

# A Small, Island Community Hospital Removes Barriers to Lung Cancer Screening and Detection



## Getting LDCT lung cancer screening to work within a network

The Outer Banks Hospital is a 21-bed critical access community hospital uniquely situated on a barrier island on the coast of North Carolina. A not-for-profit hospital and joint venture between Chesapeake Regional Medical Center in adjoining Virginia and Vidant Medical Group in Greenville, N.C., it is one of several community hospitals in eastern North Carolina that serve a local population of roughly 30,000 year-round residents. Because of the location and climate, the area continues to grow, especially among retirement-age people. Like many other communities across the country, the Outer Banks sees its fair share of lung cancer, and in most cases, patients present at later stages when therapies are less likely to have a curative effect. This can be daunting to both patients and their healthcare providers.

### Our Call to Action

In 2014, The Outer Banks Hospital decided to make cancer care a high priority, hiring a nurse administrator, Robin Hearne, to coordinate services at the hospital. Hearne embraced the challenge, and her first order of business was to create a Cancer Committee. The newly formed group conducted a review of the cancer types diagnosed or treated at the hospital, identifying lung cancer consistently as one of the top cancers in prevalence locally by site. Further analysis of the local registry data revealed a high preponderance of advanced stages among local lung cancers over the prior two years (95 percent presented as stages III/IV in 2013 and 88 percent as stages III/IV in 2014), which perhaps reflected a lack of thoracic services (Figure 1, page 71). In a hospital that is typical of a small community setting, patients are typically

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referred elsewhere for primary evaluation and diagnosis, and by the nature of the referral process they are usually scored in other tumor registries if early stage, where local therapy is also typically done and completed (e.g., a lobectomy). Nonsurgical patients (e.g., advanced stage patients who require services such as radiation and chemotherapy that *are* available locally) are then typically referred back to the community, creating some bias in staging for a community that treats lung cancers. Although this was a source of stage migration and potential bias, our Cancer Committee believed that analysis of the demographic data in our community highlighted a clear need to change the patterns of care for this disease. Accordingly, the Cancer Committee looked at the development and implementation of a low-dose computed tomography (LDCT) lung cancer screening program.

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The Outer Banks Hospital is remotely located on a barrier island.



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### Getting Started

Because of its size and remote location, The Outer Banks Hospital does not possess the resources to support either a pulmonologist or a thoracic surgeon. The hospital typically sees 20 to 25 cases of lung cancer per year, and the majority are diagnosed outside the area for this reason. They are often late in presentation for this reason, and perhaps this accounts for some of the later stages. Therefore, in order to build an effective screening (and diagnostic) process, the hospital decided to partner with a larger thoracic

program that had produced quality outcomes in the region for lung cancer, and Vidant Cancer Care nicely fit that bill.

Vidant Cancer Care is a Commission on Cancer-accredited comprehensive community cancer program in Greenville, N.C., that enjoys a great model for thoracic services. A tertiary care center that includes East Carolina University and Vidant Medical Group, Vidant Cancer Care is a center for excellence in lung cancer, which is its most common cancer by site in eastern North Carolina. Because The Outer Banks Hospital is part of a corporate network with Vidant Health, we used a hub-and-spoke wheel model that leveraged shared resources centrally in Greenville. Mark Bowling, MD, head of the pulmonary team at Vidant Cancer Care and champion of its low-dose CT program, agreed to help pilot the program at The Outer Banks Hospital beginning in December 2014. With Donna Delfera, the nurse navigator for the thoracic program at The Outer Banks Hospital, partnering with Dr. Bowling and his team at a larger center with all available and necessary services, this program goal was easily achievable.

### Committing Hospital Resources

The Outer Banks Hospital agreed to commit resources to address this identified issue with smoking-related cancers, which are more common in our region (Figure 2, page 72). The decision was an

easy one because it did not require additional capital expenditures. (The hospital already had an existing computed tomography [CT] scanner [64 Slice GE] for diagnostic radiology services.) Administration engaged the support of the hospital's development council to assist with uninsured or underinsured patients who qualified for LDCT scans. At the time we began this program, Medicare had not yet approved reimbursement of LDCT. Roger Lever, MD, a hospitalist at The Outer Banks Hospital and former chair of the Cancer Committee, was an early local champion for this program, as was Dr. Lysle Ailstock, a body radiologist with Eastern Radiologists. It was their idea—made possible by support from the radiology department—to implement a pilot LDCT lung cancer screening program in this small community hospital.

Critical to the pilot program's success was Donna Delfera, RN, who was assigned as the site-specific nurse navigator for lung cancer, as well as for coordinating the LDCT screening pilot with Vidant Cancer Care. She coordinated every patient case and tracked them in a database. She reported back to the primary ordering physician all cases requiring follow-up based on significant or abnormal results (Lung-RADS category 3 and Lung-RADS category 4). The primary care physician then directed the workup and care efficiently, and patients were referred for surgical or further radiological evaluation as indicated. A "pulmonary nodule" clinic at Vidant Cancer Care in Greenville (2.5-hour drive) helped to facilitate efficient evaluation of these patients, as did access to a pulmonologist in adjoining Virginia. The LDCT lung cancer pilot was overseen with periodic reviews by a physician on the Cancer Committee.

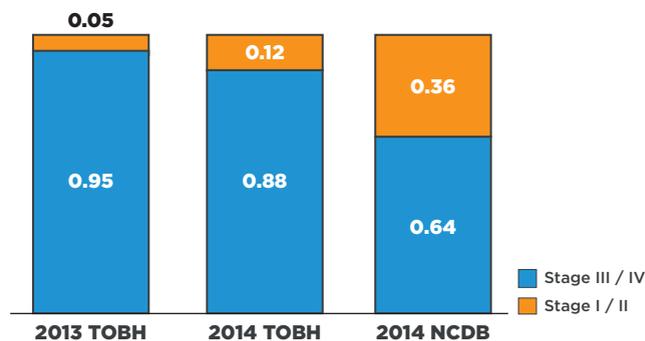
### Engaging Local Providers

To engage local providers, the Cancer Committee sent a delegate (Dr. Shelton) out into the community with the nurse navigator to discuss the LDCT screening program and encourage support. Meetings were typically short and held at lunchtime, and food was provided to encourage attendance. In total, The Outer Banks Hospital was able to engage five primary care groups that see most of the local patients considered at risk. The Outer Banks Hospital also provided an educational program with continuing medical education to local primary care providers. The expert speaker panel included a pulmonologist (Dr. Bowling), a thoracic oncologist from Vidant Cancer Care, and a thoracic surgeon who outlined potential patient and provider benefits of an LDCT screening program.

### Interim Analysis

The Outer Banks Hospital performed more than 350 LDCT scans in the first three years as part of the screening program, and it is by far still the leader in the network of local community hospitals. For a small community care facility that deals with a small volume of cancers (~115 analytical cases per year, all types combined), this success reflects local interest level in changing the patterns of care within the community and hitting high marks in quality metrics. Therefore, it was important for The Outer Banks Hospital to analyze data, report on outcome measures, and show how a

Figure 1. Lung Cancer Stage at Presentation



TOBH = The Outer Banks Hospital.

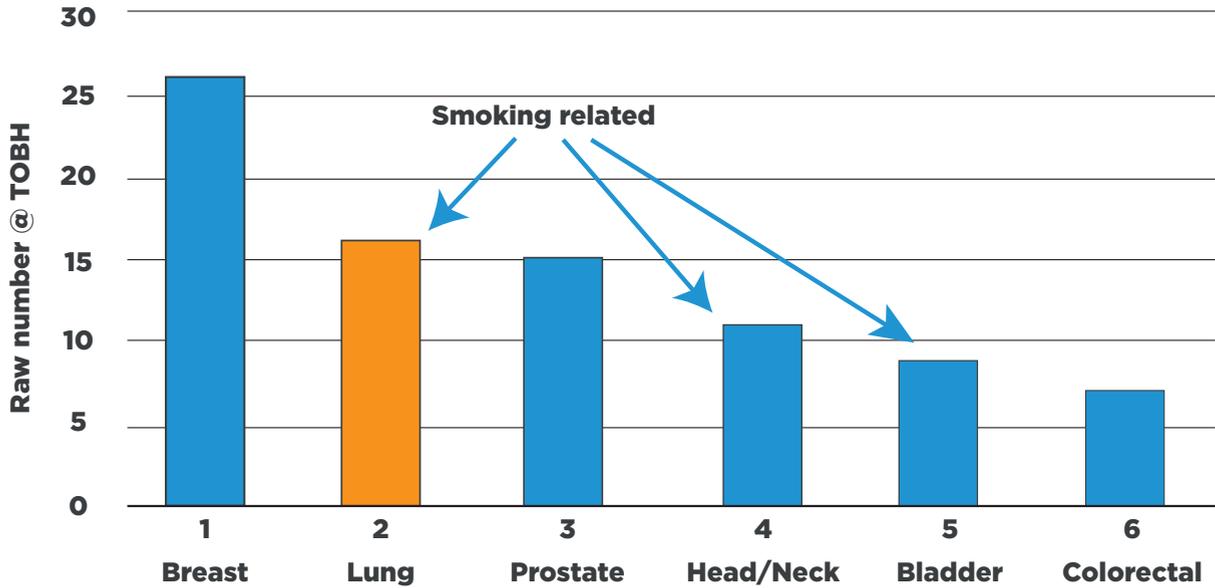
small change in a rural hospital program can successfully translate into meaningful outcomes for the local population. To date the hospital has scanned more than 500 patients, with every case tracked in a lung cancer registry monitored by the American College of Radiology (ACR) since program inception.<sup>1</sup>

The first several cases were indicative of the final outcomes and highlighted the need for these services early on. Four patients were scanned in the first month of the program (December 2014), with two being read as Lung-RADS category 1 (lowest risk category) and two as Lung-RADS category 4 (the highest risk category). One of the two initial Lung-RADS category 4 patients was diagnosed with a small nodule that turned out to be a stage IA adenocarcinoma of the lung, treated surgically for cure in early 2015. The year-end data for 2014 therefore revealed four scans with one diagnosis of cancer, adding excitement to the program results early and highlighting its need.

One surprising result of the LDCT program was a high incidence of continued abnormal scans—much higher than expected after the first several years. For example, based on U.S. statistics provided by the American College of Radiology, the expected number of abnormal scans (Lung-RADS category 3 and 4) should have been 9 percent collectively based on national data<sup>2</sup> (5 percent for Lung-RADS category 3 and 4 percent for combined Lung-RADS category 4). The Outer Banks Hospital found combined rates of over 25 percent for these two groups spanning the first two years—much higher than the expected outcomes. Lung-RADS category 4, which is the highest risk group based on low-dose CT findings, includes subtypes 4A, 4B, and 4X—all of which were significantly higher in this community population as well.

More relevant, the detection rate of cancer in patients with abnormal Lung-RADS category 4 was markedly higher at The Outer Banks Hospital than elsewhere in the United States, again pointing to the idea that our LDCT program is likely being offered to a higher-risk population and that our process is quite efficient. One hundred percent of our Lung-RADS category 4X patients and 72 percent of our Lung-RADS category 4B patients had lung cancer diagnoses in the first year, which is extraordinarily high

Figure 2. Cancers in Our Region by Rank (Lung is Common)



TOBH = The Outer Banks Hospital.

by comparison to national ACR findings. (Expected results for screening population should be greater than 15 percent, but not to this large degree.)

For the pilot period analyzed, 11 lung cancers were detected in 10 patients. One patient had two cancers diagnosed a year apart (one was non-small cell carcinoma, and the other was small cell carcinoma). Six of these cancers diagnosed at The Outer Banks Hospital were stage IA (all adenocarcinomas), and five were stage IIIA. There were no patients with stage IV lung cancer detected by the LDCT screening program. According to Eastern Radiologists, which provided subspecialty interpretation of all images by fellowship-trained radiologists, these results supported a need to continue the LDCT program. Our cancer detection rate for this initial period (41.67 per 1,000) was significantly higher (eight times) than the national and regional average (5.44 per 1,000) according to ACR data<sup>1</sup> (Figure 3, page 73).

One challenge identified within our internal data review was scan compliance with recommended follow-up. For example, the ACR-recommended follow-up LDCT for a category 1 finding is one year. Sixty-five percent of the patients in year one of the LDCT program were not compliant with a follow-up LDCT (most were Lung-RADS category 1), and for year two of the LDCT program results were only slightly better at 60 percent noncompliance. This means that the majority of our patients were not continuing the screening process as originally intended. Most noncompliance came from patients feeling a false sense of security with a single scan, and some emanated from the primary

providers recommending longer intervals between scans (e.g., 1.5 years) despite existing evidence-based screening guidelines. The Outer Banks Hospital looked to address this issue in late 2017 and early 2018 and recommended measures to improve compliance, including educating primary providers about the appropriate intervals and the need to continue to screen patients after the initial normal scans. To date, these efforts have helped improve our follow-up rate, but there is still much room for continued improvements in this quality measure.

A summer intern in public health from Eastern Carolina University, Micayla Albers, who collaborated on the LDCT program, noted another finding from data analysis—an opportunity for improvement in tobacco cessation. In year one, 100 percent of the LDCT patients were counseled by their primary care providers on tobacco cessation (we achieved this metric by incorporating it into the consent process); however, only 16 percent of screened patients were able to successfully quit. For year two of the LDCT lung cancer screening program, all patients were still counseled on the need to quit smoking, but only 1 percent (1 patient) quit because of the program. That one patient was someone with a newly found lung cancer who had to quit in order to undergo surgery for cure. We had no formal tobacco education program at that time and relied on the primary care providers to achieve those outcomes. This therefore became another project identified by The Outer Banks Hospital Cancer Committee, and in 2017 a formal tobacco cessation program was implemented following a proven model from MD Anderson

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**Figure 3. Facility 103393: Regional Comparison**

Jan-Dec 2016 with follow-up through September 2017

2016									
Measure		Your Facility (103393)		Rural		Community		South Atlantic Division	
		Rate	Num-Den	Rate	Num-Den	Rate	Num-Den	Rate	Num-Den
All Exams		97	97	24590	24590	90665	90665	32441	32441
Appropriateness of screening by USPSTF criteria		89.69	(87 / 97)	90.45	(22242 / 24590)	89.12	(80801 / 90665)	87.42	(28360 / 32441)
Smoking cessation offered		100.00	(97 / 97)	75.34	(18525 / 24590)	74.86	(67875 / 90665)	76.95	(24964 / 32441)
	Smoking cessation offered among current smokers	100.00	(55 / 55)	83.46	(12706 / 15224)	83.91	(45027 / 53659)	84.11	(15347 / 18246)
Radiation exposure 1	Mean CTDIvol - Overall	5.62	(NA / 97)	3.61	(NA / 24590)	3.09	(NA / 90665)	3.20	(NA / 32441)
	Mean CTDIvol - Underweight (BMI <18.5)	3.82	(NA / 1)	2.64	(NA / 874)	2.74	(NA / 3421)	2.58	(NA / 1446)
	Mean CTDIvol - Normal (BMI of 18.5–24.9)	5.12	(NA / 22)	2.95	(NA / 6094)	2.56	(NA / 22788)	2.65	(NA / 8849)
	Mean CTDIvol - Overweight (BMI of 25–29.9)	5.78	(NA / 38)	3.21	(NA / 8037)	2.93	(NA / 30082)	2.93	(NA / 11239)
	Mean CTDIvol - Obese (BMI of 30 or greater)	5.84	(NA / 28)	4.46	(NA / 9178)	3.66	(NA / 32233)	4.09	(NA / 10438)
Radiation exposure 2	Mean DLP - Overall	213.87	(NA / 97)	100.71	(NA / 24590)	93.62	(NA / 90665)	95.62	(NA / 32441)
	Mean DLP - Underweight (BMI <18.5)	156.07	(NA / 1)	75.19	(NA / 874)	77.06	(NA / 3421)	77.50	(NA / 1446)
	Mean DLP - Normal (BMI of 18.5–24.9)	197.97	(NA / 22)	82.60	(NA / 6094)	79.02	(NA / 22788)	81.38	(NA / 8849)
	Mean DLP - Overweight (BMI of 25–29.9)	219.84	(NA / 38)	96.13	(NA / 8037)	89.76	(NA / 30082)	93.33	(NA / 11239)
	Mean DLP - Obese (BMI of 30 or greater)	217.71	(NA / 28)	119.18	(NA / 9178)	109.37	(NA / 32233)	114.03	(NA / 10438)
Abnormal Interpretation Rate	(Lung-RADS 3, 4a, 4b, 4x)	25.77	(25 / 97)	20.22	(4973 / 24590)	19.20	(17406 / 90665)	19.27	(6250 / 32441)
	Abnormal interpretation rate, at baseline exam	26.04	(25 / 96)	20.94	(4468 / 21340)	20.24	(15579 / 76961)	19.88	(5733 / 28840)
	Abnormal interpretation rate, at annual exam	0.00	(0 / 1)	14.57	(436 / 2992)	12.45	(1586 / 12737)	12.33	(401 / 3251)
Cancer Detection Rate (CDR) per 1000		41.24	(4 / 97)	5.00	(123 / 24590)	5.66	(513 / 90665)	4.59	(149 / 32441)
	CDR for prevalent cancers, detected at baseline exam	41.07	(4 / 96)	5.44	(116 / 21340)	6.16	(474 / 76961)	4.82	(139 / 28840)

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Future projects that everyone will learn from include finding ways to improve compliance with recommended follow-up scans in the time suggested, based on the category of findings. In this preliminary analysis, The Outer Banks Hospital lost more than half of the recommended follow-ups each year. Until the impact is made known to providers and consumers, patient noncompliance will remain a concern.

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- Why do we see much higher rates of abnormal results (Lung-RADs category 4 findings and cancers) from LDCT in this rural population than elsewhere in the country?
- Are the results higher than normal rate of true positives because of an effective and efficient diagnostic workup process (e.g., partnership with Eastern Carolina University and the Leo Jenkins Cancer Center, aggressive endobronchial ultrasound, better radiology, better quality CT)?
- Are these results significantly higher than normal (i.e., more abnormal) because our population simply smokes more than others? Subset analysis revealed an average smoking rate of >50 pack-years in all screened patients for this LDCT population, which may be higher than elsewhere. Similarly, our smoking cessation rates are very poor, reflecting a higher-risk population as well (more addicted).
- Are these results higher because of other risk factors? Are there other contributing factors that we need to elucidate such as interaction of environment with smoking or genetics? (We had a high incidence of first-degree family members with lung cancer in our population of cancers.)

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Cancer Center, with improved results noted within a short time.<sup>3</sup>

Albers also conducted a financial analysis of the LDCT program, mainly for educational purposes as it related to public health outcomes. The Outer Banks Hospital believed that other small hospitals and administrators would be more excited about projects like this if they could see some impact on the bottom line. A cursory analysis was done on the revenue that the hospital generated through this program locally. This included LDCT, any follow-up scans (e.g., diagnostic positron emission tomography or CT), and any treatments generated from a diagnosis of cancer due to the screening program.

For this small hospital alone, the revenue for the two years (using no additional equipment or capital) amounted to roughly \$750,000 of billed revenue and \$500,000 of actual captured revenue (revenue from LDCT and follow-up scans and treatments of cancers locally at The Outer Banks Hospital). This averaged out to roughly \$50,000 to \$60,000 of captured revenue per cancer case diagnosed and treated locally (four cases), and Dr. Shelton estimated that the revenue for the cases referred outside The Outer Banks Hospital amounted to roughly \$30,000 per patient (costs tend to be less for earlier stage cancer at diagnosis). Dr. Shelton estimated that the average revenue per screened patient seen downstream at The Outer Banks Hospital was just under \$2,000, if all screened patients were included in the analysis, allowing the LDCT program to pay for itself—an important consideration for hospitals and administrators.

### Future Considerations

Currently, The Outer Banks Hospital is looking at ways to improve the processes at its LDCT program. Several questions asked by the Cancer Committee included the following:

Ideally, LDCT screening picks up early stages (I/II) of lung cancer to be of the most benefit. A 2016 review of the stages of lung cancer from the tumor registry for The Outer Banks Hospital showed a fourfold increase in early lung cancer detection over the previous year. Specifically, in the preceding year (2014, when LDCT was not available), The Outer Banks Hospital saw 95 percent of its patients in stage III or stage IV lung cancer, with 5 percent in early stage (I or II). For the first time, in its 2016 annual registry review, The Outer Banks Hospital saw an increase in lung cancers being detected in early stages (I or II) within its annual registry to 20 percent, with 80 percent presenting in late stages (III or IV). Though there is more improvement to be made, The Outer Banks Hospital is already seeing further positive outcomes from its LDCT program. The 2017 registry review continues to show that this program is working at achieving its intended goal. For the year 2017, The Outer Banks Hospital performed 148 screening scans, and 100 percent of the cases detected by screening LDCT were stage I ( $N = 2$ ), which is also improved over previous years (50 percent in year 1 were early stage, and 60 percent in year 2 were early stage). Though the overall detection rate has declined, as is typical of a screening program with time,<sup>4,5</sup> the majority of cases are now early stage, which is an improvement. These are, in theory, the patients who we think benefit the most by screening (Figure 4, page 75).

Future projects that everyone will learn from include finding ways to improve compliance with recommended follow-up scans in the time suggested, based on the category of findings. In this preliminary analysis, The Outer Banks Hospital lost more than half of the recommended follow-ups each year. Until the impact is made known to providers and consumers, patient noncompliance will remain a concern. Smoking cessation, which is the key to changing this disease through prevention, will become more

Figure 4. Update on Cancer Detection Rates and Stage

Year	Number LDCT	Long-RADS 4	Lung CA	Early Stage
2015	108	12	6	3 (50%)
2016	98	12	5	3 (60%)
2017	148	7	2	2 (100%)
Total first 3 years	354	31 (9%)	13 (3.7%)	8/13 = 61%

of a focus in future studies. Additionally, we are trying to assess the cardiac evaluation implications from LDCT screening from the incidental findings of coronary artery calcifications. Lastly, The Outer Banks Hospital recommends participating in a national registry to track all patients early to simplify processes and to validate the way in which the LDCT program is being managed.



*Donna Delfera, RN, is nurse navigator; Micayla Albers is a public health intern and recent graduate from Eastern Carolina University; and Charles Shelton, MD, is Cancer Committee chair and an oncology physician, The Outer Banks Hospital, Nags Head, N.C. Lysle Ailstock, MD, is lead radiologist with LDCT for Eastern Radiology.*

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