



*A hub-and-spoke  
model for rural  
North Carolina*

# A Prospective Peer Review Model for Radiation Therapy

## COMMUNITY HOSPITALS OFTEN LACK THE RESOURCES

of larger cancer programs, and not simply because of size alone.

The Outer Banks Hospital is a 21-bed, critical access, rural, community hospital that is part of a cooperative group of health-care providers from eastern North Carolina. The cooperative's mission is to improve the health and well-being of the region's residents by leveraging shared resources and common approaches to care delivery. Specific to oncology, this network aims to ensure that the quality of services provided at each facility mirrors a proven standard of excellence. For The Outer Banks Hospital, participation in this cooperative has brought cancer services to the forefront of its operation.

Located on a barrier island off the Atlantic Ocean, The Outer Banks Hospital has a patient demographic that is somewhat typical for a rural community provider. Through recent Commission on Cancer (CoC) accreditation and the eastern North Carolina cooperative's partnerships with other cancer programs at the tertiary cancer care level, the hospital offers cutting-edge treatment options for its cancer patients. Further, by tapping into centrally located shared resources, this rural community provider has achieved metrics that are usually only seen in much larger cancer programs. Peer-to-peer quality review of radiation therapy is one example of these metrics. It's a model that the authors believe can be replicated by other small facilities.

In the ideal world, a provider's radiotherapy treatment planning and treatment recommendations are reviewed by a peer who also works in the field of radiation therapy—a process called peer-to-peer review.

## Radiation Treatment in the Community Setting

Radiation therapy is complex both in planning and in delivery. While radiation therapy guidelines and standards exist for each, unless an accreditation process is adopted by the hospital or clinic, these are not always followed consistently. This is particularly evident in the process of radiation therapy planning and peer review. For an example, as part of its accreditation process, the American College of Radiation Oncology (ACRO) has developed basic guidelines,<sup>1</sup> as have other organizations, such as the American College of Radiology (ACR) and the American Society for Radiation Oncology (ASTRO). While these guidelines include many

The Outer Banks Hospital is a critical access 21-bed hospital in eastern North Carolina.



elements of the radiation therapy process—from the initial evaluation stages, to treatment design and planning, to delivery of radiation—the guidelines are recommendations only and truly represent only a minimal standard. For instance, ACRO’s current guidelines call for approximately 10 percent of curative cases to be peer reviewed; however, the timing for peer review is not often specified. One annual review is the usual recommendation for most programs dedicated to some type of quality reporting. Many cancer programs take this to mean that a quality review should include only 10 percent of all representative cases, and these are often examined retrospectively at the end of a calendar year.<sup>1</sup>

As a provider of radiation therapy services locally, The Outer Banks Hospital believes that meeting standards that are based on evidence-based guidelines is important. In addition, the hospital has taken an extra step to improve the quality of its services by helping to develop a hub-and-spoke (wheel) model of healthcare delivery that allows rural providers to partner with East Carolina University. Currently, five community clinics (the spokes of the wheel) participate, partnering with a centrally located tertiary cancer provider (the hub), the Leo Jenkins Cancer Center at East Carolina University in Greenville, N.C. This model allows sharing of resources, including medical expertise, and helps facilitate standardization of cancer services across the region.

The Outer Banks Hospital leveraged this hub-and-spoke model to implement a peer review process for radiation oncology providers.

### Peer Review in Radiation Oncology

In the ideal world, a provider’s radiotherapy treatment planning and treatment recommendations are reviewed by a peer who also

works in the field of radiation therapy—a process called peer-to-peer review. As with multidisciplinary tumor boards, input from multiple providers is most helpful prospectively, before the patient begins treatment. Unfortunately, peer-to-peer review in radiation therapy is not done as commonly as most cancer programs would like, due to lack of resources, other available physicians, or consensus on the need for the peer review. The average rural clinic providing radiotherapy typically employs only one radiation oncologist, making peer review challenging and often reserved for complex cases. Thus, it is an area ripe for improvement in quality measures and dovetails with the hub-and-spoke model for shared resources.

For cancer programs looking to develop and implement a radiation oncology peer-to-peer review process, some common questions to consider include:

- Should peer review be done before treatments begin if the process creates further delay in starting therapy?
- Is it appropriate to review cases once treatment has started if the review is done early on?
- Are retrospective audits by peers considered acceptable if it is too late to make any changes based on the review findings?
- Do more complex treatments, such as stereotactic radiation, require more intense review by peers?

These questions are starting to evolve into recommendations, especially as the complexity of radiation treatment grows. At present, how often peer review is done (and to what degree) varies tremendously among cancer programs and is often related to the accreditation process, the expectations of the individual physician, and the availability of the necessary resources (see box, right).

## Getting Started: A Pilot Program

In 2014 The Outer Banks Hospital and four other community cancer programs piloted a robust peer-to-peer review process for all patients undergoing radiation therapy in the region by partnering with East Carolina University.

Although peer review tends to be more robust at tertiary programs, the degree of radiation oncology peer review at East Carolina University is exceptional by most standards. The university's process involves a prospective review of *all* cases considered curative patients receiving radiation therapy and often includes complex palliative cases as well. The peer review is done collegially among fellow radiation oncologists and provides input regarding the various components of care, including doses, treatment volumes, and other important metrics. As mentioned previously, prospective peer review, similar to a multidisciplinary tumor board, provides the optimal benefit to patients by having these discussions up front.

Eleanor Harris, MD, professor and chair of radiation oncology at East Carolina University, pioneered using the hub-and-spoke model to oversee a peer review process centrally located at both East Carolina University and the Leo Jenkins Cancer Center. Dr. Harris describes the overall objective of this process:

*“Our goal is to prospectively review 95 percent of curative cases at all facilities that participate, which is well above the societal standard. Furthermore, the aim is to peer review more than 95 percent of eligible radiation treatment patients, prospectively evaluating quality metrics by the peer group with the goal of decreasing minor and major change scores to improve the quality of radiation treatment plans delivered regionally throughout the Vidant Health network and the Leo Jenkins Cancer Center.”*

Dr. Harris is a huge proponent of peer review, not only because it allows a formal process to control and monitor quality within community cancer programs, but also because it also supports improved care coordination for patients being treated at different facilities. Using the hub-and-spoke model to support the peer review process helps promote some level of care standardization, which is in keeping with evidence-based medicine.

This process was adopted initially as a quality program for standardizing peer-to-peer review in the radiation oncology community cooperative network (and internally within the tertiary cancer center) with the hopes of identifying specific needs and providing help with solutions for community solo practitioners in radiation oncology. Moreover, the peer review process provides a standard of care throughout the region that is in keeping with many other healthcare organizations that seek to minimize variability and disparities in healthcare delivery.

## Putting the Team Together

The formation of a peer-to-peer quality team was the first step. The team consisted of providers from the university-based cancer center (the “hub”) where the most complicated cases are often seen and treated, and providers from the five affiliated community cancer programs that treat patients with radiation therapy (the “spokes”). Team members from East Carolina University included:

- 4 radiation oncologists
- 2 radiation therapists
- 4 medical physicists
- 3 dosimetrists
- Other quality personnel with a focus on the clinical management of patients.

Within the eastern North Carolina cooperative, five community clinics (with plans to potentially expand to others) are staffed with a single radiation oncologist at each site:

- The Outer Banks Hospital Radiation Therapy
- Roanoke Chowan (Ahoskie) Radiation Therapy
- Beaufort Radiation Therapy
- Onslow Radiation Oncology
- Vidant Radiation Oncology (Greenville).

These rural providers are centrally managed as part of Vidant Health System.

All physicians participating in the peer review process, whether university-based specialists or community-based generalists, were fully engaged at each phase of development and implementation of the peer review process, including its design and metrics.

**O**ne recent review of more than 5,000 radiotherapy physicians (with a sampling participation rate of only 10 percent, or 572 physicians) revealed that 65 percent of radiation oncology physicians currently use some sort of (minimal) peer review process, with even fewer reviews occurring before treatment begins.<sup>2</sup> Yet, 90 percent of physicians reported changing radiation plans because of the peer review.<sup>2</sup> At most institutions, the rate of significant alteration in treatment plans following peer review was roughly 7 to 10 percent of cases.<sup>2</sup> Most peer review was done early in the treatment process: 83 percent of physicians reported peer review was done within the first week that treatment started.<sup>2</sup> Some facilities clearly do this review prospectively before treatment—65 percent reported performing some prospective peer review, but it was not clear which patient cases were being reviewed and what percentage of patients were reviewed.<sup>2</sup> When all variables are considered together, the study authors concluded that only about one-third of patients who should be considered for this quality peer review process actually had prospective peer review of their radiation treatments.<sup>2</sup>

Robin Hearne, director of cancer services (standing), helped make this peer review model a part of The Outer Bank Hospital's 2014 quality improvement efforts.



All physicians were encouraged from the beginning of the project to provide peer-to-peer review to their colleagues, and not to allow a system in which the “ivory tower” disease specialists were providing their opinions in a unilateral manner. Rather, the input from the specialized academic physicians and the community physicians was viewed as equally valuable in the peer review process, and evidence-based guidelines were emphasized by all participants.

### Developing a Process

The peer-to-peer review program started as a weekly conference using *WebEx*, a Citrix-based video and phone-based program. Community providers could request a time and day to log on to prospectively review with providers at the university. Times were assigned based on availability, with generally a lag of no more than one day for presentation of cases. Reviews were scheduled quickly to minimize delays in the start of treatments. Eventually, this process was changed to a regular Monday, Wednesday, Friday (MWF) schedule and held from 8:00 to 9:00 AM. All participating clinicians are invited; a central scheduler at East Carolina University assigns cases based on the requesting number of patient cases and centers. In a typical week, between 20 to 30 cases are presented for peer review.

The first goal of the peer review program: implementation of the telemedicine platform, with discussion of all eligible cases prospectively. The second goal: establishment of a baseline score for each facility to be able to measure the effect of peer review. For the first six months, all patients were prospectively presented and tabulated using the metrics described below.

### Step 1. Design & Measure the Metrics

To implement and test the feasibility of the peer review program, the following actions were taken:

- Measure the baseline of quality metrics that were identified by participating clinicians as important in radiation planning. These metrics include more than just radiation dose and overall strategy; they include many more elements that are key to the planning process (see a list of metrics below).
- Score these metrics for each radiation facility (N = 5) and by provider (N = 8) for each case.
- Evaluate improvement twice yearly by individual physician (or by hospital) quality metrics as scored prospectively by the peer group.
- Present all major changes in a treatment plan again *before* the patient begins treatment, thereby reducing the incidence of treatment plans that may not have initially met evidence-based guidelines.
- Compare aggregate data annually to prior years for the physician group, as well as individual current and new physicians.

Twenty-five metrics were tracked for radiation treatment planning, including:

- Gross target volume (GTV)
- Clinical target volume (CTV)
- Planning target volume (PTV)
- Nodal volume (CTV-N)
- Organ at risk volume (OAR)
- Total dose
- Dose/Fraction

- PTV Dose Constraints
- OAR Dose Constraints
- Plan quality-dose volume histogram
- Use of RTOG or other evidence-based guidelines.

Other metrics tracked include TNM staging, tumor markers (e.g., for breast ER+, PR+, Her2neu, IDH1 and MGMT for brain, HPV for head and neck, margins status for postop cases), histology, grade, use of image fusion for contouring (e.g., MRI or PET), use of image guidance (IGRT), and use of other modalities (e.g., sensitizers of radiation, concurrent or adjuvant chemotherapy).

Metrics were graded using the following scheme for each eligible case presented at each facility and were scored by the quality team at East Carolina University:

- Grade 1: No change recommended.
- Grade 2: Minor change recommended.
- Grade 3: Major change recommended.
- Grade 4: Referred to chair at East Carolina University.

Minor changes (grade 2) included subtle differences in dose recommendations or otherwise insignificant changes that affect planning or treatment (e.g., addition of hormone therapy in prostate cancer).

Major changes (grade 3) included re-contouring to include or exclude anatomy, and/or major deviations in dose planning based on agreed dose objective and constraints not being achieved up front. All major changes had to be planned again and presented again to the peer review group before treatment could start.

...Peer review was successful at reducing variation within the planning process for various practitioners, and indeed most practitioners were performing at a similar level based on these metrics after one to two years.

A weighted average of all scores was then assigned to each case for each provider (physician). A weighted average of 1 is when no changes were recommended. The quality team at East Carolina tracked these data in an Excel spreadsheet, which was *(continued on page 30)*

**Table 1. Comparison of Baseline Score and Year One Data**

	JUNE-DEC 2014			JUNE-DEC 2015		
	n=283			n=352		
	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 2	LEVEL 3	LEVEL 4
<b>PEER CRITERIA</b>						
Target Volume (GTV)	4	1		2	2	
Nodal Volume	6	3		5	2	
Image Fusion						
CTV/PTV Volume	7	1		2	1	
OAR Volume				2		
RX-Total Dose	10	2		6		
Rx-Dose/Fraction	2					
PTV Dose Constraints	5	1		2		
OAR Dose Constraints	7	3		4	1	
Plan Quality	3	1		2	1	
<b>TOTAL</b>	44	12	0	25	7	0
Percent of Total	15.55%	4.24%		7.10%	1.99%	

The Radiation Therapy Clinic at The Outer Banks Hospital services a typical rural population with only one (solo) radiation oncologist.



*(continued from page 29)*

scored prospectively at the time of the peer review meeting. All data were collected and reviewed semi-annually. At the time of this article, the prospective peer-to-peer review process has been in place for three years.

### **Step 2. Perform a Collective Baseline Measure at All Participating Sites**

All participating sites tracked and scored six months of data to establish a baseline score before implementing any changes in peer-to-peer review. For this initial six-month period, minor changes were recommended based on discussions from the peer-to-peer review process in 15.55 percent of cases (n=44/283), and major changes in 4.24 percent of cases (n=12/283).

### **Step 3. Interval Reporting & Performance Improvement**

After six months, the quality team at East Carolina University evaluated the peer review program with feedback from community providers. Changes were made as to what cases were eligible for peer review. For example, in clinics with new physicians, all cases (i.e., palliative and curative intent) were initially eligible for peer review, but after a period of central review, only curative cases were believed in need of prospective review.

In addition, all participating providers felt it was helpful in the planning process to have templates for each site that included parameters of dose recommendations, dose prescriptions, dose constraints, etc. As an example, for prostate cancer treatments, task groups created site-specific templates to define a unified set of criteria for intact prostate irradiation (with conventional fractionation), as well as templates for postoperative radiation for prostate fossa treatments. Similar templates were built for altered fractionations (e.g., SBRT) and for all other common sites treated with radiotherapy. These templates are reviewed annually and updated based on new RTOG data and other evidence-based guidelines. All data continue to be tracked by site and by physician,

with individual feedback provided periodically as needed.

Results one year after implementation of peer-to-peer review:<sup>3</sup>

- Minor changes (level 2) in the prospective treatment plans dropped from 15.55 percent to 7.10 percent (p = 0.001)
- Major changes (level 3) similarly declined from 4.24 percent to 1.99 percent.
- There were no level 4 changes.

These data are summarized in Table 1, page 29.

### **Overall Results**

Alterations in the planning for radiation treatments decreased at all facilities as the peer-to-peer review process was used more frequently. Overall, major and minor changes have decreased as shown in Table 1, page 29.

Aggregate scores for physicians also normalized over time (from 1.150 to 1.005 in the first two years), suggesting a learning curve for the peer-to-peer review process. In other words, peer review was successful at reducing variation within the planning process for various practitioners, and indeed most practitioners were performing at a similar level based on these metrics after one to two years.

All cancer programs benefitted from the prospective peer-to-peer review process, with some benefitting more than others. Not only did the changes drop over time, but treatments became more standardized, which was an original goal of the program. To move the peer-to-peer review program forward, participating sites identified physician champions who were tasked to participate in the quality management of the program.

In addition, more providers bought into the program over time as they understood the convenience and ease of the peer review process and became more comfortable with it. Physicians began using the conference time to pre-review cases with their colleagues, which was likely another major contributing factor to overall improvement in the quality of treatment plans.

*(continued on page 32)*

Figure 1. Aggregate Scores for Physician Average Comparison

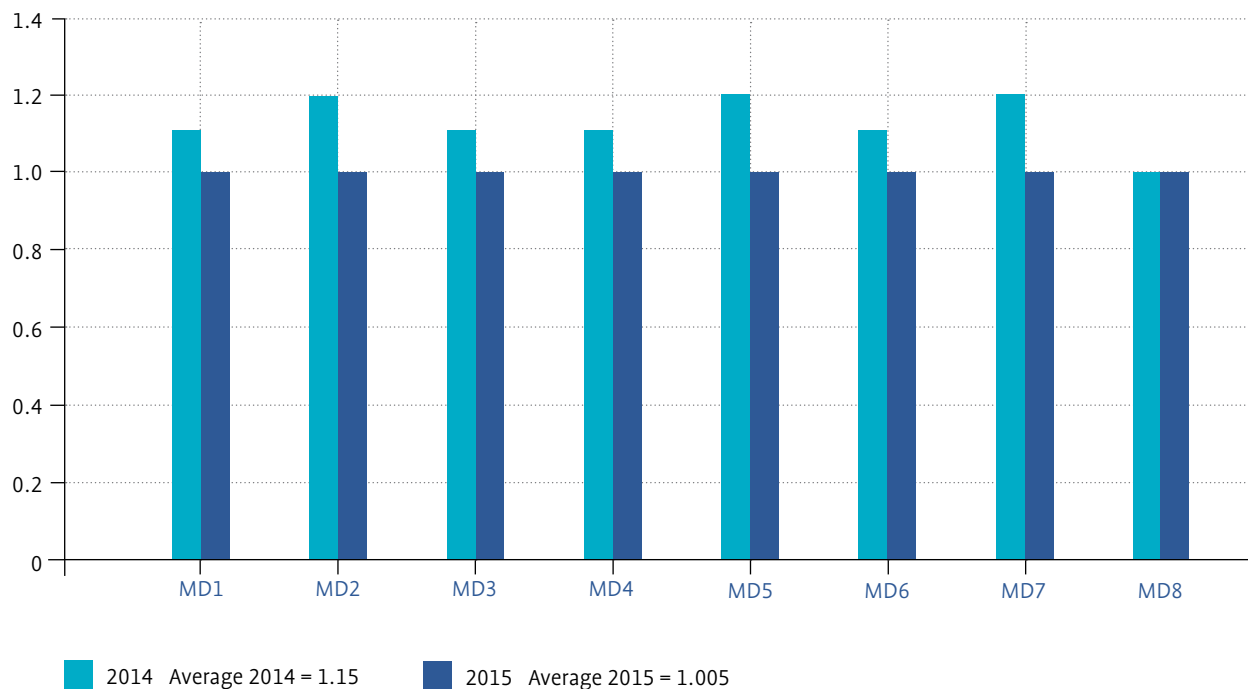
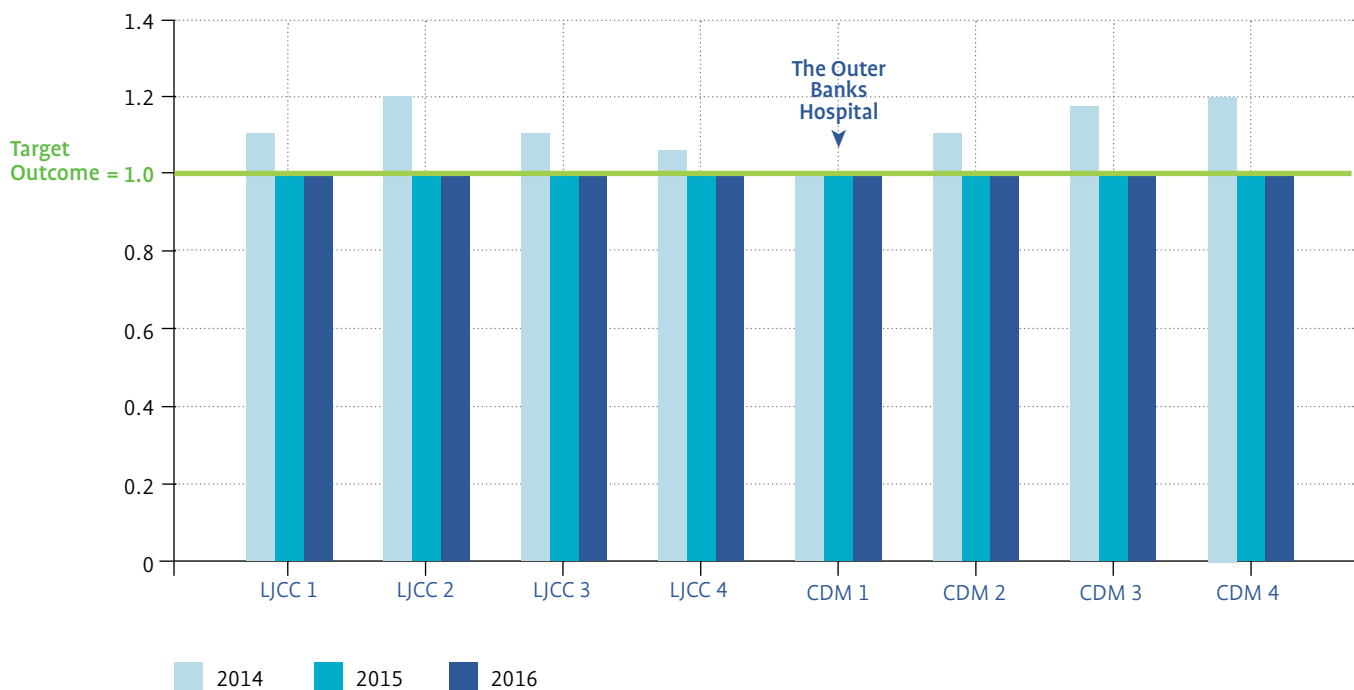


Figure 2. Results by Hospital (Academic versus Community)





**Table 2. Current Template Used for Peer-to-Peer Review**

<b>PEER-TO-PEER CASE REVIEW</b>	
<b>Physician</b>	
	Patient name
	Gender
	Inpatient vs. outpatient
	Disease diagnosis/histology
	Site being treated (with laterality when appropriate)
	Additional clinical background, HPI
	Intent of treatment (curative, adjuvant, neoadjuvant, palliative)
	Disease TNM stage (clinical and/or pathologic)
	AJCC stage grouping
	Molecular markers (when appropriate)
	Any use of concurrent chemotherapy, hormonal therapy, or other systemic agent
	Treatment modality (3D, IMRT, VMAT, SBRT, etc.)
	Motion management (ITV, IGRT, none, not applicable)
	Overview of the targets contoured (GTV, CTVs, expansion to PTV) (include who contoured which volumes)
	Prescription dose(s) and fractionation
	Review of image guidance modality
<b>Dosimetry Preparation</b>	
	Axials with treatment volumes +/- critical structures
	Fusions, if applicable
	Fields (3D)
	Axials with Isodose
	DVH (address any dose constraints not met)
	Any additional comments, discussion regarding the plan

*(continued from page 30)*

Aggregate scores by physician (first two years of the program) are found in Figure 1, page 31; aggregate scores by hospital (for the five unique facilities) are found in Figure 2, page 31. Note the normalization of these metrics over time because of the peer-to-peer review process.

All curative cases (95 percent or more) were presented prospectively, as was the initial goal. The only cases not presented typically were palliative cases, although in some cases where

critical decision-making was required (e.g., retreatment), these were also presented prospectively.

#### **Step 4. Process Improvement & Program Continuation**

To streamline the peer-to-peer review process, participating facilities invested in and implemented a cloud-based IT system in addition

*(continued on page 34)*

Figure 3. Example of a Dose Objectives Worksheet

DOSE OBJECTIVES WORKSHEET							
<b>Protocol:</b> Prostate Post-op				<b>Attending:</b> Physicians			
PLAN IDENTIFICATION							
Patient Name:				Plan Name:			
MRN:				Plan Label:			
Date of Birth:				Plan Date/Time:			
Plan Site:				Plan Rx (cGy):			
TPS Name:				TPS Version:			
PRESCRIPTION							
Target Volumes	Doses (cGy)	%V	#Fx	Dose / Fx	Plan Structure	Max Dose	% V @ Rx
PTV70	7000	95.0%	35	200			
PTV70 93% Rx	6510	99.0%	35	186			
<b>Notes:</b> Used for Rx from 66–70 Gy							
PLAN CONSTRAINTS							
Priority	Structure	Plan Structure	Type	Limits		Plan Value	Result
				Dose, cGy	Volume		
	Rectum		CC	7500	5		
	Rectum		%V	7000	10.0%		
	Rectum		%V	6500	20.0%		
	Rectum		%V	6000	35.0%		
	Rectum		%V	4000	55.0%		
	Bladder-CTV		%V	7500	25.0%		
	Bladder-CTV		%V	7000	35.0%		
	Bladder-CTV		%V	6500	50.0%		
	Bladder-CTV		%V	4000	70.0%		
	Femoral Heads		%V	5000	10.0%		
	Femoral Heads		MAX	5500			
	Small Bowel		CC	6000	1		
	Bowel		CC	4500	100		
	Penile bulb		MEAN	5000			
<b>Notes:</b>							
DOSE DISTRIBUTION CHARACTERISTICS							
Rx (cGy)	PTV structure	Conformity Index		Gradient Index		Maximum Dose	

(continued from page 32)

to utilizing custom *WebEx* and telemedicine approaches. In this way, real-time viewing of workstations and treatment planning images could be reviewed by all physicians.

To meet the goal of 95 percent of all eligible cases being reviewed prospectively, the peer review adheres to a regular schedule. One community provider is assigned a time on Monday at 8:00 AM; another on Wednesday at 8:00 AM; another on Friday at 8:00 AM; a fourth on Monday at 8:20 AM; and so on; based on a rotation. All providers are encouraged to participate on all days, time permitting. If a provider did not present a case for peer review, the treatment was held until at least an off-line review could be done formally with one of the reviewers at East Carolina University or the case could be presented by another colleague familiar with the treatment plan.

---

**Partnering radiation therapy providers at small community hospitals with a respected tertiary care facility—in an easy-to-access way—demonstrated that a process of quality review can work at the community level.**

---


More recently, a form in tabular format was developed and made available to presenters that includes the metrics identified as important to peer reviewers so that the scorer does not have to solicit this information for each case on his or her own. The current template used for peer-to-peer review, with listed elements for each presenter to reference during all prospective discussions, is shown in Table 2, page 32. Each element is discussed, scored, and tracked. Figure 3, page 33, provides an example of one of the dose objective worksheets for a site (prostate cancer [post-op XRT]).

### **Summary of the Peer-to-Peer Review Program**

Partnering radiation therapy providers at small community hospitals with a respected tertiary care facility—in an easy-to-access way—demonstrated that a process of quality review can work at the community level. Prospective peer-to-peer review not only helps individual radiation oncologists during the critical phase of radiation therapy planning; it also facilitates discussion with experts in the field who are able to make suggestions regarding use of evidence-based guidelines, thereby improving adherence to certain standards (e.g., NCCN guidelines, RTOG guidelines). Without this peer-to-peer cooperative effort, community programs would be challenged to meet these metrics at such a high standard. Currently, all eligible cases are being prospectively presented and reviewed, which has had a positive influence in the quality of radiation therapy treatments offered in rural and smaller communities.

In the first year of peer-to-peer review, participants saw a 50 percent reduction in major and minor changes in radiation therapy that resulted from another physician review. The normalization of all providers at all clinics over the first two years suggests that the process of standardizing treatments helps equalize the quality of care between facilities and among all physicians. While this is no guarantee that the outcomes will be the same, by adhering to evidence-based guidelines and incorporating guidelines into the peer review process, participating sites are minimizing disparities in treatments for rural communities as much as possible.

The Outer Banks Hospital believes peer-to-peer review will translate into meaningful benefits for its patients long-term as well, and the hospital is proposing a similar peer-to-peer review process for outcomes such as survival and morbidity from treatments in the future.

Today, 100 percent of curative cases undergo this prospective, robust peer-to-peer review process using the hub-and-spoke model described in this article. The Outer Banks Hospital recommends other facilities consider adopting a similar quality improvement effort in radiation therapy departments with limited resources. The authors believe that this process is particularly robust for prospective radiation therapy planning that involves conventional fractionation. Further, the authors believe that such peer review is critical in facilities offering stereotactic radiation (e.g., CyberKnife, SBRT) or other altered fractionation regimens that consist of significantly higher doses of radiation and more complex planning techniques with a potential for adverse outcomes if quality measures are lacking, recommending prospective peer-to-peer review in all cases. 

*Eleanor Harris, MD, is chair of Radiation Oncology at Eastern Carolina University/Leo Jenkins Cancer Center, Greenville, N.C. Robin Hearne, MS, RN, is director of cancer services and Charles Shelton, MD, is chair of the Cancer Committee and solo radiation oncologist at The Outer Banks Hospital, Nags Head, N.C.*

### **References**

1. ACRO. Manual for ACRO Accreditation, March 2016 update. Available online at: [acro.org/wp-content/uploads/2016/05/ACRO-AccreditationManual.pdf](http://acro.org/wp-content/uploads/2016/05/ACRO-AccreditationManual.pdf).
2. Hoopes DJ, et al. Practice patterns for peer review in radiation oncology. *Pract Radiation Oncol.* 2015;5(1):32-38.
3. Data collected by Eleanor Harris, MD, Chair at Leo Jenkins Cancer Center/ECU, and presented at quality forum in 2017.