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Lung Cancer Screening

Implementation of and barriers to a nurse practitioner–led program

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Lung cancer accounts for more American deaths annually than any other cancer, and the survival rate is low among those diagnosed with advanced-stage disease. Screening with low-dose computed tomography (CT) can help to reduce mortality. CT screening for lung cancer should be performed in the context of a comprehensive screening program, rather than as a single isolated test. The addition of the nurse practitioner role is instrumental in creating a lung cancer screening program that may increase patient satisfaction and that meets regulatory criteria.

AT A GLANCE

- Lung cancer screening with low-dose CT has been shown to help reduce lung cancer mortality rates.
- A nurse practitioner is well equipped to evaluate patients, engage in shared decision making, offer smoking cessation guidance, and counsel patients regarding lung nodules within a lung cancer screening program.
- With the right stakeholders and interprofessional collaboration, development and implementation of a lung cancer screening program can be successfully realized.

KEYWORDS
lung cancer screening; cancer screening programs; early detection; nurse practitioner

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An estimated 234,030 individuals will be diagnosed with lung cancer in 2018, and a predicted 154,050 will die from the disease that same year (Siegel, Miller, & Jemal, 2018). Lung cancer is rarely identified in its early stages. For example, at initial diagnosis of lung cancer, 57% of patients have distant disease, whereas only 16% have localized disease (Siegel et al., 2018). Presenting symptoms of lung cancer do not appear until there is a large disease burden or the cancer metastasizes, making early diagnosis more difficult. Across all stages and histologies, the five-year relative survival rate of lung cancer is 18%, which is the lowest among all cancers (American Cancer Society, 2017). In addition, the five-year survival rate across stages varies significantly, ranging from less than 1% for stage IVB non-small cell lung cancer to 92% for stage IA non-small cell lung cancer (American Cancer Society, 2017). Screening for lung cancer and early detection can improve outcomes, but only 4% of an eligible 6.8 million Americans are being screened for the disease (Siegel et al., 2018). A need exists for lung cancer screening programs to effect change.

Prior to 2015, no consensus recommendations for lung cancer screening existed because prior research demonstrated a lack of sensitivity or specificity for chest x-ray and sputum cytology for lung cancer diagnosis (Moyer, 2014). The National Lung Screening Trial (NLST), which was undertaken from 2002–2004, enrolled 53,454 individuals with the aim of identifying whether computed tomography (CT) screening for lung cancer affected lung cancer mortality rates (Aberle et al., 2011). To be eligible for participation, individuals had to have at least a 30 pack-year smoking history or be former 30 pack-year smokers who had quit fewer than 15 years prior, be aged 55–74 years, and be asymptomatic (without hemoptysis or without significant weight loss of greater than 15 pounds within the previous year) (Aberle et al., 2011). Being asymptomatic was a particularly important criterion for participants, because a low-dose CT scan is meant for screening purposes, unlike a diagnostic full-dose CT scan. Participants were randomized to chest x-ray versus low-dose CT scan of the chest, and they underwent annual imaging for two years. Low-dose CT provided earlier detection of pulmonary nodules and cancer detection at an earlier stage compared to chest x-ray, resulting in a 20% reduction in lung cancer mortality and a 7% reduction in all-cause mortality (Aberle et al., 2011).

Based on NLST findings, the U.S. Preventive Services Task Force (USPSTF) recommends annual lung cancer screening with low-dose chest CT scan for adults aged 55–80 years with at least a 30 pack-year smoking history who either currently smoke or have quit within the past 15 years (Moyer, 2014). This recommendation is given a grade of B by the USPSTF, because there is high certainty that the net benefit is moderate, weighed

against the risks and potential harms of screening, and that this service should be offered (Moyer, 2014). The Centers for Medicare and Medicaid Services adopted the USPSTF's recommendations for low-dose CT screening for lung cancer in 2015 and requires a shared decision-making visit to be performed in addition to the screening itself (Moyer, 2014). Additional lung cancer screening recommendations are listed in Figure 1.

Program Design

Healthcare leaders at the University of Maryland Medical Center wanted to create a formal lung cancer screening program to implement the findings from the NLST and provide comprehensive, high-quality lung cancer screening for the surrounding patient population. Certain requirements needed to be met; these are set by the American College of Radiology, which accredits lung cancer screening centers, and the Centers for Medicare and Medicaid Services, which sets the standards for insurance and reimbursement.

Comprehensive Lung Cancer Screening Program Considerations

CONSIDERATION 1: Fulfill the American College of Radiology (n.d.-a) lung cancer screening program requirements, which are as follows:

- Verification of imaging specifications and protocols
- Radiologist reading requirements of more than 200 chest CT scans in 36 months
- Use of Lung-RADS™ (Lung Cancer Screening Reporting and Data System) by the radiologist to categorize pulmonary nodules based on size and density; a score of 1 is a normal scan with no lung nodules and a score of 2 signifies the presence of a lung nodule, and scores of 2–4 indicate increases in size and probability of malignancy. Lung-RADS also provides management recommendations for subsequent imaging for each score (American College of Radiology, n.d.-b).
- Presence of a patient follow-up system
- Provision of smoking cessation program
- Participation in the American College of Radiology's lung cancer screening registry

CONSIDERATION 2: Create a lung cancer screening program that is comprehensive (as opposed to a single CT scan ordered and performed). The term *program* denotes ownership of the patients enrolled, as well as that follow-up is maintained. This stands in contrast to the independent screening of patients via freestanding tests (Wood et al., 2012). The programmatic approach benefits patients by educating them and allowing dedicated time for smoking cessation efforts. Primary care providers also benefit. For example, criticisms of screening program implementation have included challenges related to workload management; however, having a dedicated interprofessional team made up of at least a licensed independent practitioner (a doctor of medicine, nurse practitioner [NP], or physician assistant with independent practice authority), a nurse navigator, and a secretary allows primary care providers to be relieved of additional time-consuming responsibilities and regulations (Gesthalter et al., 2017).

CONSIDERATION 3: Promote a thorough shared decision-making discussion between the patient and a licensed independent practitioner; this discussion should involve explanation and identification of the high-risk patient (smoker, family history of lung cancer, increasing age, lung disease, exposures), risks and benefits of lung cancer screening,

FIGURE 1.
LUNG CANCER SCREENING RECOMMENDATIONS

U.S. PREVENTIVE SERVICES TASK FORCE

- Individuals aged 55–80 years who are current smokers with at least 30 pack-years or who are former smokers with at least 30 pack-years who quit fewer than 15 years ago should undergo screening; an additional factor is being asymptomatic.

ACS, ASCO, CHEST, AND AMERICAN LUNG ASSOCIATION

- Individuals aged 55–74 years who are current smokers with at least 30 pack-years or who are former smokers with at least 30 pack-years who quit fewer than 15 years ago should undergo screening; additional factors include being asymptomatic, having no weight loss greater than 15 pounds in the past year, and having no hemoptysis.

AMERICAN ASSOCIATION FOR THORACIC SURGERY

- Individuals aged 55–79 years with 30 pack-years should undergo screening; lung cancer survivors should start at year 5 to age 79 years.
- Individuals aged 50–79 years with 20 pack-years should undergo screening; consider additional comorbidity that produces a cumulative risk of developing lung cancer that is greater than or equal to 5% in 5 years using a risk calculator.

NATIONAL COMPREHENSIVE CANCER NETWORK

- Individuals aged 55–74 years who are current smokers with at least 30 pack-years or who are former smokers with at least 30 pack-years who quit fewer than 15 years ago should undergo screening.
- Individuals aged older than 50 years with a 20 pack-year history should undergo screening; additional factors include a history of lung cancer, lung disease, radon and occupational exposure, and family history of lung cancer.

AMERICAN ACADEMY OF FAMILY PHYSICIANS

- There is insufficient evidence to recommend for or against screening because of the inability to reproduce National Lung Screening Trial data in a community setting.

ACS—American Cancer Society; ASCO—American Society of Clinical Oncology; CHEST—American College of Chest Physicians

Note. Based on information from American Academy of Family Physicians, 2013; Jaklitsch et al., 2012; Moyer, 2014.

implications of potential findings and false positives, need for annual screening examinations even when past results have been negative, and the risk of radiation exposure (Centers for Medicare and Medicaid Services, 2015).

Program Development

To initiate a lung cancer screening program at the University of Maryland Medical Center, leadership from thoracic surgery, thoracic radiology, and pulmonary medicine were identified as key stakeholders to be involved in the development and maintenance of the lung cancer screening program. The work group also consisted of a medical oncologist, a thoracic surgery NP, a radiology administrator, a CT technologist, information technology personnel, and billing personnel. An NP with a specialization in thoracic surgery was appointed to oversee the program. This NP assesses patients independently, coordinates clinical care and patient navigation, and maintains data entry. Six months of planning took place prior to the official launch of the program, and it became a seamless operation about 10 months after formal implementation.

When a patient presents to the lung cancer screening program, a comprehensive evaluation is performed and the patient's navigation through the program begins (see Figure 2). Because primary care providers were already ordering low-dose CT scans for lung cancer screening, a foundation existed to enroll these patients in the lung cancer screening program. However, some patients were not being referred to the lung cancer screening program. Consequently, collaboration took place between information technology personnel and the CT technologist to identify those patients. This effort ultimately evolved into the creation of an automated report that originates from the low-dose CT order in the electronic health record (EHR). The NP and scheduling coordinator review the reports and enroll patients into the lung cancer screening program. All patients with low-dose CT scan orders undergo a chart review, and sometimes further patient inquiry is necessary. For example, if the EHR does not reflect a 30 pack-year history, the patient is contacted for additional information about his or her smoking history. Smoking pack-year information is often underreported in the EHR, with estimates as high as 85%; this lack of documented and verified smoking history may result in missed opportunities for screening (Modin et al., 2017).

Role of the Nurse Practitioner

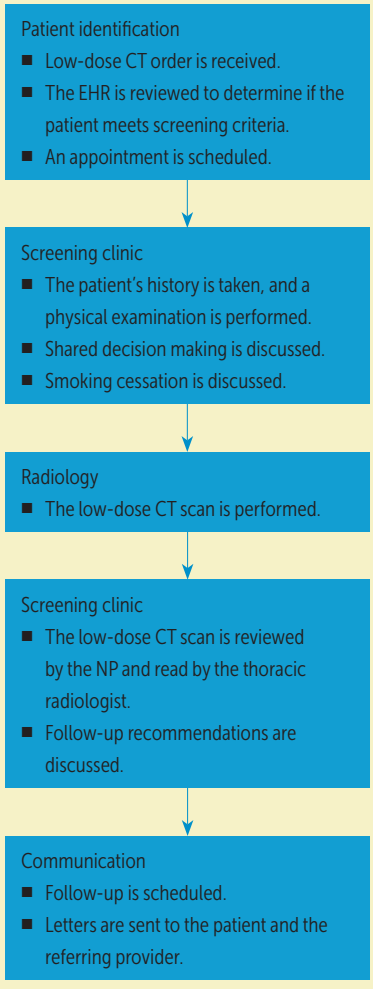
Because the lung cancer screening program offers a comprehensive service (as discussed in the second consideration), a licensed advanced practice provider (e.g., an NP) is well positioned to deliver and coordinate care. The NP affiliated with the lung cancer screening program assesses and evaluates the patient independent of a physician, orders the low-dose CT scan, interprets the CT scan, and counsels the patient. A complete history is taken and a physical examination is performed, with meaningful time spent on smoking history, review of systems potentially related to lung cancer, and family history of cancer. This discussion centers on the indications for and risks and benefits of screening. The NP is equipped to educate patients about the presence of a potential nodule or incidental findings, lung cancer overall, and the disease's prevalence in smokers. A discussion about smoking cessation includes identification of smoking habits, development of a patient-centered plan for cessation, and prescription of pharmacologic cessation aids. The low-dose CT scan occurs immediately after the counseling session, and the patient then returns to the screening clinic for a discussion of the results. In the event that the scan shows possible lung cancer, the NP has the opportunity to discuss next steps in management, including how to confirm the diagnosis.

Lung nodule follow-up is managed by the NP affiliated with the lung cancer screening program and includes short interval scans of three to six months, biopsy referrals, and additional diagnostics. The NP communicates with the primary care provider regarding all results, including any incidental findings, such as aortic aneurysm or upper abdominal mass, and care needs that require further management.

First-Year Program Results

In 2017, the program's first year, many developments and changes occurred. A total of 96 patients were screened overall at the

FIGURE 2.
LUNG CANCER SCREENING PROGRAM WORKFLOW



CT—computed tomography; EHR—electronic health record; NP—nurse practitioner

author's institution (26 in the first quarter, 25 in the second, 23 in the third, and 22 in the fourth). Considerable effort had been made by the fourth quarter to increase the proportion of patients appropriately directed to the lung cancer screening program. Overall, 18 of 22 patients screened in the fourth quarter were seen through the lung cancer screening program. The ability to increasingly capture patients into the program is attributed to the use of an EHR-based reporting system; as a result, it was possible to create a report of all patients ordered for low-dose CT, contact them, and schedule them appropriately. Of the 96 patients screened, 1 patient was diagnosed with lung cancer, and the remaining patients were followed up with, in accordance with Lung-RADS recommendations.

Developing and implementing a lung cancer screening program presents many challenges. A primary obstacle was transforming provider referral habits and promoting use of the lung cancer screening program. The EHR-directed referral to the program from the low-dose CT scan order helped providers to more easily refer patients. The institution's marketing department assisted with advertisements, emails, and Internet presence (i.e., website and social media promotion) to inform patients and providers of the lung cancer screening program. Presentations about the lung cancer screening program occurred throughout the institution via grand rounds and clinic staff meetings.

The institution is located within 50 miles of 20 American College of Radiology accredited facilities offering low-dose CT scans for lung cancer screening. As a result, creating a unique program was important to provide for the needs of patients and providers.

FIGURE 3.
CASE STUDY

A 56-year-old current smoker with a 41 pack-year smoking history was referred for lung cancer screening during a routine physical examination. The patient's initial low-dose computed tomography scan showed a peripheral left upper lobe nodule of 9 mm, a contralateral right lower lobe nodule of 7 mm, mediastinal and left hilar adenopathy, and additional smoking-related changes. The patient's Lung-RADS™ (Lung Cancer Screening Reporting and Data System) score was 4B, which is suspicious for lung cancer, and a positron-emission tomography scan was recommended. This scan showed fluorodeoxyglucose avidity in bilateral nodules and mediastinal nodes without distant disease. The patient underwent brochoscopy with endobronchial ultrasound for diagnosis and mediastinal staging. Pathology revealed small cell carcinoma of the 4R nodal station, and the patient was referred to medical and radiation oncology for definitive treatment.

Recommendations

Much has been learned through implementation of this lung cancer screening program that may benefit others considering development of a similar program. For example, a dedicated coordinator position (preferably an RN) should be established to contact patients for lung cancer screening program enrollment, relay the rationale for the program, and scheduling. The coordinator ensures that patient follow-up efforts are completed, as well as transmits results of the screening CT scan and notes to referring providers. The coordinator also maintains the American College of Radiology's lung cancer screening registry and facility-based lung cancer screening program databases.

In addition, the NP affiliated with the lung cancer screening program should become a certified tobacco cessation specialist. Research indicates that those with a positive low-dose CT scan finding are receptive to quitting smoking and may be successful with longer-term smoking cessation when provided with targeted smoking cessation interventions (Brain et al., 2017).

> "Screening and early detection may improve outcomes, but just 4% of an eligible 6.8 million Americans are being screened for the disease."

Training related to smoking cessation provides tools that will help to elicit from the patient an accurate smoking history and details about his or her habits, as well as to create meaningful patient-centered cessation plans.

The availability of interprofessional input should also be ensured when a patient's low-dose CT scan detects lung cancer. Having existing relationships with interventional pulmonology, medical oncology, thoracic surgery, and radiation oncology personnel is invaluable and critical when a stage III or IV lung cancer is detected (see Figure 3). Thoracic tumor boards comprised of these specialties are held weekly to discuss cases.

Several software packages are available to create patient databases. They can be used to keep track of patients, provide automatic data entry, and streamline additional manual processes. Radiologic nodule tracking software may provide some benefit for lung cancer screening programs.

Conclusion

Lung cancer screening is an essential part of health maintenance, particularly in those who meet USPSTF recommendations. NPs specializing in thoracic

surgery or pulmonary medicine can lead lung cancer screening programs because they have expertise in reviewing chest CTs and in counseling patients about lung nodules and cancer. The NP-led lung cancer screening program at the author's institution integrated and implemented the American College of Radiology's and Centers for Medicare and Medicaid Services's requirements, with clinical outcomes including patient-centered care, care coordination, and patient and staff satisfaction.

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