OPTIMIZING LUNG CANCER SCREENING WITH LOW-DOSE COMPUTED TOMOGRAPHY IN A PRIMARY CARE SETTING

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Dedication and Acknowledgements

This project is dedicated to my amazing husband and our precious son. It is also dedicated to all of the Hospice patients I have worked with who had lung cancer diagnoses.

Abstract

Background: Lung cancer is the leading cause of cancer-related death worldwide. Early detection and diagnosis of lung cancer through low-dose computed tomography (LDCT) scanning has been shown to increase treatment options and decrease overall mortality. Despite lung cancer screening (LCS) recommendations from the United States Preventive Services Task Force (USPSTF) and evidence LDCT screening can promote early diagnosis, decrease mortality, and improve outcomes for people with lung cancer, referral rates for LDCT in eligible patients remain low. **Purpose:** The purpose of this program evaluation project is to examine the current LCS practices at a designated primary care clinical site in an effort to optimize provider recognition of patients at risk for lung cancer who meet LDCT screening eligibility. The specific aims are to assess levels of provider knowledge on the updated USPSTF LCS recommendations, to determine barriers to LCS within the practice, and to make evidence-based recommendations that may increase LDCT LCS referrals for eligible patients. **Methods:** A plan-do-study-act (PDSA) approach was used to conduct the project. Data was obtained through provider interviews. **Results:** Providers had low knowledge of LCS recommendations and were not following any specified LCS guidelines. **Conclusion and Recommendations:** Ongoing provider education on current LCS guidelines, reminders, and use of a LCS nurse navigator to facilitate the referral and follow-up processes are recommended for this practice. Further investigation could include assessing whether the site's current smoking history collection practices result in accurate data, and interventions to determine patient-perceived barriers to LCS.

Key Words: lung cancer screening, guidelines, provider, knowledge, education, nurse navigator, adherence, barrier, low dose computed tomography, LDCT, perceptions, attitudes, and primary care.

Background and Significance

Each year in the United States, approximately 235,000 people are diagnosed with lung cancer, and nearly 132,000 people die from the disease (Siegel et al., 2021). These numbers are an improvement over those in recent decades due to educational campaigns and smoking cessation efforts. However, lung cancer remains the leading cause of cancer-related death in the U.S. and around the world, accounting for approximately 1.8 million deaths in 2020 (Centers for Disease Control and Prevention, 2021; World Health Organization, 2022). Oftentimes, lung cancer is not diagnosed during early localized stages. This is because the disease typically remains asymptomatic until it has progressed to later stages. In fact, nearly 60% of initial lung cancer diagnoses occur after the disease has already metastasized to other regions of the body (Siegel et al., 2021). Metastatic lung cancer is associated with a five-year survival rate of just 6%, compared to 59% for lung cancer that is detected when the disease is still localized (Siegel et al., 2021). Early detection and diagnosis of lung cancer through low-dose computed tomography (LDCT) scanning has been shown to increase treatment options and decrease overall mortality (Jonas et al., 2021). LDCT is a non-invasive radiographic procedure that emits a very low dose of radiation in order to produce three-dimensional cross-sectional images of internal organs and tissues (National Cancer Institute, n.d.). The detailed images can be used to detect abnormalities within the body. LDCT generally uses approximately 80% less radiation than a standard chest CT (Hoffman & Sanchez, 2017).

In 2013, the U.S. Preventive Services Task Force (USPSTF) issued a grade B recommendation for the use of LDCT scanning for lung cancer screening (LCS). A grade B recommendation is designated for an intervention when, “there is high certainty that the net benefit is moderate, or there is moderate certainty that the net benefit is moderate to substantial”

(USPSTF, 2018, para. 5). The USPSTF made this designation for LCS with LDCT after the National Lung Screening Trial (NLST) landmark study found that LDCT is more effective than chest radiography at detecting lung cancer and decreasing mortality (National Lung Screening Trial Research Team, 2011). That is, a 20% reduction in death from lung cancer was shown with the use of LDCT versus chest x-ray. Subsequently, in February 2015, LDCT was approved as a preventive service covered under Medicare (Centers for Medicare and Medicaid Services, 2015).

Further investigation by Pastorino et al. (2019) showed that detection of lung cancer in its early stages through in-depth screening, follow-up, and more inclusive eligibility criteria can reduce mortality by as much as 39% compared with no screening intervention. Based on these and other findings, the USPSTF updated its LCS recommendations on March 9, 2021. The USPSTF (2021) now recommends that people aged 50-80 with a 20-pack-year history of smoking who currently smoke or have quit smoking in the last 15 years should receive LDCT scanning yearly until they no longer meet the criteria. They also recommend that screening be discontinued if a person develops a life-limiting health condition, or a health condition that decreases their ability or willingness to undergo curative surgery. The USPSTF does not recommend the use of chest x-ray, sputum cytology, or biomarker measurement for LCS.

Despite these recommendations and an abundance of evidence that LDCT screening can promote early diagnosis, decrease mortality, and improve outcomes for people with lung cancer, referral rates for LDCT in eligible patients remain low. In fact, only about 7.3% of eligible patients receive referrals for LDCT scanning, and just 2.0% of eligible patients are actually screened (Li et al., 2018; Pham et al., 2019). This issue is so pressing that the Office of Disease Prevention and Health Promotion (n.d.), has designated the increase of LCS in adults as a Healthy People 2030 objective. Moreover, most insurances cover the cost of LDCT LCS. Indeed,

under section 2713 of the Patient Protection and Affordable Care Act (2010), preventive health services that are recommended by the USPSTF and have a grade level of A or B, such as LCS with LDCT, must be covered by health insurance plans without passing any cost-sharing along to the patient.

Purpose

The purpose of this program evaluation project is to examine the current LCS practices and workflow at a designated primary care clinical site in an effort to optimize provider recognition of patients at risk for lung cancer who meet LDCT screening criteria. The three specific aims of the project are:

- To assess levels of provider knowledge on the updated USPSTF recommendations for LCS
- To determine provider-perceived barriers to LCS within the practice
- To make evidence-based recommendations that may increase LDCT LCS referrals for eligible patients

Review of Current Evidence

To obtain a comprehensive understanding of the current evidence available on LDCT for LCS, a literature review was performed. The following search terms were used: lung cancer screening, guidelines, provider, knowledge, education, nurse navigator, adherence, barrier, low dose computed tomography, LDCT, perceptions, attitudes, and primary care. The searches were conducted using the databases CINAHL Complete, ProQuest Health and Medical Complete, Google Scholar, EBSCO Complete, and PubMed. Articles that were published more than five years from the search date were excluded. Included articles were peer-reviewed, had the full text available, and were written in English. Also, a number of relevant sources were found by

searching the reference lists of other articles. Altogether, 24 sources met the criteria and were included in the review.

It is well documented that LDCT is an effective means of LCS (Jonas et al., 2021; Pastorino et al., 2019; US Preventive Services Task Force, 2021) and that chest x-ray is no longer recommended for LCS because it does not decrease lung cancer mortality (Hoffman & Sanchez, 2017). Further, a number of professional organizations endorse annual screening with LDCT in patients at high-risk for lung cancer development, including the American Cancer Society, the American College of Chest Physicians, the American Thoracic Society, the National Comprehensive Cancer Network, and the USPSTF (American Cancer Society, 2020; Mazzone et al., 2021; USPSTF, 2021; Wiener et al., 2015; Wood et al., 2018).

Barriers to LCS with LDCT

A major theme that emerged from the literature is that there are a number of barriers preventing providers from making LDCT referrals for patients meeting LCS eligibility criteria. These barriers include a lack of provider knowledge about current LCS recommendations, incomplete or inaccurate records of patient smoking history, disagreement with LCS recommendations, and time constraints during the patient-provider encounter.

Provider Knowledge Gap

A number of studies have shown that low knowledge of LCS recommendations among providers is a primary contributor to low rates of referrals and recommendations for LDCT (Cattaneo et al, 2018; Lewis et al., 2019; Simmons et al., 2017). In fact, one study showed that 42% of primary care providers were completely unaware of USPSTF recommendations for LCS (Kanodra et al., 2016). In addition to unawareness of guidelines, the lack of provider knowledge includes not being able to correctly identify patients who meet eligibility criteria for LDCT

scanning, not knowing specific elements of LCS recommendations, and a lack of knowledge about the correct way to document LCS in order to meet Centers for Medicare and Medicaid Services (CMS) requirements.

In order for LCS to occur, a provider must first recognize that a patient meets eligibility criteria. However, a study done at Stanford Health Care showed that just 31% of primary care providers were able to accurately identify smoking and age eligibility criteria for LCS (Duong et al., 2017). The same study found a 37% inappropriate referral rate, further highlighting a lack of eligibility criteria knowledge. Lewis et al. (2019) reported similar findings with 62% of providers being unable to correctly identify eligibility criteria. Another study found that most providers could not spontaneously recall eligibility criteria for screening, but rather relied completely on alerts imbedded within the electronic health record (EHR) to identify appropriate patients (Kanodra et al., 2016). Higher levels of provider knowledge about current LCS recommendations and understanding of patient eligibility criteria are associated with higher likelihood of referral for LDCT (Coughlin et al., 2020; Lewis et al., 2019; Rajupet et al., 2017; Simmons et al., 2017).

In addition to not recognizing whether patients are eligible for LCS, providers also lack knowledge about specific recommendations for LCS. For example, in one study only 36% of physicians knew that LDCT screening should be completed each year in eligible patients (Ersek et al., 2016). Additionally, Ersek et al. (2016) found that the majority of physicians did not know which organizations endorse LDCT scanning for LCS or whether LDCT is covered by Medicare. In fact, in order for the cost of LDCT to be covered by Medicare, a provider must correctly conduct a shared decision-making visit prior to the scan (Centers for Medicare and Medicaid Services, 2021). This visit must include a determination of the patient's eligibility for LDCT

based on CMS criteria, a shared decision-making discussion using a decision aid, counseling about the need to screen annually until no longer appropriate, and smoking cessation or abstinence counseling. Furthermore, all of these elements must be documented accurately within the patient's health record in order to meet reimbursement requirements. However, Reese et al. (2021) found the majority of physicians interviewed did not know requirements for LCS reimbursement through insurance, or whether patients would incur cost-sharing. Triplette et al. (2018) also found that 90% of providers could not identify the elements of documentation required by CMS for reimbursement. Declined coverage for LDCT as a result of deficient provider documentation could prevent a patient from obtaining recommended screening. Moreover, many providers continue to order chest x-rays, believing that they are an effective and acceptable means of LCS (Ersek et al., 2016; Kanodra et al., 2016; Richards et al., 2019; Simmons et al., 2017). In fact, low provider knowledge of current LCS guidelines has been directly correlated with a higher likelihood of inappropriately ordering chest radiography for LCS (Lewis et al., 2019).

Even when providers are aware of LDCT recommendations for LCS, many are still unfamiliar with the screening process. For example, Rajupet et al. (2017) found that nearly 50% of primary care providers did not feel comfortable counseling patients about LDCT due to lack of knowledge about LCS guidelines. Lack of provider knowledge about LDCT LCS and subsequent missed counseling opportunities can translate into uninformed patients. Indeed, in one study the majority of primary care providers admitted to having limited knowledge of LCS recommendations (Simmons et al., 2017). In the same study, all LCS-eligible patient participants reported that LDCT LCS had never been discussed or recommended to them by any healthcare provider.

Provider education can be employed to address provider knowledge gaps, and can increase LDCT referral and utilization (Cattaneo, et al., 2018). Additionally, reminder tools may increase provider recognition of patient eligibility for LDCT. When asked, the majority of providers preferred an online lecture for education on LCS and recommendations (Duong et al., 2017), and pocket guides or other decision-making aids as provider education supplements (Triplette et al., 2019).

Incomplete or Inaccurate Smoking History

An inaccurate or incomplete smoking history can create a significant obstacle to LDCT utilization (Cattaneo et al., 2018; Reese et al., 2021). Smoking history awareness and documentation are fundamental in the determination of a patient's LCS eligibility. However, oftentimes patients' smoking history documentation is inaccurate or missing altogether. This can cause missed opportunities for LCS in patients who may be eligible. In a large study conducted within the Veteran Health Administration, 39% of primary care patients meeting age, life expectancy, and comorbidity criteria for LCS did not have documented smoking status or tobacco pack-years calculated, and were therefore excluded from the study and potential LCS interventions (Kinsinger et al., 2017). Similar findings were noted in another study where 30% of otherwise eligible patients were excluded due to unknown smoking status, quit date, or pack-years (Li et al., 2018). Additionally, in some cases if smoking history is not documented in a designated location within an EHR, automatic reminders for providers to perform LCS may not be triggered (Brenner et al., 2018). This issue can occur when healthcare staff or providers enter smoking history information into narrative notes rather than in discrete EHR fields (Brenner et al., 2018).

Furthermore, variation in data collection and documentation practices may result in inaccurate smoking histories and low-quality data (Modin et al., 2017). This may be a concern when various clinical users across a healthcare system enter smoking history information into an EHR. For example, one study showed that in 96% of patients, there was a discrepancy between smoking pack-years documented in the EHR and pack-years determined through shared decision-making conversations (Modin et al., 2017). That is, pack-years were underreported in the EHR in 85% of cases, and overreported in 15% of patients. Sole reliance on the inaccurate data entered in the EHR would have resulted in the exclusion of 54% of patients who were eligible for LCS. Provider and nursing staff education and training on smoking history data collection and documentation may significantly improve smoking history completeness and accuracy. Indeed, one study showed that an educational intervention increased complete smoking history collection from 2% to 47% (Brenner et al., 2018).

Disagreement with LCS Recommendations

Some providers may be fully aware of current LCS recommendations, but disagree with them. This is a significant barrier to referral because the provider may choose not to inform patients about LDCT, or they may not recommend it. Complicating this barrier is the fact that the American Academy of Family Physicians (AAFP; 2021) initially concluded in 2013 that they did not agree with the USPSTF recommendations for LDCT, arguing that evidence to recommend LDCT was not sufficient. This proclamation from the prominent organization could have had a significant impact on the views and subsequent practices of many primary care providers. After the release of the updated LCS recommendations from the USPSTF, the AAFP performed an evidence review and revised their position on March 31, 2021 in support of the new USPSTF recommendations (AAFP, 2021). However, the impact of their initial rejection of the

recommendations could have a lasting effect. Indeed, Eberth et al. (2018) found that although 75% of surveyed physicians believe the benefits of LDCT outweigh the risks, only 50% believe that the evidence is sufficient enough to show that LDCT reduces mortality. Other studies have shown similar beliefs among providers (Ersek et al., 2016). Additionally, Rajupet et al. (2017) found that although the majority of primary care providers believed that LCS with LDCT reduces cancer mortality in high-risk patients, only 28% believed that the recommended annual screening interval is feasible.

Time Constraints

In an already hectic primary care setting with a limited amount of time with each patient, providers may feel there is not enough time to dedicate to LCS. They may choose to prioritize other aspects of care. Providers consistently report time constraints and competing health priorities as notable barriers to LCS (Duong et al., 2017; Eberth et al., 2018; Rajupet et al., 2017; Randhawa et al., 2018; Simmons et al., 2017; Triplette et al., 2019). Indeed, in one study over 85% of primary care providers reported feeling like they do not have sufficient time to counsel patients about LDCT for LCS (Rajupet, et al., 2017). Additionally, insufficient time and competing priorities have been cited as obstacles to being able to conduct shared decision-making discussions and provide thorough patient education on LCS with LDCT (Kanodra et al., 2016; Reese et al., 2021; Simmons et al., 2017). In fact, one study found that when asked, most patients who received LDCT could not recall having received significant education about LDCT scanning or having had an in-depth discussion about it with their referring primary care provider (Kanodra et al., 2016). They reported either entering into the process without adequate information, or having subsequently received information from nursing coordinators. Patients and providers alike expressed a preference for follow-up education and discussions to be

completed with coordinators or navigators rather than within the patient-provider interaction. Further, the amount of time and effort required to obtain prior-authorization from some insurance companies, as well as the time required to complete all CMS documentation requirements, have been cited by providers as barriers to LCS (Randhawa et al., 2018).

Opportunities and Interventions for LCS Quality Improvement

Based on the current literature, there is a significant amount of evidence showing that interventions to increase provider knowledge about LDCT and LCS recommendations, to improve smoking history accuracy and documentation, and to facilitate the referral and follow-up processes for LDCT scanning may address barriers and increase LDCT referrals. In fact, the majority of study authors within the review concluded that provider education and efforts to disseminate LCS evidence-based guidelines are areas of opportunity to increase appropriate LDCT uptake.

Nurse Navigation

Nurse navigation is one effective means of facilitating the LDCT LCS process. The practice model of patient navigation was first developed in Harlem in 1990 by Dr. Harold Freeman in an effort to help decrease disparities and barriers to diagnosis, treatment and care for disadvantaged people with cancer (Freeman & Rodriguez, 2011). Over the years, the role of nurse navigator has evolved and expanded to meet the needs of various patients throughout the ever-changing healthcare domain. A nurse navigator's role involves personal interactions between a nurse and patient to facilitate patient education, access to resources, and strategies to overcome barriers to healthcare (Watson et al., 2020). Integrating nurse navigators into the multidisciplinary healthcare team can help mitigate barriers to LCS with LDCT and improve patient outcomes (Gorin et al., 2017; Watson et al., 2020).

In addition to provider education and nurse navigation, dissemination of decision-making tools, quick-references, and reminders may have a bolstering effect on LCS. Gaps in the literature include studies regarding specific instruments or tools to use for provider education and decision-making support. Furthermore, there is limited literature regarding application of LCS recommendations for electronic nicotine delivery systems users.

Theoretical Model

For this project, I selected the Awareness-to-Adherence Model of the Steps to Clinical Guideline Compliance as a theoretical model. The model was developed in 1996 by Pathman et al. in an attempt to describe factors that affect whether a provider follows practice recommendations and guidelines. They proposed that there are a number of cognitive and behavioral factors involved with following clinical guidelines. The model contains a four-component sequence of awareness, agreement, adoption, and adherence. That is, providers must first have an awareness of the guidelines, then they must agree with the guidelines before progressing to adopting them into practice. Once guidelines have been adopted, the provider must then continue to adhere to them. In order to successfully progress along the sequence, each step must be realized before advancing to the subsequent step. The authors posit that if progression through the steps is halted for any reason, the result will be non-adherence to guidelines. This theoretical model applies directly to my project because findings from the literature review suggest that some of the greatest barriers to LDCT referral are lack of provider awareness or lack of agreement with updated USPSTF recommendations. In fact, Randhawa et al. (2018) report receiving feedback from providers that the education session provided during their study led to increased awareness and agreement with LCS recommendations, as well as an increase in referrals for LDCT.

Translational Framework

I used the Plan-Do-Study-Act (PDSA) model to provide a framework for my project. This model, which was developed by Walter Shewhart and W. Edwards Deming, is widely used as a cyclic approach to systematic change and quality improvement (Taylor et al., 2014; The W. Edwards Deming Institute, 2021). The method is composed of the four stages within its name: plan, do, study, and act. Together, these stages form a cycle that can be utilized for continuous development and improvement.

Plan

The "Plan" portion of the PDSA method involves identifying a need for change, determining an appropriate intervention to promote that change, and formulating a strategy for enacting the process (Taylor et al., 2014; The W. Edwards Deming Institute, 2021). For my project planning, I began by searching the literature for information about the current state of LCS in the U.S., including the most up-to-date recommendations, effectiveness, and barriers to screening. Then I reviewed evidence-based interventions shown to optimize LCS with LDCT. After determining these elements, I identified a healthcare site in which to conduct the project. I planned a program evaluation project to determine the effectiveness of the current LCS practices at the clinical site. The project site was a primary care office in central North Carolina. I contacted the healthcare providers at the practice and obtained support from a site facilitator. The project participants included healthcare providers at the practice. There was a total of four practicing providers made up of two physicians and two nurse practitioners. After obtaining support from the site to perform the project, I met with a LDCT LCS nurse navigator to discuss ways to facilitate LCS programs within primary care settings. I then communicated with the practice providers to formulate a data collection plan and to tailor an ideal method of evaluation

for the LCS program at the site. It was determined that the optimal means of evaluation would be through conducting surveys via virtual interviews with providers about their current LCS practices.

Do (Implementation)

The "Do" portion of the PDSA involves implementation of the process or intervention developed during the plan phase (Taylor et al., 2014; The W. Edwards Deming Institute, 2021). This portion of the cycle usually involves the collection of data. For my project, the intervention was accompanied by simultaneous data collection.

Intervention

The project intervention included individual interviewing sessions with providers at the designated practice. I developed an interview outline consisting of 15 questions (see Appendix A). The interviews included questions about the providers' current LCS practices, their level of knowledge about USPSTF LCS recommendations, their perceived barriers to LCS from a provider perspective, perceived barriers from a patient perspective, their beliefs about LCS, and some provider demographic information. Each interview included the same questions, in addition to an invitation to share any additional information, beliefs, or perspectives pertinent to the topic. Individualized clarification questions were asked when needed. The interviews were conducted virtually over Zoom. Immediately following the interviews, I provided a brief informational session using a PowerPoint format to review the current state of evidence on LCS. Providers were educated on the updated USPSTF recommendations and eligibility criteria, insurance coverage for LCS, CMS requirements for reimbursement, and resources available to simplify the LDCT LCS and follow-up processes. The combined interview and information sessions were conducted in December 2021, and each lasted approximately 30 minutes. Of the

four providers at the practice, two responded to requests for participation, and completed the interview and information sessions. The two responders were nurse practitioners and the two non-responders were physicians.

Data Collection

Each interview with the providers' responses was recorded after receiving individual consent from each provider. The providers were informed that the interview footage would not be viewed by any other party, and would be promptly deleted after completion of the project. Demographic questions included information about length of time in practice, and whether the provider was a member of any professional organizations. Data was collected in the form of note-taking during the interviews to record provider responses. After the interviews, the recordings were reviewed and transcripts were made of each interview to facilitate the data analysis process. The transcripts were inspected for accuracy before proceeding with data analysis.

Study

The "Study" portion of the PDSA involves examination of data and results to determine what was learned (Taylor et al., 2014). It also includes summarization, comparison, and interpretation of data. Challenges and barriers may also be reviewed during this step.

Data Analysis

The data collected was primarily qualitative data. I analyzed the data using the transcribed interviews to compare provider responses. Data were then classified into four categories, including demographics, current LCS practices and workflow, provider knowledge of USPSTF recommendations, and barriers to LCS. I compiled responses in order to determine trends and differences between the practicing providers.

Results

There are a total of four practicing providers at the clinic, including two physicians and two nurse practitioners. There was a 50% response and participation rate for the program evaluation intervention. The two nurse practitioners responded to requests to participate in the evaluation, and the two physicians did not. Among the responding providers, one had been practicing for more than 10 years, while the other had been practicing for less than one year. Additionally, one provider belonged to several professional organizations, while the other belonged to none.

Current LCS Practices and Workflow. The LCS practices and workflows differed slightly between the providers. Each provider had a different list of criteria for determining LCS eligibility. While one provider stated that they attempt to follow guidelines, the other stated that they do not follow any specific guidelines or recommendations for determining LCS eligibility. Both providers reported that the EHR they use does not contain any automated alerts or reminders about LCS. They also both reported that the process for collecting and maintaining patients' smoking history begins with the nursing staff during the intake portion of patient encounters. They both emphasized that this occurs at the beginning of every patient visit. The providers reported that the information is recorded in discreet fields within a flowsheet rather than in narrative form, and that pack-year history is automatically calculated and displayed based on the inputs for years of smoking and packs-per-day smoked. However, one of the providers reported always following up with patients on the smoking history, stating that they can often elicit more truthful information by informing the patient about why the questions are being asked. The providers shared that patients may often under-report their pack-per-day amounts to

the nursing staff. Overall, both providers believed the process for collection and documentation of smoking history is sufficient at their practice.

Although each of the providers reported having ordered a LDCT for LCS within the past year, neither provider reported consistently ordering the test for LCS. Indeed, both providers also reported ordering chest x-rays for LCS. Moreover, one provider elaborated that they always begin the LCS process by ordering a chest x-ray, and will follow-up with a standard CT of the chest without contrast based on findings from the chest x-ray. One provider also reported that it is common practice within the clinic to order a standard chest CT for LCS rather than LDCT for fear of losing their patients through the LCS referral system imbedded within their EHR system. When asked for clarification, the provider explained that in the past when ordering a LDCT for LCS, a patient from the clinic had undergone LCS at a different facility and was then referred back to a provider outside of the clinic for follow-up care. Therefore, the clinic had changed their practice from ordering LDCT for LCS to ordering standard chest CTs in an attempt to avoid having their patients referred back to other practices after undergoing LCS.

Provider Knowledge of USPSTF Recommendations. Results on provider knowledge of the current USPSTF LCS recommendations were varied. Although both providers were aware that the USPSTF has LCS recommendations, neither provider was able to accurately recall all elements of patient eligibility criteria. Both providers knew that the recommended screening interval is annually, but only one knew what diagnostic test is recommended for LCS. Neither provider knew what elements of the LCS process and documentation are required in order for LDCT to be reimbursed by CMS. Both providers reported agreement with USPSTF recommendations and belief that the benefits of LDCT outweigh the risks.

Barriers to LCS. Both providers identified several barriers to LCS within their practice, including provider-related barriers and provider-perceived patient barriers. Provider-related barriers included lack of provider knowledge about patient eligibility criteria, the difficultly of the actual process of ordering a LDCT scan in their EHR, and a lack of time to discuss LCS and its importance with patients during a visit. Their suggestions to overcome these barriers included automated LCS reminder pop-ups in the EHR when patients meet eligibility criteria, a physical cheat sheet with eligibility criteria and LCS recommendation reminders visible in the office setting, and practice or guidance on ordering and obtaining insurance approval for LDCT scans.

Providers were asked about their perception of the barriers to LCS that patients experience. Both providers reported receiving pushback to LCS from patients. The perceived contributing factors to this pushback included patients thinking LCS is unnecessary, lack of transportation, financial concerns, and fear of a cancer diagnosis. Each provider believed that patient education about LCS; including the benefits of early detection, insurance coverage, and comparison of LCS to other more familiar screening tests, such as mammography and colonoscopy; could help overcome perceived patient barriers. However, lack of time during the patient-provider encounter was reiterated as an obstacle to in-depth education and discussions on LCS.

Discussion

Despite an abundance of evidence that LCS with LDCT can promote early lung cancer diagnosis and help reduce lung cancer mortality, LDCT utilization remains low. According to the literature, common barriers to LCS with LDCT include lack of provider knowledge, incomplete or inaccurate smoking history documentation, disagreement with LCS recommendations, and time constraints. The purpose of this program evaluation project was to assess levels of provider

knowledge on the updated USPSTF recommendations for LCS, to determine perceived provider and patient barriers to LCS, and to make evidence-based recommendations that may increase LDCT LCS referral rates for eligible patients at a designated clinical site.

Summary of Findings. LCS practices among providers did not follow USPSTF recommendations or any other specific published guidelines. Provider knowledge of current LCS recommendations and eligibility criteria was low. Neither of the providers was able to accurately recall the eligibility criteria for LCS as recommended by the USPSTF. Rather, they ordered diagnostic screening based on what tests they deemed appropriate for patients they believed were at high risk for lung cancer. These findings suggest that LCS is suboptimal at the clinical site and there are opportunities for improvement. Both providers generally agreed that the smoking history collection practices at their clinic are sufficient. The providers identified lack of knowledge, difficulty ordering LDCT, and time constraints as provider-related barriers to LCS. They identified patient resistance, financial concerns, lack of transportation, and fear of a cancer diagnosis as patient-related barriers to LCS.

One provider-perceived patient barrier was concern about LDCT-related costs. Of note, since neither provider knew the required elements for reimbursement by CMS, it is feasible that cost could be a significant barrier for Medicare patients whose LCS process and subsequent documentation failed to meet CMS requirements. Those patients could end up incurring undue costs as a result of low provider knowledge.

While some findings echo those from the literature, others deviate. Findings consistent with the literature are low provider knowledge of LCS recommendations (Cattaneo et al, 2018; Coughlin et al., 2020; Duong et al., 2017; Ersek et al., 2016; Kanodra et al., 2016; Lewis et al., 2019; Rajupet et al., 2017; Richards et al., 2019; Simmons et al., 2017; Triplette et al., 2018),

providers inappropriately ordering chest x-ray for LCS (Ersek et al., 2016; Kanodra et al., 2016; Richards et al., 2019; Simmons et al., 2017), and time constraints within the patient-provider encounter (Duong et al., 2017; Eberth et al., 2018; Kanodra et al., 2016; Rajupet et al., 2017; Randhawa et al., 2018; Reese et al., 2021; Simmons et al., 2017; Triplette et al., 2019). The providers at the designated practice exhibited low knowledge of LCS by being unable to correctly identify patient eligibility criteria, not knowing what elements are required in order to meet CMS reimbursement requirements, and ordering inappropriate diagnostic tests for LCS, which was consistent with the literature.

In contrast, the literature showed disagreement with USPSTF LCS recommendations (Eberth et al., 2018; Ersek et al., 2016; Rajupet et al., 2017), and inaccurate or incomplete smoking history (Brenner et al., 2018; Cattaneo et al., 2018; Kinsinger et al., 2017; Li et al., 2018; Modin et al., 2017; Reese et al., 2021) as barriers to LCS. However, neither disagreement with USPSTF recommendations, nor confidence in smoking history collection and documentation practices were identified as barriers to LCS within the designated clinic. Both participating providers verbalized agreement with USPSTF recommendations, and both providers believed that the clinic's current smoking history management practices are adequate for completeness and accuracy. These findings were inconsistent with those in the literature. Of note, however, the accuracy of smoking history data in this case is subjective. Further investigation could determine whether current practices at the clinic are in fact eliciting accurate smoking history information and documentation.

An unexpected finding was the reluctance of providers to order LDCT for fear of losing their patients to other practices through the referral process. Although some of the literature discussed providers ordering inappropriate tests for LCS due to lack of knowledge on current

guidelines, I did not find any reports of providers ordering inappropriate diagnostics to avoid referral of their patients to different practices. The approach of ordering standard chest CT for LCS rather than LDCT could certainly prove problematic for patients, as standard chest CT exposes patients to 80% more radiation than LDCT (Hoffman & Sanchez, 2017). Furthermore, since standard CT is not recommended for LCS, patients would likely incur pricey cost-sharing for this exam, as opposed to having the cost of LDCT fully covered.

Limitations. The project was limited by a low response rate from the clinic's providers. After initial contact and conversations, I was unable to elicit the participation of the two physicians at the practice despite multiple attempts. This resulted in less data upon which to base my recommendations.

Act

The "Act" portion of the PDSA involves taking information learned from the other steps in the cycle and using it to adopt process adjustments and improvements (Taylor et al., 2014; The W. Edwards Deming Institute, 2021). This portion can also include identifying next steps to fortify a new process, or to identify further needs for change.

Based on the findings from my project, I compiled a list of recommendations for the practice to address some of the areas of opportunity identified. These recommendations included provider education on current USPSTF LCS guidelines and important elements of LCS, and collaboration with a LCS nurse navigator. Ongoing provider education may improve provider knowledge of LCS recommendations, increase LDCT utilization, and decrease inappropriate referrals (Cattaneo et al., 2018; Duong et al., 2017). Nurse navigator collaboration is an effective strategy to overcome barriers to LCS with LDCT and to improve patient outcomes (Gorin et al., 2017; Watson et al., 2020). Additionally, I recommended the development and distribution of a

quick-reference information tool to assist each provider within the practice. This tool would be a small card in bullet-point form highlighting eligibility criteria for LDCT scan referral, reminders about smoking history documentation, and contact information for a designated nurse navigator.

The provider education element of my recommendations was initiated after each provider interview, as previously discussed, in the form of a PowerPoint presentation. The providers were each furnished with a copy of the presentation for future reference. The individual provider education was followed up with an in-person group information session with a designated LCS nurse navigator. All staff members and providers were invited to attend. This session was completed in February 2022, and included an introduction to the LCS nurse navigator, a full explanation of their role, a review of LCS guidelines, specifics about the processes facilitated by the nurse navigator, an invitation for questions, and a discussion of future collaboration between the practice and the nurse navigator. After the information session, the participants agreed to collaborate with the LCS nurse navigator moving forward, and to change their practices from ordering standard chest CT for LCS to ordering referrals for the recommended LDCT.

This process change represents the enactment of the Awareness-to-Adherence Model, which served as the theoretical model for this project. The model elements of awareness, agreement, adoption, and adherence correspond with the progression of the project. Initially, the providers were unaware of the updated USPSTF recommendations for LCS. The provider education portions of the project made the providers aware of the recommendations. Once the providers were aware of the updated USPSTF recommendations for LCS and the potential impact their current practice of ordering standard chest CT rather than LDCT could have on their patients, they agreed to change their practices to align with current LCS recommendations. Furthermore, after the in-person introduction and information session with a LCS nurse

navigator, they further agreed to collaborate with the nurse navigator to ensure that they consistently meet LCS guideline requirements. To successfully complete the Awareness-to-Adherence cycle, the providers must now adopt this practice change and continue to adhere to LCS guidelines in the future.

Conclusion

Lung cancer is the primary cause of cancer-related death around the world. LCS with LDCT has been shown to increase early detection of lung cancer and to decrease lung-cancer mortality. Yet, use of LDCT for LCS remains low. There are a number of barriers that contribute to low utilization of LDCT, including lack of provider knowledge, inaccurate or incomplete smoking history documentation, disagreement with LCS recommendations, and patient-provider encounter time constraints. This project was conducted in an effort to evaluate the LCS practices at a designated primary care clinic with the goal of providing evidence-based recommendations that may optimize recognition of high-risk patients and increase use of LDCT for LCS. With updated LCS guidelines from the USPSTF, many more people qualify for LCS with LDCT. Provider education, LCS eligibility reminders, and use of a LCS nurse navigator can help promote guideline-based LCS practices, potentially increasing the number of high-risk patients receiving the recommended screening for lung cancer.

Recommendations for Future Practice

Based on the collective findings from this project, my recommendations for the designated practice include ongoing up-to-date provider education on current LCS guidelines, LCS eligibility reminders, and utilization of a LCS nurse navigator to facilitate the referral and follow-up processes. In the future, the practice may also benefit from tracking the number of eligible patients for LCS and the number of referrals being made to assess whether LCS is being

optimized. Further investigation could more objectively and thoroughly examine smoking history collection practices among nursing staff and the accuracy of the information documented. Additionally, interventions to determine patient-reported barriers to LCS may provide helpful information for further opportunities for improvement. Future research is needed to determine the impact of vaping on a patient's eligibility for LCS.

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Appendix A

Provider Interview Questions Outline

Current Practices/Workflow

1. What is your current practice for determining lung cancer screening (LCS) eligibility for your patients?
    a) Are there any specific LCS guidelines that you follow?
2. Does your EHR contain automated alerts or reminders about LCS?
3. What are the current practices for collecting and maintaining patient smoking hx?
    a) Do you know if pack year history is calculated/documented?
4. What do you currently do if you recognize that a patient qualifies for LCS?
5. In the past year, have you ordered low-dose computed tomography (LDCT) for LCS?

Provider Knowledge about USPSTF LCS Recommendations

6. Are you familiar with the current USPSTF guidelines?
    a) Eligibility criteria
    b) Appropriate diagnostics for screening
    c) Screening intervals
7. Do you know what elements are required in order for LDCT to be reimbursed by CMS?

Provider Barriers to LSC

8. What barriers to LCS, if any, do you experience as a provider?
9. If any barriers identified, what do you think could aid in overcoming those barriers?

Perceived Patient Barriers to LCS

10. What barriers to LCS, if any, do you think that patients experience?
11. If any barriers identified, what do you think could aid in overcoming those barriers?

Provider Beliefs

12. Do you agree with USPSTF guidelines; do you think they are appropriate?
13. Do you think that the benefits of LDCT for LCS outweigh the risks?

Provider Demographic Information

14. How many years have you been practicing?

15. Do you belong to any professional organizations?