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Lung cancer screening: Practice guidelines and insurance coverage are not enough

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Abstract

Background and purpose: Low-dose computed tomography (LDCT) is expected to increase early detection of lung cancer and improve survival. The growth in the number of advanced nurse practitioners (NPs) in primary care settings increases the likelihood that an NP will serve as a patient's provider. This study's purpose was to examine knowledge, attitudes, and practices regarding LDCT among NPs who work in primary care settings.

Methods: An explanatory, sequential, mixed-method design used a 32-item questionnaire, followed by a semi-structured telephone interview. The development of the survey and interview questions were guided by a conceptual framework representing a temporal sequence for behavior change and potential barriers to guideline adherence.

Conclusions: Nurse practitioners believe that shared decision making with their high-risk patients about LDCT is within their scope of their practice. Working in time-constrained primary care settings, NPs have limited abilities to improve the uptake of LDCT. Substantial patient barriers exist that deter follow through on providers' recommendation. Disseminating guidelines and authorizing health insurance reimbursement is insufficient.

Implications for practice: Research is needed that investigates the screening process so that barriers can be closely studied. Culture change is needed where early detection has greater value for insurers, providers, and patients.

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Keywords

Cancer screening; diagnostic imaging; early detection of cancer; lung neoplasms; multimethod research; nurse practitioners; primary care; thoracic

Although the incidence of lung cancer has decreased over the past 30 years, the American Cancer Society (ACS) estimated that 222,000 new lung and bronchus cancer cases would be diagnosed in 2017, accounting for 25% of all new cancer diagnoses (ACS, 2017). Rates by sex are similar, with an estimated 116,990 men and 105,510 women newly diagnosed (Siegel, Miller, & Jemal, 2017). Lung cancer mortality is also high. Of the almost 600,000 all-cause cancer deaths in the United States, 27% are attributed to lung cancer (Siegel et al., 2017), in part because of delays in presentation and diagnosis in advanced stages (Verma et al., 2015).

Symptoms of early-stage lung cancer may include persistent cough, hoarseness, recurrent pneumonia or bronchitis, and/or shortness of breath. Unfortunately, as these symptoms may be identical to those of other disorders caused by tobacco smoking (e.g., chronic obstructive pulmonary disease), lung cancer frequently remains undiscovered until the cancer has reached a regional stage (i.e., metastasis to nearby lymph nodes, tissues, or organs) or distant stage. The overall 1-year and 5-year survival rates for lung cancer are 44% and 18%, respectively; however, with early detection, the 5-year survival rate improves dramatically—to approximately 55%. More than half of lung cancers are detected at a distant stage, when the 1-year and 5-year survival rates are 26% and 4%, respectively (Siegel et al., 2017). Dependable early-detection methods are essential to increasing survival and quality of life for patients diagnosed with lung cancer.

In 2011, the results of the National Lung Screening Trial (NLST) were released, comparing the effectiveness of using single-view chest x-ray (CXR) and helical low-dose computed tomography (LDCT) in reducing mortality. This trial randomized more than 53,000 patients at high risk of lung cancer (defined as adults aged 55–74 years who were current smokers with a 30-pack-year smoking history or had quit smoking within the previous 15 years). These patients received either three annual screenings with CXR or LDCT. Lung cancer mortality decreased by 20% for patients randomized to the group receiving annual LDCT screening compared with those who received annual CXR (NLST Research Team et al., 2011). A cost-effectiveness study of the NLST showed that LDCT screening costs an additional \$1,631 per patient or \$81,000 per quality-adjusted life year gained in comparison to no screening which experts consider below the \$100,000 threshold (Black et al., 2014). The pilot United Kingdom Lung Cancer Screening produced results consistent with those of the NLST, and an examination of quality-adjusted life years suggested the cost effectiveness of LDCT screening (Field et al., 2016). The interval results of the ongoing joint Dutch–Belgian Randomized Lung Cancer Screening Trial are consistent with those of the NLST and United Kingdom Lung Cancer Screening Trial (Horeweg et al., 2013).

In 2013, the United States Preventive Services Task Force (USPSTF) recommended annual LDCT screening for adults aged 55–80 years who have a 30-pack-year smoking history and who currently use tobacco or who have stopped smoking within the previous 15 years

(Moyer & USPSTF, 2014). Other organizations—including the ACS (2017), the National Comprehensive Cancer Care Network (Wood et al., 2012), the American College of Chest Physicians (Detterbeck, Mazzone, Naidich, & Bach, 2013), and the American Lung Association (2015)—have incorporated LDCT screening into their recommendations. Although slight differences in eligibility criteria exist across groups, the consensus is that screening should begin at an age of 55 years and include patients who have a 30-pack-year or longer history.

Although implementation of high-quality lung cancer screening is widely supported, concerns about using LDCT—including radiation exposure, false-positive rates, compliance with annual screening recommendations, and the cost to patients—have been raised (Gill, Jaklitsch, & Jacobson, 2016; van der Aalst, Ten Haaf, & de Koning, 2016). Similarly, there has been some apprehension about adopting LDCT screening in community-based settings that may not have access to multidisciplinary physician teams able to manage abnormal findings or radiologists with experience in interpreting LDCT chest scans (Zeliadt et al., 2018). Nevertheless, the Patient Protection and Affordable Care Act requires that insurers cover all USPSTF grade A and B screening recommendations with no out-of-pocket costs (United States House of Representatives Office of the Legislative Council, 2010). Furthermore, the Centers for Medicare and Medicaid Services (CMS) issued a decision memo, authorizing coverage for LDCT screening for eligible Medicare beneficiaries in 2015 (CMS, 2015). Given the unique set of risks and benefits associated with LDCT screening, CMS also established a requirement that screening candidates complete a shared decision-making (SDM) visit (and smoking cessation discussion for current smokers) with a primary care provider before obtaining an LDCT scan. Despite the broad support for LDCT screening by professional organizations and insurers, uptake has been very limited (Henderson et al., 2017). Similarly, recent changes in screening recommendations for other cancers have not been readily adopted by primary care providers, including nurse practitioners (NPs) (Haas et al., 2016).

Recent studies that explored physicians' knowledge, attitudes, and referral patterns for LDCT screening reported low referral rates, referrals for noneligible patients, and inappropriate use of CXR. Numerous barriers were described, including concerns about the generalizability of the NLST findings and uncertainty about the screening benefit-versus-harm ratio. Physicians were concerned about the persistent lack of institutional infrastructure to support screening referrals, the complexity of the required SDM discussions, and documentation requirements (Duong et al., 2017; Ersek et al., 2016; Henderson et al., 2011; Hoffman et al., 2015; Lewis et al., 2015; Raz et al., 2018; Volk & Foxhall, 2015). Recent national surveys reflect ongoing concerns about institutional, provider, and patient barriers to LDCT screening use (Eberth et al., 2018; Zeliadt et al., 2018).

There are currently 220,000 licensed NPs in the United States, and 83% are certified in one of the primary care fields. The greatest numbers (55%) are certified in family practice, and another 20% are certified in adult and adult-gerontology primary care (American Association of Nurse Practitioners, 2016). It is estimated that, by 2025, there will be 244,000 or more NPs in the country (Auerbach, 2012). This growth in the number of advanced practice nurses increases the likelihood that an NP will serve as a patient's primary care

provider. Nurses have been on the forefront of primary prevention of lung cancer through smoking cessation efforts and now have the opportunity to be involved in secondary prevention through screening and early detection (Smith, Kepka, & Yabroff, 2014).

Only one study conducted before NLST (Lawvere et al., 2003) examined NPs' knowledge, practice, and attitudes about the early detection of lung cancer and the management of patients at high risk of lung cancer. At that time, most NPs selected either CXR or sputum cytology as their detection method of choice, although both methods had been shown ineffective at diagnosing lung cancer in earlier stages (Lawvere et al., 2003). Understanding how NPs feel about lung cancer screening in general, what they know about LDCT recommendations, and to what extent they implement these recommendations is paramount to early detection and to achieving gains in public health. This study's purpose was to examine knowledge, attitudes, and practices regarding LDCT among NPs who work in primary care settings.

Method

A conceptual framework representing a temporal sequence for behavior change and potential barriers to guideline adherence was used to guide the study (Figure 1). Cabana et al. (1999) conducted a comprehensive review of qualitative and quantitative literature and found that most barriers could be characterized using a framework of knowledge, attitudes, and behaviors, yielding a unique model that incorporates self-efficacy and outcome expectancy as important behavioral constructs. Physician adherence to practice guidelines varies substantially (Cabana et al., 1999; Iskandar et al., 2015), and we expected NPs' adoption of lung cancer screening guidelines to follow a similar pattern.

This study used an explanatory, sequential, mixed-method design (Guetterman, Creswell, & Kuckartz, 2015), which included three phases of data collection and analyses: (1) collection and analysis of the initial quantitative data; (2) collection and analysis of the follow-up qualitative data; and (3) data integration with the purpose of exploring how the qualitative data facilitated a more complete understanding of the quantitative data.

The quantitative questionnaire used in the study was originally created for a study of family practice physicians in South Carolina (Ersek et al., 2016). A team of family physicians, nurse researchers, lung cancer experts, and epidemiologists drafted the original survey and reviewed this new one after it was adapted to fit the needs of NPs, the specific population for this study. The final questionnaire consisted of 32 questions. A variety of question types (e.g., multiple-choice, Likert-scale, and open-ended) was used to assess NP demographics, practice settings, and typical patient populations. The questionnaire also assessed NP knowledge, opinions, and behaviors in regard to LDCT screening referrals, along with their experience in using an SDM approach with patients in the case of lung cancer screening. The subsequent semi-structured qualitative interviews were directed by an interview guide developed after careful review of the theoretical framework and initial survey results from South Carolina family physicians. The script included questions such as "Tell me about your knowledge regarding low-dose CT screening," and "What did you think are the greatest

facilitators to getting screenings done?” The Institutional Review Board of the University of South Carolina approved this study.

Sample

We purchased from InFocus Marketing a random national sample of 5,000 NPs, who self-identified as practicing in a primary care setting. The sample source had access to state licensing board data. We recruited participants in two waves. Wave 1 ($n = 3,000$) consisted of sending an introduction letter with an option to complete either an online questionnaire or a TeleForm survey, which participants returned using a prepaid return envelope. Each participant was assigned a unique PIN number to be used on both the online survey (as an access key) and the TeleForm survey. Wave 2 ($n = 2,000$) consisted of only a cover letter and an online survey invitation.

Procedure

Survey distribution was initiated during the summer of 2016. Data collection from the surveys and interviews was completed within 1 year. As an incentive, participants who provided their contact information and participated in a follow-up telephone interview received a \$50 Visa gift card as a “thank you” gift. No incentives were provided to those who completed only the survey portion of the study. A database was created to track survey mailings and responses. Data from the TeleForm surveys were scanned and combined with the online survey responses.

Of the 305 NPs who provided additional contact information, 15 were selected for the qualitative telephone interview. Selection criteria were limited to NPs who submitted their contact information (i.e., gave permission to be contacted for further interview). Our selection was also based on whether the NP had patients who asked whether they can or should be screened for lung cancer. The selection process started with the NPs with the largest number of patient inquiries. Initially, the NPs were contacted by email to establish an interview appointment. After consent was obtained over the phone, audio-recorded interviews were conducted and lasted 1 hour or less. The data were transcribed for analysis by a professional transcriptionist. Finally, the principal investigator compared the transcripts with the audio recordings to ensure that the text represented the participants’ statements accurately.

Data analysis

Descriptive statistical analysis of the quantitative data was performed using Stata (v.14) to assess primary care NPs’ knowledge, attitudes, and practices regarding LDCT screening (StataCorp. LLC, College Station, TX). The qualitative interview data were analyzed using a thematic analysis approach (Braun & Clarke, 2006). As a group, two doctorally prepared research nurses with experience in qualitative data collection and analysis, along with one baccalaureate student, met to review data analysis procedures and code one interview transcript. This meeting involved a discussion on personal reflexivity and acknowledgment of how individual experiences and previous knowledge influence interpretations of the data (Dowling, 2006).

The group began data analysis separately, reading and rereading the transcripts to familiarize group members with the data, constantly considering the possible effects of variable contextual factors, including practice setting, guideline knowledge, barriers, and facilitators on the part of both the providers and patients. During the identification of initial codes, the researchers theorized how the framework revealed relationships and connections, leading to the emergence of initial themes. The researchers then came back together to discuss their findings and review, define, and name the final themes. Finally, the quantitative and qualitative results were integrated to more robustly represent how NPs experience, understand, and implement LDCT screening.

Results

Quantitative results

Participants' characteristics.—Nurses responded from every state in the United States, with a greater response from the mailed paper survey (wave 1; 74%). A total of 380 NPs completed the questionnaire (Table 1). Most responders were women (89%) and between the ages of 30 and 59 years (75%). In terms of work setting, 27% worked in private practice, 17% in hospital settings, 16% in group practices, 14% in community health centers, and the remaining 26% in a variety of other environments (e.g., health maintenance organizations, universities, retail). A majority of participants (59%) reported working in urban settings. Most respondents (94%) were board certified, and a large majority (78%) described their specialty as family medicine. Most (87%) held a master's degree, with a few holding a doctorate (10%). A majority said that they practice with 2–5 colleagues as providers (43%) and see 11–20 patients per day (53%). A fully electronic medical record is used in most practices (85%), with only a few having an LDCT screening alert system based on age and smoking status (11%). Nearly half (48%) care for a pre-dominantly Medicare-insured population.

Nurse practitioner knowledge. Nurse practitioner knowledge was assessed using several clinical scenarios (Table 2). Four vignettes were presented, in which patients varied in age, smoking status, smoke exposure, quitting history, and family history. The NPs were asked to select a screening strategy based on published guidelines that they would recommend (no screening, screening with CXR, or LDCT). Nurse practitioners were instructed to assume that these patients had no symptoms of lung cancer, no exposure to occupational carcinogens, and no previous screening for lung cancer.

A majority of NPs (68%) selected LDCT for the correct vignette (3) that reflected the USPSTF criteria. For vignette 1, which described a 50-year-old nonsmoker with three decades of smoking “exposure only,” 38% selected the correct option of recommending no screening. Chest x-ray was a common recommendation for all four vignettes, despite the fact that no guidelines currently recommend CXR as a screening strategy.

Nurse practitioner attitudes. A substantial majority of NPs (78%) agreed or strongly agreed that the benefits of LDCT outweigh the risks for patients at risk of lung cancer (Table 3). More than half agreed that there is substantial evidence that LDCT screening saves lives

(55%) and is a cost-effective strategy for screening (52%). About 42% of participating NPs acknowledged that the false-positive rate is unacceptable.

Nurse practitioner behaviors. Nearly one-quarter of the NPs (24%) had not yet tried to order an LDCT screening for a patient and thus were unaware of any particular barriers. More than one third of the participating NPs (34%) reported that previous authorization was required by health insurance companies. This was described as the greatest barrier to ordering LDCT screening for patients at high risk of lung cancer (Table 4). A few participants (11%) reported that their patient population lacks any health insurance coverage. A very small number (1%) reported receiving a coverage denial. Other practical concerns were not commonly reported. For instance, very few indicated uncertainty regarding how to document screening eligibility in the medical record (2%), a lack of a suitable nearby radiology center (2%), or transportation or financial challenges for their patients (3%). A few (8%) wanted to know more about LDCT screening before referring their patients. Most NPs perceived the time commitment to engage in an SDM discussion with a patient as an important barrier. These participants agreed that an SDM discussion must be brief in order for it to fit into their daily practice. When questioned about the amount of time for such a discussion, a strong majority of NPs (92%) admitted that they were “likely” to engage in SDM if it required less than 3 minutes (Table 5).

A majority of NPs (61%) reported that, within the previous 12 months, no patients had asked them about screening for lung cancer (Table 6). Nurse practitioners (40%) reported that they had initiated a conversation with patients about LDCT screening. Only 12% described always discussing LDCT screening with asymptomatic, high-risk patients. In the same time period, a majority of NPs (57%) did not order a single LDCT screening, whereas 26% ordered between one and five screenings. Only 3% had used the Medicare billing code (G0296) for an SDM visit. In terms of SDM, most participants (72%) stated a preference that “my patient and I make the decision about lung cancer screening together.” Exactly half strongly agreed that they felt comfortable engaging in a brief SDM conversation with their patients.

Qualitative results

Three emergent themes illustrated the inherent, overarching challenge of NPs need to constantly consider multiple and often competing issues when evaluating whether, when, and how to follow the most recent lung cancer screening guidelines. These three themes are discussed in detail below and were used to organize related subthemes that more specifically illustrated insights of this study regarding LDCT screening: (1) LDCT screening decision making: Competing demands; (2) Guideline adherence: Identifying and responding to patient challenges; and (3) Optimizing evidence-based practice: Provider facilitators and barriers. We include participant quotes to illustrate these themes; minor grammatical edits made to enhance readability did not affect the content of their statements (Corden & Sainsbury, 2006).

Theme 1: Low-dose computed tomography screening decision making—Competing demands.—Nurse practitioners faced the complex task of balancing their

knowledge of LDCT guidelines with the expectations and constraints of the NP role. Nurse practitioners described feeling “overwhelmed” by the need to consider competing demands within the context of providing excellent patient care (e.g., system demands related to patient turnaround time or regulations associated with the Affordable Care Act). In addition, as these NPs indicated that their patients never or very rarely requested screening of any type, they were completely responsible for initiating the conversation on the appropriateness of LDCT screening.

Low-dose computed tomography screening decision making. Most NPs were aware of current LDCT guidelines, as well as the efficacy of LDCT based on trial evidence, and used this knowledge to guide screening decision making. NPs indicated that they learned this information from professional journals and websites, colleagues, and their own literature searches. However, one NP questioned the legitimacy of the information received from a local facility that had a financial interest in obtaining patient referrals

The major imaging center in our area would come and give us sort of bullet points on the major governing bodies and sort of help us to give them business. So, hopefully they were feeding me accurate information. They come into the offices. They bring lunches. They had pre-printed script pads for the LDCT scan. They had pamphlets that you could keep in your waiting rooms. I mean, they pushed pretty hard, obviously, to get our business.

Even so, the vast majority of interviewees could accurately relay screening guidelines and understood the increased efficacy of LDCT over previous treatment recommendations:

I know that they’ve done a lot of research. And that they used to recommend just a simple chest x-ray, and they found that chest x-rays can miss some things, and that’s why they recommend a CT of the chest—the low-dose one.

Interviewees could accurately relay the decreased risks of LDCT: “It [LDCT] has a better sensitivity with finding lung nodules with less radiation exposure. So, in that way, it’s safer and certainly more cost-effective.” The interviewed NPs could also relay location-specific knowledge: “Because of where we’re located geographically, we get a decent number of patients who are diagnosed with lung cancer, and it’s associated with 9/11, the World Trade Center.”

The complexity of the patients’ conditions affected whether some NPs decided to offer screening:

If they already have other compounding medical issues, at this point, why add one more? And I’ve had several train wrecks that could be like that too. So, you know, they already have kidney problems. Why try to find out if they have lung cancer too?

Other NPs firmly held that decision making should be a shared process between the provider and patient:

I think you have to take that shared approach with your patients to get anything done with them or for them. And if they’re not in agreement at the time that you see

them, you can at least say, “Well, you can chew on that,” and then go from there. But, definitely shared.

The role of providers in low-dose computed tomography screening.: Most NPs were adamant that recommendations for screening lay squarely within the primary care provider’s scope of practice and that they (the NPs) should take advantage of every engagement opportunity to suggest LDCT screening if the patient met the eligibility criteria for it: “I think the majority of the time, the primary care provider should be the one discussing these things with the patient, and then send them to the specialist.”

Respectful working relationships with local pulmo-nologists or other specialists facilitated follow-up care if screening indicated the need for a referral:

We have a handful of pulmonologists that we use frequently, and we have a very good relationship, where I could call them on the phone and say, “Hey, I’m going to be sending this patient to you. This is their name. This is what I’m concerned about.” And they’ll be like, “Okay, great, thanks for the heads-up. We’ll look out for them.”

However, NPs often needed to creatively negotiate system constraints associated with ordering the screening, such as obtaining insurance approval:

Well, I don’t think I would have a problem doing it myself [ordering LDCT screening], but it definitely has a higher rate of approval if a specialist is ordering it, and then referring it to me to actually do the manual work.

The influence of others on decision making about screening.: The NPs interviewed for this study generally evaluated their patients and made evidence-based recommendations. However, there were circumstances in which some NPs felt compelled to practice in ways contrary to established lung cancer screening guidelines. For example, although these NPs did not experience conflict with specialists such as pulmonologists, some experienced tension with clinic colleagues who opted for a different approach to lung cancer screening. One related how the power differential between her and her physician employer (who had a financial interest in CXR screening) influenced the screening process implemented at her practice site:

Well, it [LDCT] is supposed to be more efficient at screening for lung cancer than just routinely doing x-rays, which [pause] the other physician in my office did a lot more chest x-rays on patients with a high smoking history who were over 50... [He] recommended that you offer them an x-ray, because it was incredibly cost-efficient and convenient at our site.

Consideration of patient desires and fears also affected NP decision making:

I think everybody has probably sent somebody for screening who really didn’t meet criteria, but they were just so anxious about it, and spent so much of their time thinking about this ... that they’re just better off with, “Okay, let’s go get it done, if that’s what’ll, you know, help you sleep at night.”

Theme 2: Guideline adherence—Identifying and responding to patient

challenges.—The NPs interviewed for this study consistently conveyed that the ability to provide excellent care was impossible without understanding the patient’s circumstances. However, this understanding often affected their ability or willingness to recommend LDCT screening.

I need to advocate for the patient. Is this the best time for this patient to undergo a cancer screening? What are this patient’s health care priorities?

Complex comorbidities. Screening for a potential problem seemed trivial when faced with the need to address existing, substantial concerns. Each NP related an experience with the multitude of patient issues that required attention during each appointment. One NP noted:

So you have to cover diabetes, hypertension, anemia, anything else, in that visit. Oh, and by the way, they probably have bronchitis or some other illness They have an infestation of bedbugs, or scabies, or something else that you have to talk to them about.

The NPs also expressed the need to consider the patient’s priorities:

It just seems like—at least, my population that I serve is very sick, underserved, underinsured, and usually the least of their concerns is that something may potentially be happening. They’re more worried about what is happening. Or what they perceive to be a problem, more so than what health-care providers perceive as a problem.

These NPs related that the reliance on acute, episodic care by the vast majority of their patients, coupled with patient resistance to preventive care, often resulted in unrealistic patient expectations:

I mean, we are a quick Band-Aid America these days. Everybody wants to continue to eat their junk food and smoke their cigarettes, and then they want to come to the hospital for a quick fix. They want me to fix it immediately. Honestly, I think that is the problem.

Nurse practitioner-related delays in appropriate care. Most of our patients are seeing us for the first time. They haven’t seen a provider in 10 years or longer, and they’ve never had any screenings done. Being referred to one more provider is going to take time So, when they already haven’t had healthcare for 10 years, making them wait months to see a specialist is just delaying their care longer.

Patient knowledge and attitudes. In addition to considering patients’ complex physical issues, NPs also had to take into account patients’ knowledge deficits related to a lack of public awareness. One NP said:

The American Heart Association has done a great job. Everybody wants to know their cholesterol level. You hear a lot about that and other screenings like Pap smears. But I don’t think that I’ve ever had one person ask about lung cancer screening.

Nurse practitioners also reported encountering patient fear and the psychological consequences of waiting for follow-up if LDCT screening revealed a suspicious nodule that did not warrant immediate intervention. A common occurrence encountered by these NPs was a sense of fatalism on the part of patients that was difficult to overcome:

The biggest barrier is that they've made their mind up. They're set in their ways. You know, they're going to die of something, so—why not lung cancer? I don't know. They have that kind of mentality. So the patient actually being open to it—that's the biggest barrier we hit.

Another common occurrence was outright denial or unwillingness to change behaviors:

A couple of them have said that they don't want something [i.e., lung cancer screening] because, "Well I don't plan on quitting smoking, so I don't want to have any testing done." And then I've had a couple [of patients] who say, "Well, if I found something, I wouldn't want to know."

Financial constraints.: Practical issues such as economic pressures on patients are well documented and were a concern as well. A common experience among NPs when developing patient care plans was a perceived responsibility to consider how following LDCT recommendation guidelines may financially affect their patients:

I talk to them about lung cancer screening, and the hospital that we're associated with charges, I think, like 99 bucks for a LDCT. But most of them can't afford a \$4 prescription, let alone \$100 for a CT scan.

Even the costs associated with transportation were problematic for some patients:

For some of my patients who are on fixed or very little income, it's hard for them to actually get to one of the hospitals that can do the screening. Gas money seems to be a barrier for them.

In many NP practice locations, insurance covered the initial screening CT. However, if a suspicious nodule was identified, any follow-up imaging was considered diagnostic rather than preventive and was not covered by insurance, thus making it cost prohibitive: "A lot of these low-cost insurances have very high deductibles, like \$6,000 deductibles. And that's really a lot of pressure for some families."

The financial burden of follow-up affects patient decision making. One NP reported "Once they've been screened, they don't want to go and do it again every year. They say, 'Okay, I'm fine, there's nothing wrong with me. Maybe in a few years I'll check again.'" Financial concerns also affected provider decision making:

A lot of our patients have high deductibles and, you know, out-of-pocket expenses for patients are high. So, unless they're sick, I oftentimes don't talk people into doing things that cost a lot of money.

Responding to barriers.: Nurse practitioners also had to consider the implications of screening barriers when assessing patients' need for screening and facilitate negotiation of

these challenges. One NP took a professional self-preservation approach when faced with patients unwilling to follow provider recommendations:

I do hear about some providers who dismiss a patient from their practice around issues like that. You know, “If you’re not going to follow the guidelines, then I don’t want a bad outcome on me.” That sort of mode of thinking. But we would not do that in our practice.

Nevertheless, in general, NPs reported using their knowledge of the contextual and individual patient factors to craft targeted interventions designed to facilitate better patient outcomes. For example, one NP anticipated potential patient barriers in the face of a positive screening result and incorporated solutions into patient care plans:

[I] bring them back into the office. I usually call them myself. I don’t let the secretaries or the medical assistants call. I just say, “We need to talk,” and, “Can you come in today?” I will already have an immediate appointment set up with a respiratory specialist. And then when they come in, I have the next appointment scheduled. “Well, you’re going to see Dr. Smith at four o’clock tomorrow.” I don’t want it to wait and that’s the way I handle it.

Other NPs included pragmatic solutions targeted to their particular location and patient population: “We implemented a service at our office, because of how poor our population is, where we actually pay for a taxi service so that they can travel to their appointments.”

Theme 3: Optimizing evidence-based practice—Provider facilitators and barriers.—The NPs in this study identified specific tools and structural conditions that facilitated or hindered their ability to offer appropriate LDCT screening to their patients.

Financial incentives.: For some NPs, the ability to bill for SDM visits was a financial incentive to complete the screenings:

Actually, our coder who comes around at least once monthly had mentioned that [ability to bill for SDM visits] to us before. I think we’re still trying to work on how to be more proficient in that, so that it doesn’t become too time-consuming compared to the amount of revenue [laughs] that you can bill for.

Optimal system management.: When clinic systems (such as electronic medical record reminders) and personnel knowledge were congruent regarding LDCT screening, the NPs felt supported in their ability to provide appropriate screening recommendations to their patients, and patients were much less likely to be overlooked:

We use a check-off sheet with our patients, when they’re coming in for an annual exam. One of the questions prompts us to remember to ask them about screening... I think it’s like auto-populated in our electronic medical record. Because the guidelines are always changing, it’s hard to keep it straight... I think that the tool being built into our electronic medical record really helps... We have a very good administrative assistant in our office who handles all the referrals. She’s like the referral manager. And she does a really good job at getting insurance approval and this and that.

Provider inhibitors.: When systems were not co-ordinated to facilitate individual practice, NPs indicated that they forgot to offer the screening or other concerns took precedence. Other inhibitors to optimal, evidence-based practice included individual provider knowledge deficits:

I'm really personally nervous about the radiation exposure. And I didn't know that we can just jump to CT, or that we can start out screening with CT first. I thought it had to be chest x-ray first. Since that's what most of my colleagues are doing, that's what I tend to do too. So I haven't really just jumped to CT.

Another inhibitor is ingrained group practice patterns: "And I think we are so ingrained in doing chest x-rays first ... [laughs] because that's been the longest practice. Do a chest x-ray. You know? So, this is relatively actually new, doing the LDCT scans."

Finally, in rural settings, provider turnover inhibited NPs' ability to provide consistent care within their practice setting:

We have a lot of turnover with physicians and even nursing staff, currently. So until we can keep people long enough to start setting up some of that stuff, I don't know if it's ever going to happen. In rural communities, we get a lot of physicians who come here for short periods of time. You know, they sign a contract to work here to pay off their school loans for a couple, 3 years, and then they go home. *It's a rural area.* People don't dig it here.

Mapping quantitative and qualitative data—Mixing methods (i.e., collecting quantitative and qualitative data) facilitated a deeper interpretation of the survey responses. Both quantitative data generated by the survey and qualitative data generated from the telephone interviews were mapped against the conceptual framework of sequential change as proposed by Cabana et al. (1999). The framework (Figure 1) characterizes barriers as related to knowledge, attitudes, and behaviors. Our data show a high level of congruence between the conceptual framework and the quantitative and qualitative data.

Discussion

Clinical practice guidelines are systematically developed statements designed to guide health care providers and consumers in making decisions about the best care for specific clinical situations (Cabana et al., 1999). Successful guideline implementation accelerates the translation of research advances into clinical practice. However, the up-take of newly approved guidelines for cancer screening is a slow process that can be challenging and complex for practitioners in clinical or community-based settings (Kinsinger et al., 2017). Physician adherence to cancer screening guidelines is commonly studied. However, NP adherence is less studied and yet is critical to the translation of screening recommendations into improved outcomes (Haas et al., 2016). Nurse practitioners comprise the largest group of nonphysician primary care providers in the United States, and in rural areas they are becoming more central to the provision of primary care, especially for underserved, at-risk populations (Agency for Healthcare Research and Quality, 2012; Spetz, Skillman, & Andrilla, 2017).

In this national study, the response rate was lower than expected, despite using two response modalities. We implicate four factors with this response rate. First, the American Association for Public Opinion Research (AAPOR) acknowledges that response rates across all modes of survey administration have declined, in some cases precipitously (AAPOR, 2017). This drop is consistent with the response rate of mail surveys among groups of health professionals (Cho, Johnson, & Vangeest, 2013). Second, NPs in non-primary care adult settings may have been less likely to respond to the survey because it may have been outside their scope of practice. In addition, the response rate may reflect a lack of familiarity with lung cancer screening guidelines. Finally, the lack of financial incentive for survey completion may have played a role.

According to screening guideline adherence conceptual framework, knowledge, attitudes, and behaviors affect NPs' ability to execute recommendations. Overall, this study revealed that knowledge and attitudes about lung cancer screening among a majority of NPs was suboptimal. Although the NPs were familiar with the existence of the USPSTF guideline, a minority of responders (35%) selected the correct screening strategy for a variety of patient scenarios. Clinical behaviors and practice patterns lagged behind their knowledge. Moreover, most NPs had not ordered an LDCT scan in the previous 12 months. Very few were familiar with the Medicare billing code used for SDM. The NPs spoke openly about their patients' financial situations and competing health care demands. Although the initial screening would be free for many patients, additional scans and procedures together with the required deductibles would increase cost and inconvenience. The direct and indirect costs related to transportation and inevitable time off from work were sufficiently burdensome to lead patients and their providers to avoid the situation. Substantial external barriers that thwarted provider referrals included workload, lack of institutional administrative and electronic support systems-based solutions, availability of educational materials to facilitate brief SDM encounters, marketing materials to help identify high-risk patients and facilitate the referral process, and follow-up clinical resources for patient surveillance and treatment referrals.

Although most NPs described wanting to be involved in SDM regarding lung cancer screening, many reported not initiating conversations about the risks and benefits of LDCT screening. Barriers exist that prevent SDM engagement. Time is an influential factor related to SDM. When asked about the average number of patients seen per day, 24% of the NPs reported more than 20 patients per day (Table 1). When the SDM process took more than 8 minutes as opposed to less than 3 minutes, the commitment to engaging in it decreased substantially (from 92% to 37%). Further documentation is needed on the role of the NP in recommending cancer screening and engaging in formal SDM for LDCT screening.

In addition to its mixed-methodology design, a strength of this study is that it is the first survey targeting NPs since the publication of the NLST results (NLST Research Team et al., 2011), the release of the screening recommendations from the USPSTF in 2013, and the CMS decision to provide coverage. As providers of care for most patients, all primary care providers play an essential role in the early detection of lung cancer.

Several limitations in our study should be noted. The response rate by this large sample of NPs was not optimal and limits the generalizability of our findings. A very high proportion of the sample ($n = 305$; 80%) agreed to the qualitative interview, which garnered them a \$50 gift card in exchange for their participation—suggesting the importance of the “thank you” gift. Providing a gift for survey completion would likely have increased our analytic sample size. Of interest, approximately 69% of participants ($n = 254$) provide care to a primarily younger (<55-year-old) or mixed-age population of patients. This may have been a key factor in the lower survey response rate meaning that perhaps the survey was not relevant to their major focus of their practice with patients. Primary care providers are responsible for keeping abreast of a large volume of recommendations for screening services. It is understandable, therefore, that primary care providers prioritize the integration of frequently used guidelines for their patient populations. This lack of familiarity may affect survey participation and the actual responses.

Conclusions

This study illustrates the strengths of using a guideline uptake among NPs in primary care settings. The explanatory sequential design allowed for a much deeper interpretation and expanded view of the barriers that emerged. This study helped foster greater understanding of the complexity of patient-related barriers, the difficulty in changing long-standing practice patterns, and the lack of systems-based solutions in primary care practice environments. Indeed, NPs seemed to welcome the opportunity to share with us the difficult aspects of their primary care practice as it relates to the translation and adoption of a cancer screening guideline. If this conclusion is correct, then the findings of this study have serious implications for the uptake of clinical guidelines for cancer screening.

In this study, the barriers far outweighed the facilitators. Approving and disseminating clinical practice guidelines and authorizing health insurance reimbursement are not enough. We agree with Haas et al. (2016) that it is imperative for guideline-issuing organizations to work with patient and provider stakeholder groups to ensure that stakeholder concerns are addressed. It cannot be overstated that lung cancer is the most common cancer and leading cause of death in men and women (Smith et al., 2017). We have the knowledge and technological capabilities to significantly reduce this burden, but we must be realistic that greater progress will not be made until a culture change occurs in which the early detection of cancer has greater value for policy makers, insurers, providers, and patients.

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Figure 1.

A conceptual framework of barriers to screening guideline adherence in practice. Reprinted/ adapted from "Why Don't Physicians Follow Clinical Practice Guidelines? A Framework for Improvement," by M. D. Cabana, C. S. Rand, N. R. Powe, A. W. Wu, M. H. Wilson, and P. C. Abboud, 1999, *Journal of the American Medical Association*, 282(15), pp. 1,458–1,465. Copyright 1999 by the American Medical Association.

Table 1.Demographics and practice characteristics of nurse practitioner respondents (*N* = 380)

Demographics	<i>n</i> (%) ^a
Sex	
Female	340 (89)
Age range, years	
20 to 29	21 (6)
30 to 39	87 (24)
40 to 49	96 (26)
50 to 59	94 (25)
60 to 69+	71 (19)
Years since graduation from NP program	
0 to 10	329 (88)
11 to 20	28 (8)
21 to 30+	15 (4)
Specialty	
Family medicine	287 (78)
Board certified	
Yes	357 (96)
Highest educational level	
Master's degree	322 (87)
Doctoral degree	37 (10)
Other	12 (4)
Practice setting	
Hospital	63 (17)
Private practice	161 (44)
Health maintenance organization	5 (1)
Community health center	51 (14)
Medical or nursing school/university	9 (2)
Retail environment	16 (4)
Other	65 (18)
Rural or urban setting	
Rural	136 (37)
Urban	217 (59)
Not sure	15 (4)
Number of providers in practice	
1 to 5	195 (52)
6 to 10	61 (16)
11 to 15	39 (11)

Demographics	<i>n</i> (%) ^a
16 to 20+	76 (20)
Average no. of patients per day	
1 to 10	83 (22)
11 to 20	198 (53)
21 to 30+	91 (24)
Type of medical record	
Full EMR	313 (85)
Partial EMR	32 (9)
Paper charts	25 (7)
Typical age of patient population seen by NP, years	
<18	49 (13)
18 to 39	95 (26)
40 to 54	110 (30)
55+	118 (32)

Note: NP = nurse practitioner.

^a Percentages in categories may not sum to 100% due to rounding. The number of total responses to each question varied across the survey because the survey (both paper and online versions) did not require that respondents answer all questions. Thus, some participants left selected questions blank, and this altered the number of responses per question. In addition, for some questions, more than one answer choice could be selected.

Table 2.

Nurse practitioners' recommended screening strategies for a variety of patient scenarios

Vignette	Description	No Screening, <i>n</i> (%)	Chest X-Ray, <i>n</i> (%)	LDCT, <i>n</i> (%)
1	50-year-old nonsmoker with 30 years of second-hand smoke exposure from spouse	140 (38) ^a	188 (51)	41 (11)
2	50-year-old current smoker with 20-pack-year smoking history and family history of lung cancer	33 (9) ^a	127 (34)	210 (57)
3	60-year-old current smoker with 30-pack-year smoking history	12 (3)	107 (29)	251 (68) ^a
4	70-year-old former smoker with 30-pack-year smoking history who quit smoking 20 years ago	95 (26) ^a	170 (46)	105 (28)

^aIndicates correct response.

Table 3.

Nurse practitioner attitudes toward low-dose computed tomography screening

Attitude(s)	Strongly Agree, <i>n</i> (%)	Agree, <i>n</i> (%)	Neutral, <i>n</i> (%)	Disagree, <i>n</i> (%)	Strongly Disagree, <i>n</i> (%)
The benefits of LDCT outweigh the risks for patient at high risk of lung cancer.	214 (58)	73 (20)	41 (11)	16 (4)	24 (7)
There is substantial evidence that LDCT screening saves lives from lung cancer.	87 (23)	118 (32)	134 (36)	25 (7)	6 (2)
LDCT screening for lung cancer screening is cost effective.	82 (22)	113 (30)	112 (30)	46 (13)	18 (5)
The rate of false positives for LDCT is higher than acceptable.	10 (3)	42 (12)	162 (44)	109 (30)	42 (12)

Note: LDCT = low-dose computed tomography.

Table 4.

Barriers to ordering a low-dose computed tomography scan for lung cancer screening in the past 12 months

Barriers	<i>n</i> (%)
Prior authorization required by insurance	128 (34)
Lack of insurance coverage	41 (11)
Coverage denials received	3 (1)
Not sure how to document patient eligibility in the medical record	9 (2)
Transportation or financial challenges for the patient	10 (3)
Not sure where to refer my patient for an LDCT screening examination	8 (2)
Need to know more about LDCT screening before referring my patients	29 (8)
Have not experienced any barriers	33 (9)
Have not tried to order any LDCT scans for lung cancer	92 (24)
Other	21 (6)

Note: Percentages do not sum to 100% because of respondents' ability to choose more than one barrier.

Note: LDCT = low-dose computed tomography.

Table 5.

Nurse practitioner likelihood to engage in a shared decision-making discussion based on time required

Time	Likely, <i>n</i> (%)	Unlikely, <i>n</i> (%)
< 3 min	331 (92)	27 (8)
3–5 min	305 (86)	48 (14)
5–8 min	202 (58)	144 (42)
> 8 min	128 (37)	217 (63)

Table 6.

Primary care nurse practitioners' screening patterns

Practice Pattern	NP Response	n (%)
During the past 12 months, did any of your patients ask if they can or should be screened for lung cancer?	Yes	147 (39)
	No	233 (61)
	0	213 (57)
	1–5	99 (26)
	6–10	24 (6)
	11–24	26 (7)
	25–50	7 (2)
	More than 50	4 (1)
	Not sure	3 (1)
In the past 12 months, did you initiate a conversation with a patient about the risks and benefits of LDCT lung cancer screening?	Yes	149 (40)
	No	212 (57)
	Not sure	13 (3)
If a CT machine is available, does it offer LDCT screening for lung cancer?	Yes	136 (40)
	No	4 (1)
	Not sure	199 (59)

Note: LDCT = Low-dose computed tomography; NP = nurse practitioner.