time was also set aside for less formal, impromptu presentations (perhaps for patients seen 1-2 days before the VTB).

Telemedicine is increasingly being implemented as a means for community- or rural-based practitioners to access expertise of AHCs. However, most of the encounters are based on individual patients with a one-on-one consultation. Our telemedicine VTBs integrated multiple groups of practitioners with diverse medical specialties to establish long-term bidirectional communication that allowed discussion of new cancer therapies, opportunities for clinical trials enrollment, a review of personal experiences in various practice environments, and a focus on optimizing patient treatment planning and subsequent outcomes. These aspects of the process of cancer care delivery have been identified as areas that can allow for the improvement in treatment delivery.¹⁷ In fact, this is a critical mission that the NCI charges the accredited cancer centers, namely the engagement of the community to improve the process of cancer care delivery. The technology is becoming increasingly available and no longer is cost or resource prohibitive. Given our initial success, as well as the important lessons learned with regard to both technology and implementation, we currently plan to expand the VTB to other disease sites as well as open to other community providers.

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