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Assessing the Feasibility of a Virtual Tumor Board Program: A Case Study

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Executive Summary

Multidisciplinary tumor boards involve various providers (e.g., oncology physicians, nurses) in patient care. Although many Community Hospitals have local tumor boards that review all types of cases, many providers, particularly in rural areas and smaller institutions, still lack access to tumor boards specializing in a particular type of cancer (e.g., breast, gastrointestinal, hematologic). Videoconferencing technology can connect providers across geographic locations and institutions; however, virtual tumor board (VTB) programs using this technology are uncommon.

In this study, we evaluated the feasibility of a new VTB program at UNC Lineberger Comprehensive Cancer Center, which connects community-based clinicians to UNC tumor boards. We used an embedded case study design with UNC VTB as the overarching case, comprised of multiple tumor boards representing different cancer types, each with individual clinician participants (our primary unit of analysis). Methods included observations, interviews, and surveys.

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COMPETING INTERESTS
The authors report no competing interests.

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Our findings suggest that participants were generally satisfied with the VTB. Cases presented at VTB were appropriate, sufficient information was available for discussion, and technology problems were not common. UNC clinicians viewed the VTB as a service to patients and colleagues and an opportunity for clinical trial recruitment. Community-based clinicians presenting at VTB valued the discussion, even if it simply confirmed their original treatment plan or did not yield consensus recommendations. However, barriers to participation for community-based clinicians included timing of the VTB and lack of reimbursement. To maximize benefits of the VTB, barriers to participation should be addressed, scheduling and preparation processes optimized, and appropriate measures for evaluating impact identified.

Keywords

videoconferencing; health services accessibility; oncology service; hospital; interdisciplinary communication; patient care management

BACKGROUND

Many health care systems across the world have adopted a multidisciplinary approach to cancer care. This approach, intended to facilitate communication between care providers by effectively using information (e.g., research findings) to improve quality and continuity of care, is important given the increasing complexity of managing cancer patients (Taylor et al., 2010). One venue for this approach is a multidisciplinary tumor board (or multidisciplinary cancer conference), where clinicians present their complex cases to engage in treatment planning with various physician specialists (e.g., medical, surgical, and radiation oncologists; pathologists; radiologists) and other health professionals (e.g., nurses, geneticists) (Commission on Cancer, 2012). Tumor boards are an eligibility requirement for the more than 1,500 American College of Surgeons (ACoS) Commission on Cancer (CoC) approved programs (American College of Surgeons, 2013).

Studies have reported improved care processes resulting from a multidisciplinary approach in general and tumor boards specifically. Examples include adherence to National Comprehensive Cancer Network guidelines for preoperative evaluation and increased access to multimodal treatment for colorectal cancer patients (Levine, Chawla, Bergeron, & Wasvary, 2012) as well as modified patient management for breast (Newman et al., 2006) and gynecologic (Cohen, Tan, & Penman, 2009) cancer patients resulting from radiology and pathology reviews. However, we need to explore novel mechanisms that enable community-based providers to access multidisciplinary tumor boards regardless of their geographic location (Blayney, 2013). Although many Community Hospitals have local tumor boards that review all types of cases, many providers, particularly in rural areas and smaller institutions, still lack access to tumor boards specializing in a particular type of cancer (e.g., breast, gastrointestinal, hematologic cancers).

One promising tool for overcoming geographic barriers to tumor boards is videoconferencing technology. However, only a relatively small number of tumor board programs have used videoconferencing technology to enable real-time access to participants from different institutions (Dickson-Witmer et al., 2008; Gagliardi, Wright, Anderson, &

Davis, 2007). The small number of these programs may be due to the complexity of involving multiple individuals in disparate locations, often with different priorities and work practices. Several critically important operational issues (e.g., technology, scheduling) need to be managed to engage providers effectively. Therefore, evaluation efforts to assess feasibility of current programs should encompass multiple perspectives on a range of issues, such as acceptability and practicality for all participants (Bowen, Kreuter, Spring, & Etal., 2009).

The purpose of this paper is to summarize our evaluation of the virtual tumor board (VTB) program at the University of North Carolina (UNC) Lineberger Comprehensive Cancer Center (LCCC), which is part of UNC Health Care. The UNC VTB is an interactive service provided free of charge to community-based clinicians from across the state who wish to participate, regardless of whether the provider or patient is affiliated with UNC Health Care. A key difference between the VTB and the tumor board requirement of the CoC is that the CoC requires a review of new cases and discussion by the treating providers about the optimal delivery of care, while the VTB provides a second opinion on a limited number of the most complex cases from multiple facilities. Our evaluation details the structure and processes of the UNC VTB, barriers to participation, and perceived value for both UNC and community-based clinicians. We highlight implications and recommendations for leaders of institutions currently administering or potentially considering implementing a VTB program.

METHODS

We used an embedded case study design (Yin, 2009), with the UNC VTB as the overarching case comprised of multiple tumor boards each with individual clinician participants. Our primary unit of analysis was the individual participant, and our focus was to explore their experiences with the VTB. The study, funded by the University Cancer Research Fund, was reviewed by the UNC Office of Human Research Ethics and was determined to be exempt from further review.

Study setting

The LCCC telemedicine program implemented a VTB in 2010 to enable community-based clinicians to participate, free of charge, in the multidisciplinary tumor boards of various cancer specialties within the UNC Health Care System. UNC VTB leadership contacted community-based clinicians they believed might be interested in the VTB. Those interested were provided, free of charge, the necessary technology and technical assistance to access the tumor boards from a central conference room in their facility or from their personal computers via a secured interactive video network. Depending on technology already present at the collaborating facility, any additional needed equipment (e.g., monitors and cameras) was purchased using the State-supported University Cancer Research Fund. At the UNC location, each tumor board used the same conference room and technology, with video screens displaying the clinician(s) presenting the case as well as pathology slides and/or radiology images.

For any tumor board meeting, participating community-based clinicians could request to present a case or simply participate in discussion of other cases. LCCC telemedicine program staff coordinated scheduling of all cases presented by community-based clinicians. Generally, these virtual cases were integrated into the regularly scheduled UNC tumor board meeting, although one cancer specialty began 30 minutes prior to the usual meeting time when they had a virtual case to discuss and then continued with discussion of internal (UNC) cases. Each tumor board had multidisciplinary participation from UNC, including medical oncologists, radiation oncologists, surgeons, radiologists, pathologists, oncology nurses, and other clinical and research staff. Prior to the community-based clinician's presentation of the case, a UNC oncologist typically reviewed the case and prepared for the ensuing discussion, often identifying supportive references from the literature.

Notably, UNC did not use this program to attempt to increase market share. The VTB was a State-funded educational program designed to keep patients in their communities. Likewise, UNC reserved the right to review any external marketing that used the program to enhance a collaborating facility's market share. A review of UNC referral patterns and activities did not suggest a significant change in referrals due to the VTB.

Technology Used

The VTB program used interactive video technologies via broadband internet telecommunications to connect participating sites to the state's high speed data network known as NCREN (North Carolina Research and Education Network). The UNC Cancer Network hub site was located at the UNC North Carolina Cancer Hospital (UNC NCCH) in the main educational conference room. This facility was connected directly to NCREN using a 10 gbps (gigabit per second) data connection with a redundant 10 gbps connection. The UNC Cancer Network's bridge was used for multipoint calls. Currently the technology enables hosting 40 702p High Resolution (HD) interactive sessions. This resolution was chosen so the radiology and pathology images would retain their fidelity and make the interactive experience more immersive for the physicians. During the installation process at the remote locations, UNC assigned specific information to the video teleconferencing units that allowed them to register to the UNC systems. Sites were not able to connect to the UNC conference room unless they had been registered and had signed appropriate documents to ensure HIPAA compliant discussion of personal health information.

Study Participants

Our study consisted of (1) UNC and community-based clinicians who participated as a presenter or discussant in one of four multidisciplinary tumor boards—breast, gastroenterology (GI), head and neck, or malignant hematology—and (2) community-based clinicians and staff at organizations who had access to the VTB technology but had not presented a case at the VTB. We selected the breast, GI, and malignant hematology tumor boards because they were actively receiving VTB cases presented by community-based clinicians and represented both solid tumors and lymphoproliferative malignancies. Even though the head-and-neck tumor board was not participating in the current VTB program, we included it in the study because it had used videoconferencing in the past to engage community-based clinicians in tumor board discussions.

Data collection procedures

Table I summarizes our data collection approach using a combination of observations of VTB cases; interviews with UNC clinicians, community-based clinicians, and a staff liaison to the VTB; and a survey of UNC health professionals. The use of multiple methods allowed data collection strategies to evolve as unanticipated issues emerged, which is a strength of qualitative research in understanding context-specific phenomena (Creswell, 2007). Furthermore, having multiple data sources, both qualitative and quantitative, allowed for triangulation of the data (Yin, 2009) on issues related to acceptability, barriers, and perceived value of the VTB program.

For the observations of the VTB cases, we used a structured observation checklist, capturing the institutional affiliation of the community-based presenters, number of virtual participants, length of case discussions, recommendations for treatment, and whether consensus was reached on a recommendation. In addition, we noted unstructured observations, such as level of participant engagement in discussions and plans for follow-up with the presenter. These observations informed the interview process by providing a context for interviewer-interviewee discussions of VTB case presentations.

We conducted semi-structured interviews to gain in-depth understanding of UNC and community-based clinicians' perceptions of the acceptability, barriers, and value of the VTB. Interview participants included: (1) UNC physicians participating in the VTB (i.e., physicians practicing on the main UNC Hospitals campus); (2) community-based clinicians presenting at the VTB (i.e., both those affiliated with UNC but practicing at sites off the main campus and those not affiliated with UNC); and (3) non-participating community-based clinicians and staff (i.e., those with access to the VTB equipment but had never participated in a VTB). The interview guide was developed by three members of the research team with experience in qualitative research (CS, RT, LHM). Interviews were conducted either in-person at a location convenient for the physician or by telephone. Each lasted approximately 30 minutes, was audio-recorded and professionally transcribed, and participants were offered a $100 gift card as compensation for their time.

For the survey, items were developed to map directly to themes and recommendations that arose during the interviews (e.g., frequency of technology glitches, capacity for more VTB cases). We piloted the survey with four individuals (two with survey development experience and two with clinical backgrounds) and revised it according to their feedback. Once the survey was finalized, we distributed it to participants at one meeting for each of the tumor boards in the study that were participating in the VTB: breast, GI, and malignant hematology.

Data coding and analysis

The research team developed an initial list of codes based on the research questions and topics from the interview guide (Miles & Huberman, 1994). Using this starting list, two members of the research team selected and independently coded four transcripts using ATLAS.ti 6.0. Team members (CS, RT, LHM) met to discuss and reconcile coding and fine-tune coding definitions and decision rules. Four more interviews were then coded using the revised codes and decision rules. After a second meeting to discuss and reconcile coding, the remaining transcribed interviews were independently coded. Once the coding of all interviews was complete, we determined the frequency with which the codes appeared in the data and developed summary reports of each code (See Table II).

We then calculated the percentages of response options from the survey, most of which were dichotomous (yes/no) (see Table III). The intent was not to identify statistically significant findings; instead, the survey helped ensure validity of the qualitative data analysis by allowing us to verify whether the themes identified during interviews were supported by a larger sample of UNC tumor board participants. We did not use this approach with community-based participants because the number of such participants was small, and each participant was provided the opportunity to be included in the interview sample.

Finally, based on our coding of the interview transcripts and results from the survey, we identified prominent themes within the broader topics of acceptability, barriers, and perceived value.

FINDINGS

During the evaluation period, 15 community-based clinicians located in six NC counties presented cases at a UNC VTB. We observed 14 VTB presentations and conducted 28 interviews – 16 with UNC physicians, nine with community-based clinicians who had presented a case at the VTB, and three with community-based individuals (two clinicians and one non-clinician staff member who was the organization’s liaison to the VTB program) who had access to the VTB videoconferencing equipment but had never presented a case. Finally, we surveyed 32 UNC health care providers in the breast, GI, and malignant hematology tumor boards who had participated in at least one VTB.

Each VTB (i.e., breast, GI, head/neck, and malignant hematology) had only sporadic participation by community-based presenters (i.e., Most tumor board meetings during the evaluation did not include a virtual case presentation). Findings from our interview and survey data highlight aspects of the program that were working well and issues contributing to the low levels of participation by community-based clinicians. Below we have organized the findings into three topical areas: acceptability of the program, barriers to participation, and perceived value of the program.

Acceptability of the VTB Structure and Processes

Acceptability refers to the perception among stakeholders that an innovation is suitable for its purpose based on aspects such as content and complexity of the innovation (Proctor et al., 2011). Regarding content of cases presented by community-based clinicians at the VTB, each was screened by VTB leadership for appropriateness, but no cases were denied for being inappropriate. In our interviews, UNC physicians reported that cases presented by community-based providers were appropriately complex for multidisciplinary discussion, and 97% of UNC physicians surveyed confirmed this belief. Furthermore, UNC physicians indicated in our interviews that community-based presenters generally provided adequate background information about the patient for a productive discussion, which was confirmed by 91% of UNC survey respondents.

Although most cases had sufficient information available, some interviewees mentioned occasional exceptions when radiology images or pathology slides were not available for the case discussion. One factor contributing to unavailable images and slides was pathologists and radiologists not receiving the slides/images far enough in advance of the presentation. (Note: Pathology is requested but not available occasionally for cases presented at the tumor board by UNC physicians as well, so this situation is not unique to VTB cases.) Another factor was that since VTB cases are typically external to the UNC Health Care System, community-based patients often do not have a UNC medical record number, which creates inefficiencies in retrieving and viewing images from within the UNC electronic health record system.

The roles of pathology and radiology varied somewhat by cancer group and the nature of the case. For example, if a community-based presenter requested a confirmation of diagnosis, UNC pathologists reviewed the material prior to the case presentation; otherwise, UNC pathologists generally did not conduct a formal review, and the pathology report and slides were typically included in the presentation by the community physician. With respect to radiology, images sometimes had to be reviewed by multiple individuals, for example, if multiple organs were involved or if multiple imaging technologies were used. These reviews had to occur within a tight timeframe. Among UNC participants surveyed, 44% indicated that streamlining the radiology/pathology review process to ensure results are ready for the VTB would be one of the highest impact program improvements.

Regarding technology, “glitches” were reported by both UNC and community-based interviewees as being infrequent and not a major concern. This belief was confirmed by the survey results, as only 9% of respondents indicated technology-related disruptions frequently occur. Glitches that did occur were most often the result of the technology reacting to firewall issues or bandwidth down speed.

Despite occasional technology problems and missing radiology or pathology reviews, our interview data suggest that treatment recommendations were generally satisfactory from both the UNC and community-based clinicians’ perspectives. A few of the UNC physicians that were interviewed indicated some uncertainty about whether community-based clinicians’ questions were clearly addressed. However, 91% of UNC survey respondents reported they believed discussions focused appropriately on the presenting physicians’ questions. Similarly, only 19% of UNC survey respondents believed consensus was less likely to be reached among VTB cases as compared to traditional tumor board cases. One survey respondent noted the UNC physician’s role is not necessarily to come to consensus but to “offer colleagues in the community viable options.” Finally, while a few interviewees indicated that occasional VTB case recommendations were limited by not having adequate representation of UNC expertise present, only 19% of survey respondents suggested that ensuring adequate representation (e.g., surgical, transplant, or other specialists who are not regular tumor board attendees) would be one of the top two highest-impact program improvements.

Barriers for Community-based Presenters

A commonly cited barrier to participation during interviews with both UNC and community-based clinicians was the timing of the VTB. Since the VTB was integrated within the regular meeting times of the UNC tumor boards (or adjacent to the regular meeting time), they were generally convenient and routine for UNC participants, but not necessarily for community-based participants.

Another barrier was the time lag between scheduling the VTB presentation and the presentation itself. The required lead time for submitting case material was a minimum of three days prior to the scheduled VTB presentation. Therefore, since tumor boards meet once a week, in some situations community-based clinicians would need to schedule the presentation more than a week in advance in order meet the three-day requirement for submitting materials, which might not be timely for patient management. Also, the amount of time required to prepare for a case presentation may have been a barrier. Community-based clinicians we interviewed indicated a desire to be adequately prepared for the presentation, as they did not want to look unprofessional in front of their colleagues at UNC. However, the time required for them to prepare varied based on the nature of the case and the type of consultation needed. For example, questions that focused on imaging (e.g., whether a biopsy can be performed) may have required less preparation than questions about patients with several co-morbidities. Community-based clinicians reported spending as little as five or ten minutes reviewing the details of the case before presenting but as much as 60 minutes if they needed to review literature and prepare for questions they might receive from colleagues.

Finally, a powerful barrier for community physicians was lack of reimbursement for presenting a VTB case. Physicians sometimes chose other forms of consultation (e.g., phone call and email) or referred complex patients rather than investing the uncompensated time in scheduling, preparing, and presenting the case for the VTB.

Perceived Value for Community-based Clinicians and UNC Clinicians

A key reason community-based clinicians indicated they presented a case at the VTB was to obtain a second opinion about current treatment plans. Presenters perceived the discussion and recommendations to be useful, even if they were provided validation of their current treatment plan or if they were not provided one “correct” (i.e., consensus) answer. In some cases, presenters were able to determine if the patient was eligible for a UNC sponsored clinical trial or should be seen formally by a multidisciplinary team at UNC. In addition, some physicians viewed the VTB as an alternative for patients who are unable or unwilling to travel to UNC Hospitals in Chapel Hill for treatment. Finally, as mentioned above, multiple presenters indicated that they spent substantial time preparing for the discussion by reviewing relevant literature. While this time spent might be a barrier for some, it also could be viewed as a positive unintended consequence of the VTB process, as community-based clinicians engaged the literature to become expert in the complexities of the case.

For UNC physicians, three reasons were commonly cited in interviews for participating in the VTB: (1) performing a service for cancer patients across NC, (2) providing multidisciplinary consultative assistance to providers across NC, and (3) increasing recruitment for clinical trials. One-hundred percent of UNC survey respondents indicated they found the program to be a valuable method for discussing complex cases with community-based clinicians, and 91% believed the VTB to be an effective use of resources. However, results were mixed as to whether the VTB translated into additional clinical trial recruitment. Although trial opportunities were discussed with providers during discussion of most VTB cases, participation in the VTBs was not a pre-requisite for participating in a UNC-based research study, and not all VTB participants were involved in UNC's research network. UNC's research network grew simultaneously with the VTB, so there was an increase in extramural trial participation during the timeframe of this evaluation; however, it is unclear as to whether the VTB is a major factor in the accrual increase.

DISCUSSION

Multidisciplinary tumor conferences are believed to promote collaborative cancer treatment planning. The goal of the UNC VTB program is to provide access to multidisciplinary tumor boards for physicians from across North Carolina who might not otherwise have access to such a venue, regardless of whether they are affiliated with UNC. Despite this broad reaching goal, however, participation by community-based clinicians has been sporadic. Although the timing of the VTB was a commonly-cited barrier to participation, our evaluation uncovered another underlying theme—the benefit of participating in the VTB must clearly outweigh the opportunity cost of participating (i.e., time) for community-based presenters in order to increase participation. Community-based clinicians have hectic schedules and no financial incentive for presenting at the VTB; therefore, they must perceive that the value added is worth their investment of time and energy as participants.

To increase participation and enhance the value of the VTB program, feedback from both UNC and community physicians included the following recommendations:

1. Raising awareness among community-based clinicians and patients who could benefit most from the VTB
2. Re-orienting the mechanism for participation from centralized, hospital-based venues to individual doctors who could participate from their offices via laptop
3. Optimizing scheduling processes to minimize preparation time and enable community-based providers access to consultations in a timely manner
4. Streamlining the radiology and pathology review processes to reduce the burden on individuals at UNC responsible for reviews and to help ensure reviews are completed in time for the VTB presentation
5. Scheduling a UNC faculty member(s) with specialized expertise to participate via videoconference in tumor boards administered by community-based hospitals that may not otherwise have that specialized expertise.

These recommendations illustrate the influence that structure and process can have on effectiveness of the VTB. Given that the culture and priorities of tumor boards may vary across institutions and cancer specialties, so may the goals of a VTB. For example, we observed faculty in one tumor board highlighting the venue as a learning opportunity for residents/fellows, as compared to other tumor boards which were used almost exclusively for optimizing patient care. Therefore, it seems important for each VTB to undergo a specific planning effort to identify goals for the VTB and formalize a structure and processes to support these goals. Finally, each tumor board needs to identify the clinicians who could benefit most from the VTB and ensure they are aware of the program. This is a challenge because perceived value of a VTB may vary among clinicians practicing in the same geographic area or even within the same organization, based on such factors as previous experience with tumor boards and the availability of specialized tumor boards in their own institution.

This study had some limitations. First, because the program is still in the early stages and participation by community-based presenters has been sporadic, participants' perceptions of the VTB may still be evolving. A second and related limitation is that our study focused on a VTB program housed within one institution; therefore, the findings may not be generalizable to all VTB programs in other institutions. Nevertheless, this evaluation provides insight into an early phase of such a program that could inform program planning and improvement of similar programs. Third, qualitative research involves interpretation of data that may be viewed as subjective. However, we mitigated this subjectivity through recommended qualitative tactics. For example, we employed experienced interviewers using an interview guide, audio-recorded and transcribed interview data, coded data by multiple individuals using a common codebook, and collected multiple sources of data to enhance the validity of findings.

CONCLUSIONS

The statewide UNC VTB program is intended to improve the quality of cancer care in North Carolina by providing multidisciplinary consultative assistance to community-based providers. However, it has faced several implementation challenges, including lower-than-desired utilization of the program by community-based clinicians. This evaluation revealed that those who have presented at the VTB found the experience useful and believe there is value in the service, while those who have not participated cite substantial barriers (e.g., timing, lack of reimbursement). Future research on similar VTB programs is needed to address barriers to participation and to identify structures and processes that increase the impact of the VTB on care processes and, ultimately, patient outcomes. Identifying appropriate measures of impact on treatment decisions, as well as on outcomes for patients who are presented at the VTB, will be an important aspect of future research. Some possible outcomes include patient satisfaction with choice of treatment regimen(s); patient perception of informed medical decision making; receipt of guideline concordant treatment; patient quality of life; and clinical outcomes such as morbidity, mortality, and recurrence. Consistent with the movement toward patient centered outcomes research, soliciting patient input (e.g., via interviews) about outcomes most important to them could be a useful next step.

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Table I

Data Collection Methods

Method	Overview	Collection Period	Number of Participants
Observations of VTB case presentations	Used a structured form and unstructured notes to capture data on the nature of the case presented and the quality of discussion.	August 2011–March 2012	14
Interviews of: **1** UNC physicians participating in VTB **2** Community clinicians presenting at VTB **3** Community clinicians and staff with access to VTB equipment but who have not participated in the VTB	Conducted 30-minute phone and in-person interviews using a semi-structured interview guide.	September 2011–October 2012	28 (16 UNC, 12 community-based)
Survey of UNC tumor board attendees (physician and clinical staff) who have participated in a VTB case*	Distributed one-page survey with questions based on themes and recommendations emerging from the interviews.	October 2012	32

*Breast, gastroenterology, and malignant hematology. Head and Neck tumor board participants were not surveyed because they are not currently participating in the VTB program.

Table II

Coding of Interview Data

Code Name	Frequency of code in the interview data	Code Definition and Illustrative Quotation
Program goals	21	Refers to a physician's ability to clearly state the goals and reasons for the VTB program. *"One of [the goals] is to continue to foster collegiality between community hematologist oncologists and university people. Our hope is for cooperation and not competition, and I think this allows us to kind of get to know your faculty and they get to know ours. And from a professional development point of view, I think that is important."* –Community-based physician
Structure and process	102	Refers to the operational issues involved with preparing for and participating in the VTB. Frequent topics included tasks and time required to prepare for VTB presentations and the nature of discussion during the VTBs. *"Every facility has their own speed to getting us the material. So, that sometimes takes a little time out of our -- it interferes with our workflow because we have to stop and get pieces to come through... So, we often will have to work up the tumors further to give the guys here, my clinicians, the information they need to treat the patient. So, our biggest challenge is the speed of getting the material and the, "Are we getting just the size, or are we getting some tissue we can work with?"* – UNC physician *"…if Mrs. Jones is going to be presented we have to have all the reports and probably multiple copies of CDs because I have to farm it out to different people. Then those different people have to get back to me or one of the other members of my breast imaging team to present it. There's nothing worse than all of a sudden at conference I see some other stuff on the PET scan but I haven't had anybody in the PET department review it." –UNC Physician*
Facilitators to participation	64	Refers to factors that enhance a physician's desire to attend as a UNC physician or present a case at the VTB as a community-based physician, such as educational experience and reinforced confidence in the patient's management plan. *"It's good for enrollment on studies because the outside docs don't know what studies we have available so it's a great way to publicize what we have, you know, they might not qualify for it now but if they relapse, then we have this available or we have this maintenance strategy available.*" –UNC physician
Barriers to participation	108	Refers to factors that do not enhance a physician's (UNC or community physician) desire to participate in the VTB program, such as operating model, technology issues, and time/budget constraints. *"…our model is different from the patient-hospital model. We're seeing patients pretty much all day. So unless I preventively block a slot, I'm usually not free at the times that you're having tumor boards."* –Community-based physician *"[T]here have been some really interesting, unique cases presented and I think sometimes people think that's set the bar pretty high, and I think they'll say to me I don't have any interesting cases. It's like it doesn't have to be interesting necessarily – just something that could spark up a conversation and some discussion and that kind of thing. But so I think that's why I think some people are just timid to go up there because they think their cases are not worth presenting."* – Community-based non-participant (staff member liaison to VTB program)
Treatment impact	22	Refers to when a physician speaks about the VTB program impact on their treatment decision. *"Generally, we come out of that conference with a recommendation on whether to proceed with some treatment and the second thing is whether this is a patient who would be good to go to UNC to be formally seen by the multidisciplinary groups."* – Community-based physician
Benefits to physicians	16	Refers to when physicians mention the benefits of participating in the VTB program, either for themselves, their colleagues, or the institution as a whole. *"The advantage of this approach [VTB] is that you get multiple specialists in at once… you have surgeons and medical oncologists and radiation oncologists [together]. You can hear different opinions and get a feel for what somebody might be missing or a different approach or a different thought."* –Community-based physician *"Well, I mean, certainly, the more experience you get with these complicated cases, I mean, that's always beneficial… any new case which presents its own unique set of twists and turns, and hearing what my colleagues have to say about it, and kind of where my stance is on it compared to what everyone else is thinking, I mean, that is valuable."*—UNC physician
Satisfaction	47	Refers to when a physician asserts excitement/no excitement for the program or mentions the perceived value/lack of value of the program or mentions the capability of the VTB program in a positive or negative way. *"We have taken positive steps for patient care based on the recommendation in each case that we've presented. It was a very positive experience and something I definitely want to take advantage of again."* –Community-based physician

Code Name	Frequency of code in the interview data	Code Definition and Illustrative Quotation
Program awareness	28	Refers to whether physicians mentioned knowing about the program or whether they had told colleagues about the program. *“I think the people who have been using it have been groups that have had experience using it and they continue to use it over and over again, repeat users. I’ve not seen a lot of newer users recently.”* –UNC physician
Recommendations	59	Refers to when a physician recommended or suggested ways to improve or enhance the VTB program. *“Probably the number one [thing] is you need advocates. You need somebody at the site who really cares. And it’s not enough for them to say they care. They really have to care. You’ve got to have somebody here who cares. It’s probably got to be one of the [community-based] clinicians. I think that’s probably number one. Because if you don’t have that, it’s going to be hard to make it happen.”* –Community-based physician *“If there were some marketing that patients were aware that this was available I could see potentially that somebody might say, “Well, why don’t you present my case at their tumor board?”* – Community-based, non-presenting physician

Table III

UNC Tumor Board Participant Survey Results

Survey Item	**Response Percentage[*] (n=32)**	
	Yes	**No**
In general, do you believe the external cases presented through the VTB are appropriate for multidisciplinary discussion?	97%	0%
For most VTB cases presented, is there sufficient patient information available for a productive discussion?	91%	3%
Do videoconferencing technology problems frequently disrupt the virtual case discussions?	9%	88%
Do you believe the VTB program can accommodate more cases than are currently being presented?	72%	3%
Do you believe the VTB case discussions focus appropriately on the issues raised by the presenting physician?	91%	3%
Do you believe that VTB case discussions reach consensus recommendations less frequently than regular UNC tumor board cases?	16%	66%
Do you believe the VTB program is a valuable method for discussing complex cases with community-based clinicians?	100%	0%
Do you believe the VTB program is a valuable method for increasing recruitment for clinical trials?	44%	16%
Do you believe the VTB program is an effective use of UNC resources?	91%	3%

Recommendations for VTB Program Improvement[**]	**Response Percentage[*]**
Marketing campaign to increase VTB participation among community-based clinicians	59%
Streamlining pathology and radiology review to ensure availability for VTB discussion	44%
Communicating clear VTB presentation guidelines for participants to follow	31%
Routinely collecting feedback about the VTB from community-based clinicians and communicating it to UNC participants	28%
Ensuring adequate representation of UNC expertise during VTB (e.g., surgical, transplant, or other specialists who are not regular tumor board attendees)	19%

[*] Percentages will not add to 100% if “Don’t Know” was selected or if respondent left item blank

[**] Respondents were asked to identify the top two highest impact recommendations