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Results from Lung Cancer Screening Outreach Utilizing a Mobile CT Scanner in an Urban Area

CME

VISUAL ABSTRACT

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Abstract

Introduction: Lung cancer screening using low-dose (LD) CT reduces lung cancer–specific and all-cause mortality in high-risk individuals, although significant barriers to screening remain. We assessed the outreach of a mobile lung cancer screening program to increase screening accessibility and early detection of lung cancer.

Methods: We placed a mobile CT unit in a high-traffic area in New York City and offered free screening to all eligible patients. Characteristics of the mobile screening cohort were compared with those of our hospital-based screening cohort.

Results: Between December 9, 2019, and January 30, 2020, a total of 216 patients underwent mobile LDCT screening. Compared with the hospital-based screening cohort, mobile screening participants were significantly more likely to be younger, be uninsured, and have lower smoking intensity and were less likely to meet 2013 US Preventive Services Task Force guidelines (but would meet their 2021 guidelines) and self-identify as White race and Hispanic ethnicity. Asian New Yorkers were substantially underrepresented in both hospital and mobile screening cohorts, compared with their level of representation in New York City. Two patients were diagnosed with lung cancer and were treated. Potentially clinically significant non–lung cancer findings were identified in 28.2%, most commonly moderate-severe coronary artery calcification and emphysema.

Conclusions: Mobile LDCT screening is useful and effective in detecting lung cancer and other significant findings and may engage a distinct high-risk patient demographic. Disproportionately low screening rates among certain high-risk populations highlight the imperative of implementing strategies aimed at understanding health behaviors and access barriers for diverse populations. Effective care-navigation services, facilitating high-quality care for all patients, are critical.

Key Words: early detection, healthcare access, low-dose computed tomography, mobile lung screening, smoking history

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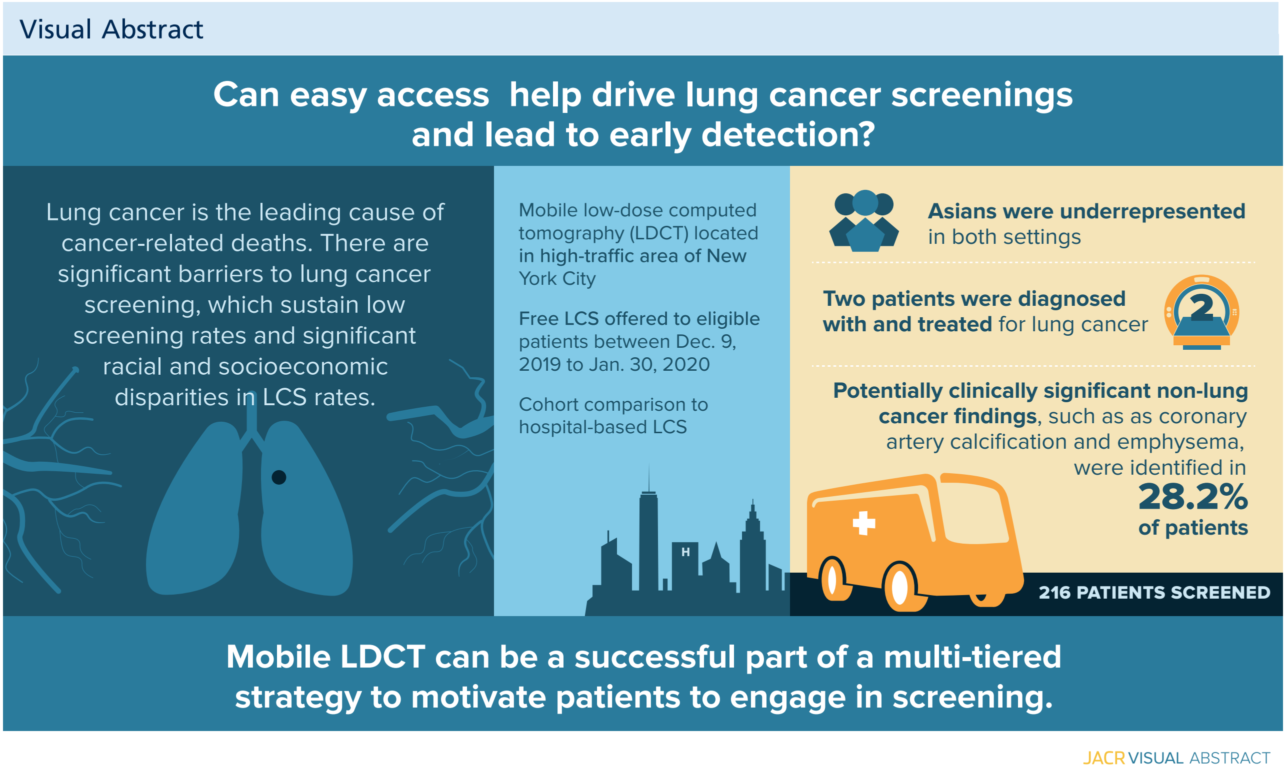

INTRODUCTION

Lung cancer is the leading cause of cancer-related mortality in the United States, but screening for lung cancer using low-dose (LD) CT is effective in reducing lung cancer–specific and all-cause mortality in high-risk individuals [1,2]. In 2013, the CMS and the US Preventive Services Task Force (USPSTF) published specific LDCT eligibility and insurance guidelines, recommending screening for adults aged 55 to 80 years with a ≥30 pack-year smoking history who either currently smoke or have quit within the past 15 years. In 2021, revised USPSTF lung screening guidelines lowered the age and pack-year thresholds to 50 years and ≥20 pack-years, respectively. Notwithstanding the compelling data from two large randomized controlled trials, the National Lung Screening Trial (NLST) [2] and the Dutch-Belgian Randomized Lung Cancer Screening Trial (Dutch acronym: NELSON study) [1], national LDCT screening rates remain low (nation, 5.8%; New York State [NYS], 6.2%) [3] among eligible individuals, with substantial sociodemographic disparities in screening rates. Reasons for low and disparate screening uptake among eligible individuals are multifactorial and are related to well-documented barriers to screening at the provider, patient, and system levels [4-8].

The long-term objective of our mobile lung cancer screening (LCS) program is to increase early detection of lung cancer and improve outcomes by facilitating access to LDCT screening and providing comprehensive navigation strategies to ensure timely, high-quality, and equitable care among diverse, high-risk populations, particularly medically underserved, minoritized, and low–socioeconomic status communities. To our knowledge, mobile LCS has not been described in an urban setting. Through the pilot program described here, we discuss the implementation of a mobile LCS program to engage and screen large numbers of high-risk patients via the following: (1) stationing the mobile unit in a high-traffic New York City (NYC) neighborhood in a historically medically underserved borough; (2) applying broader eligibility criteria (a modified version of 2018 National Comprehensive Cancer Network [NCCN] [9] and current 2021 USPSTF guidelines [10]) than the then-current 2013 USPSTF and CMS guidelines [11,12]; and (3) providing no-cost shared decision-making (SDM), LDCT screening, and care-navigation services to eligible patients. Herein, we report on the outreach results of this mobile LDCT LCS pilot study in NYC, which was designed to identify needs and gaps in relation to rolling out a mobile unit in urban areas and help inform us in preparation for a larger rollout in the future.

METHODS

Mobile Screening

Between December 9, 2019, and January 30, 2020, we partnered with a privately funded foundation to park a mobile CT unit in a high-traffic area in downtown

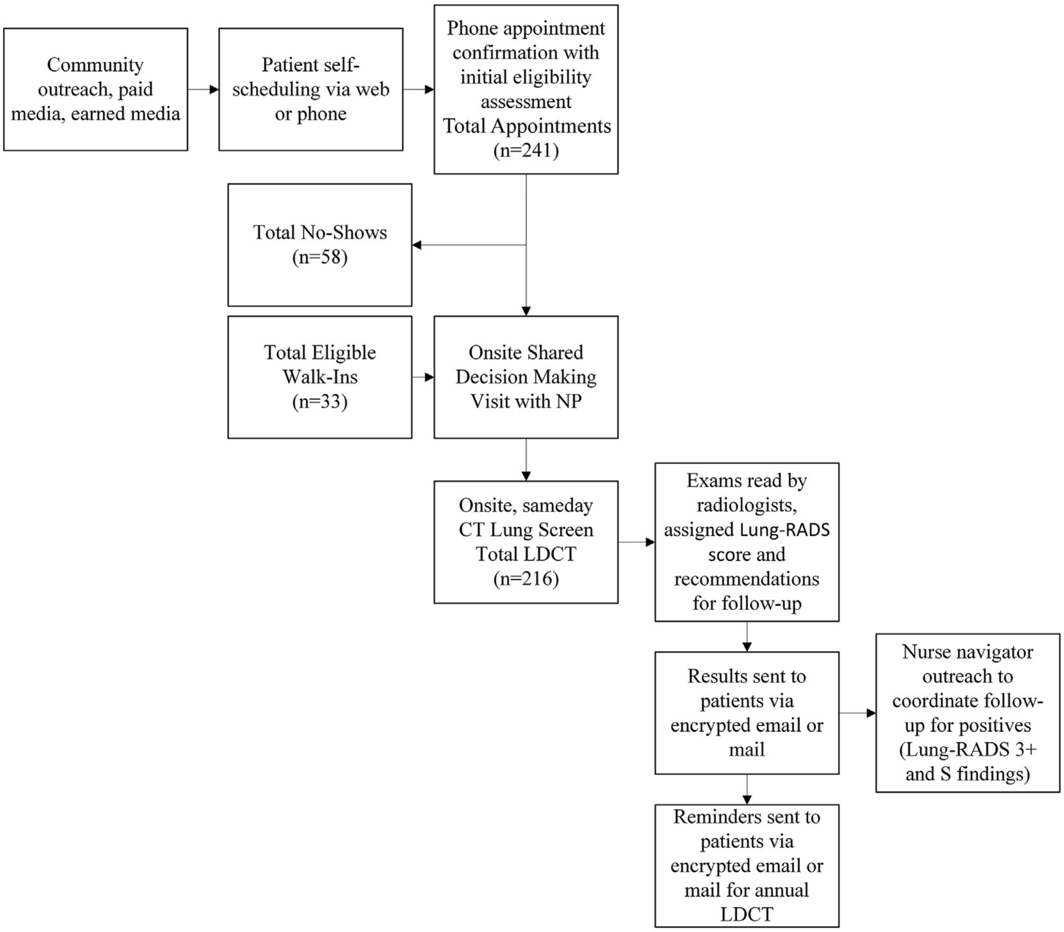

Fig. 1. Scheduling and navigation: flowchart depicting scheduling and navigation process. LD = low-dose; NP = nurse practitioner; S = "S"-modifier designation indicating the presence of potentially clinically significant non–lung cancer findings.

Brooklyn, NYC, in close proximity to public transportation, after obtaining appropriate licensure from NYS and NYC. Consultants assisted in selection of the site, communication with regulatory bodies, and identification of a leasing and scheduling agency for the scanner. The site was an area with a high level of foot traffic and was a commuter hub accessible via multiple subway lines, adjacent to New York public housing, and a short walk to the nearest hospital. The mobile unit consisted of a leased GE Lightspeed VCT 16-slice LDCT scanner (GE Healthcare, Boston MA) built into a 15-ft diesel-powered tractor-trailer, allowing for portable, high-quality images. Noncontrast LDCT images were obtained in accordance with the ACR LDCT screening protocol. The leasing company provided a CT technologist, a patient coordinator, and a call center, and a local hospital-based LCS program provided a nurse practitioner (NP), a nurse navigator, and reading radiologists. Onsite staffing of the mobile CT unit included the following positions: (1) an NP to engage patients in SDM discussions and order LDCT as appropriate; (2) a CT technologist; (3) an administrative patient coordinator to register patients and support clinic workflow; and (4) an offsite nurse navigator to facilitate results communication and downstream care if necessary. Demographic and basic patient information was collected via intake surveys. Patients who were current smokers at the time of scanning were offered tobacco-treatment services referrals to both a certified tobacco treatment specialist providing individual counseling through a 6-session curriculum and the NYS Smokers' Quitline, which offers free nicotine-replacement therapy and quit coaching, as appropriate. LDCT interpretation was performed remotely by a board-certified radiologist at our institution. Each LDCT examination was scored using Lung Reporting and Data System (Lung-RADS), a standardized reporting and management tool developed by the ACR [13].

Study Sample

No patients were recruited for this pilot, although outreach to raise awareness of the mobile LDCT program was conducted in the form of advertisements purchased in traditional media, primarily radio and community newspapers,

Table 1. Patient characteristics—mobile versus hospital-based screening

Characteristic	CT Group Mobile (N = 216)	CT Group Hospital-Based (N = 128)	Overall P	Pairwise P
Age, y, continuous	60.4 (6.8)	64.6 (5.9)	<.001	
Age, y, categories				
<55	48 (22.2)	1 (0.8)	<.001	
≥55	168 (77.8)	127 (99.2)		
Sex				
Female	104 (48.1)	58 (45.3)	.611	
Male	112 (51.9)	70 (54.7)		
Race				
Asian	6 (2.8)	3 (2.3)	<.001	1.000
Black or African American	61 (28.2)	26 (20.3)		.102
White	81 (37.5)	67 (52.3)		.007
Other	13 (6.0)	24 (18.8)		<.001
Unknown	55 (25.5)	8 (6.3)		
Ethnicity				
Hispanic	29 (13.4)	28 (21.9)	.007	.042
Non-Hispanic	159 (73.6)	73 (57.0)		.002
Unknown	28 (13.0)	27 (21.1)		
Preferred language				
English	204 (94.4)	91 (71.1)	<.001	
Other	9 (4.2)	37 (28.9)		
Unknown	3 (1.4)	0 (0)		
Smoking status				
Current smoker	126 (58.3)	55 (43.0)	.002	
Former smoker	90 (41.7)	70 (54.7)		
Unknown	0 (0)	3 (2.3)		
Pack years—continuous, median (IQR)	38 (25, 45)	40 (32, 50)	.002	
Pack years—categorical				
<20	4 (1.9)	5 (3.9)	<.001	
20-29	61 (28.2)	0 (0)		
≥30	151 (69.9)	123 (96.1)		
Health insurance status				
Insured	175 (81.0)	127 (99.2)	<.001	<.001
Uninsured	26 (12.0)	1 (0.8)		<.001
Unknown	15 (6.9)	0 (0)		
Marital status				
Single, never married	72 (33.3)	50 (39.1)	–	
Married	56 (25.9)	49 (38.3)		
Living as married	11 (5.1)	1 (0.8)		
Separated	5 (2.3)	1 (0.8)		
Divorced	47 (21.8)	16 (12.5)		
Widowed	12 (5.6)	6 (4.7)		
Other	0 (0)	2 (1.6)		
Unknown	13 (6.0)	3 (2.3)		

(continued)

Table 1. Continued

Characteristic	CT Group Mobile (N = 216)	Hospital-Based (N = 128)	Overall *P*	Pairwise *P*
Education level				
<8 y	4 (1.9)	–	–	
8-11 y	9 (4.2)	–		
High school or equivalent	45 (20.8)	–		
Vocational/technical school	12 (5.6)	–		
Some college	52 (24.1)	–		
College graduate	58 (26.9)	–		
Postgraduate	32 (14.8)	–		
Unknown	4 (1.9)	–		
Occupational status				
Employed	93 (43.1)	–	–	
Unemployed	18 (8.3)	–		
Student	2 (0.9)	–		
Retired	50 (23.2)	–		
Disabled	16 (7.4)	–		
Other	7 (3.2)	–		
Unknown	30 (13.9)	–		
Income, $				
<20,000	49 (22.7)	–	–	
20,000-34,999	25 (11.6)	–		
35,000-49,999	28 (13.0)	–		
50,000-74,999	34 (15.7)	–		
75,000-99,999	14 (6.5)	–		
≥100,000	17 (7.9)	–		
Declined	42 (19.4)	–		
Unknown	7 (3.2)	–		
Primary care provider status				
Yes	177 (81.9)	91 (71.1)	<.001	
No	28 (13.0)	0 (0)		
Unknown	11 (5.1)	37 (28.9)		
LDCT history				
Baseline	215 (99.5)	52 (40.6)	<.001	
Annual	1 (0.5)	63 (49.2)		
Follow-up	0 (0)	13 (10.2)		
Meets 2013 USPSTF guidelines				
Yes	119 (55.1)	122 (95.3)	<.001	
No	97 (44.9)	6 (4.7)		
Source of information about CT lung screening				
Community center	1 (0.5)	–	–	
Family/friends	11 (5.1)	–		
Internet	42 (19.4)	–		
Media (TV, radio, print, etc.)	141 (65.3)	–		
Other or multiple	20 (9.3)	–		
Unknown	1 (.5)	–		

Values are n (%), unless otherwise indicated. IQR = interquartile range; LD = low-dose; USPSTF = US Preventive Services Task Force.

and internet-based social media platforms (eg, Facebook), as well as earned media. Patients presented voluntarily to the mobile unit by self-referral as walk-ins or after scheduling an appointment. Two scheduling pathways were available—online and via a toll-free phone number. Patients scheduling by phone were screened for eligibility by a call center and were scheduled only if they were eligible. Individuals who scheduled online received a phone call ahead of their appointment to determine their eligibility. Onsite eligibility was determined for walk-ins by the onsite NP. Our operational algorithm is depicted in Figure 1. Patients were eligible for screening if they were aged 50 to 80 years, had a ≥20 pack-year smoking history, and were either current smokers or had quit smoking within the past 15 years. Minimum age and pack-year thresholds were identical to the current 2021 USPSTF eligibility guidelines, which are broader than the 2013 USPSTF thresholds of 55 years and 30 pack-years, respectively (current guidelines at the time of the pilot). We used lower age and pack-year thresholds, based on the 2018 NCCN guidelines and data from the NELSON Trial, which enrolled patients aged 50 to 74 years, and studies demonstrating increased screening eligibility among certain high-risk groups, such as Black Americans, using 20 pack-years [14].

The comparison, hospital-based cohort consisted of patients screened by a more traditional brick-and-mortar LCS program run by a large academic medical center servicing the NYS and tristate (NYS, New Jersey, Connecticut) area. Although the program does accept patient self-referrals, most referrals are made through primary care and specialty (pulmonology and cardiology) providers. Participants in the program receive SDM visits, LDCT, tobacco-treatment counseling if desired, and coordination of care and diagnostic follow-up and treatment as appropriate. Patient demographics, collected via chart review, are detailed in Table 1, with education level, occupational status, income level, and source of information about CT lung screening missing from the hospital cohort, as intake surveys were not used as part of the standard of care. All patient data were collected prospectively for clinical purposes, but the patient data presented here were reviewed and analyzed retrospectively. This protocol was reviewed and approved by our institutional review board.

Statistical Analysis

All group comparisons of continuous variables between the mobile screening and hospital-based screening cohorts were performed using Student's t test, except for pack-years, which was compared using Wilcoxon's rank-sum test. All group comparisons of categorical variables between the two cohorts were performed using a χ^2 test, except for preferred language and smoking status, and the pairwise comparison of Asian versus non-Asian race, which were compared using Fisher's exact test.

RESULTS

Study Population

A total of 216 patients underwent LDCT screening between December 9, 2019, and January 30, 2020. A total of 58 patients who were initially scheduled for screening either canceled or did not present to their appointment, and 33 eligible walk-ins received a same-day scan. Characteristics of mobile and hospital-based screening cohorts are described in Table 1. Overall, the mobile cohort had a mean age of 60.4 years (SD 6.8) and a median pack-year history of 38 (range 25-45). A total of 104 mobile screening participants (48.1%) were female, 142 (65.7%) had attended at least some college, 93 (43.1%) were employed, and 102 (47.2%) reported an annual income of <\$50,000. Compared with the hospital cohort, participants in the mobile cohort were significantly more likely to be younger and uninsured and to have a lower pack-year smoking history, and they were less likely to meet 2013 USPSTF screening guidelines, the current national guidelines at the time of scanning ($P <$ .001). All but 4 mobile screening participants who did not meet 2013 guidelines would have met the 2018 NCCN high-risk guidelines [9] and the updated 2021 USPSTF guidelines [10]. Additionally, smoking status differed significantly between the two groups ($P <$ .001), with 58.3% of mobile participants being current smokers versus 43% of hospital-based individuals. Similarly, a significant difference was found in primary-care-provider (PCP) status between the two groups ($P <$ .001), with 81.9% of the mobile cohort having a PCP versus 71.1% of the hospital cohort.

A total of 161 patients (74.5%) self-reported race, and 188 (87%) self-reported ethnicity. A total of 37.5% self-identified as White, 28.2% as Black, 2.8% as Asian, 6% as two or more races or "other," and 13.4% as Hispanic. The proportion of participants self-identifying as being White race or other and/or mixed race was significantly lower in the mobile cohort compared with the hospital cohort, and the mobile cohort was significantly more likely to self-identify as being of non-Hispanic ethnicity. Overall, the mobile and hospital screening cohorts differed significantly in their language preference ($P <$ .001), with 94.4% of the mobile cohort preferring English, compared with 71.1% of the hospital cohort.

A total of 215 of 216 participants provided information about how they learned of the mobile screening endeavor. A total of 65.3% individuals heard about the program through traditional (television, radio, and print) or earned media, 19.4% via internet outreach (social media and e-mail), 9.3% from multiple or "other" sources, 5.1% from family or friends, and 0.5% from their local community center. No patients listed their PCP as their information source. All but one of the patients (99.5%) were

Table 2. Lung-RADS score assignment in mobile and hospital-based screening as compared to estimated population prevalence

Lung-RADS Score	Mobile Cohort, n	Percent of Mobile Cohort	Hospital Cohort, n	Percent of Hospital Cohort	Estimated Population Prevalence, %
0	0	0.0	0	0	1
1 and 2	191	88.4	115	89.8	90
3	11	5.1	6	4.7	5
4A	10	4.6	3	2.3	2
4B and 4X	4	1.9	4	3.1	2
Total patients	216		128		
"S" modifier	61	28.2	47	36.7	10

:S”-modifier designation indicates the presence of potentially clinically significant non–lung cancer findings.

new to LCS, receiving a baseline scan on the mobile unit, whereas the hospital cohort included a mixture of screening intervals (40.6% baseline, 49.2% annual, and 10.2% follow-up).

Screening Results

Screening results are reported in Table 2. The proportion of various Lung-RADS scores assigned to the mobile screening cohort was similar to that of the hospital-based cohort and estimated population prevalence of lesions described in each respective Lung-RADS category [13]. A negative examination was denoted by Lung-RADS categories 1 and 2. Scans designated as Lung-RADS categories 3, 4A, or 4B were considered positive. Of the total 216 LDCT scans performed, 191 (88.4%) were negative and 25 (11.6%) were positive. Of the 25 positive scans, 11 were in category 3, 10 were in category 4A, and 4 were in category 4B, all on the Lung-RADS scale. Screening examinations that were in categories 3 or 4 were referred for follow-up, in accordance with Lung-RADS guidelines. Patients were monitored by a nurse navigator, to facilitate continuity of care. Two of 25 patients referred for additional follow-up were subsequently diagnosed with stage IIB lung cancer. One of the two patients was uninsured at the time of screening. Care coordinators assisted this patient with Medicaid re-enrollment, and he subsequently underwent biopsy within 28 days of

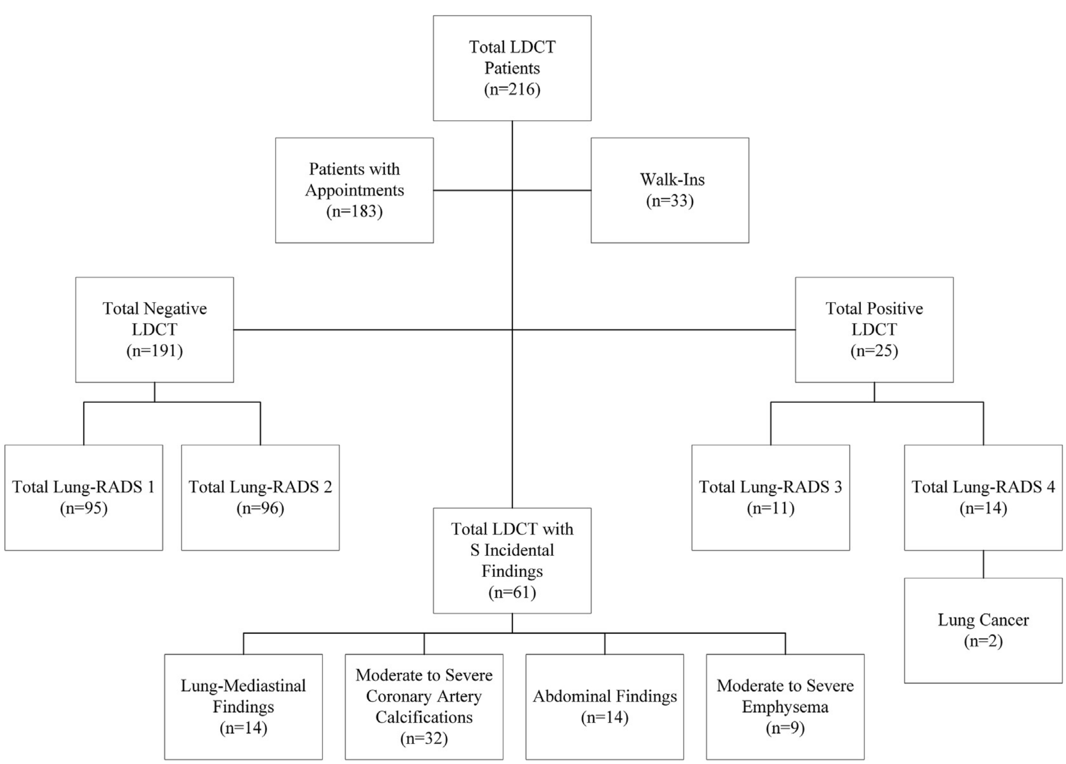

Fig. 2. Patient care flowchart showing the patient mobile-screening, diagnosis, and management process. LD = low-dose; S = “S”-modifier designation indicating the presence of potentially clinically significant non–lung cancer findings.

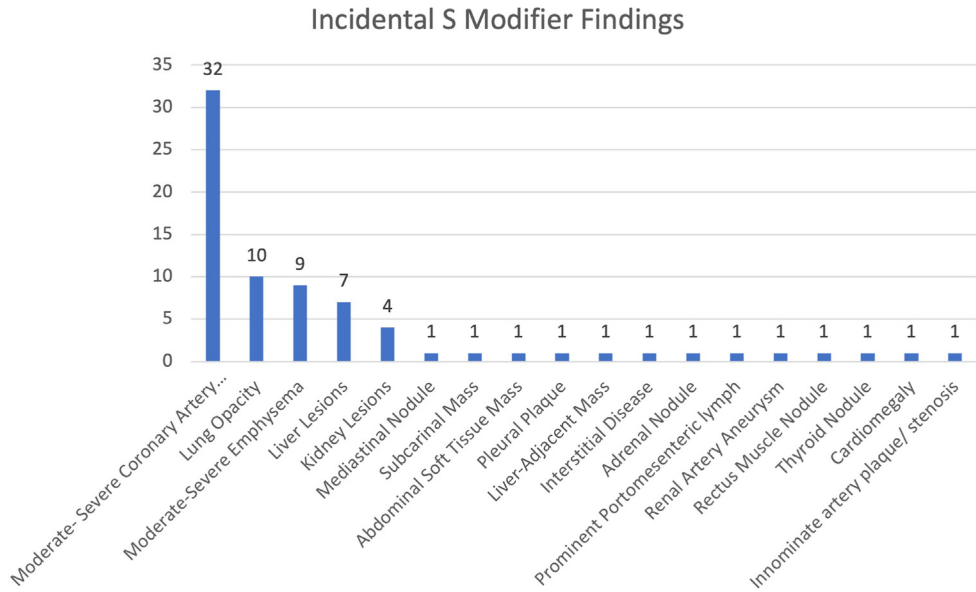

Fig. 3. Incidental "S"-modifier findings: a bar graph depicts the specific reasons for a "S"-modifier designation indicating the presence of potentially clinically significant non–lung cancer findings.

LDCT screening and surgical resection within 3 months, followed by chemotherapy. The second patient was an 80-year-old man who would not have been covered for screening by Medicare, which covers screening in individuals up to only age 77 years. He underwent surgical resection 36 days after LDCT screening. A flowchart of the patient mobile screening, diagnosis, and management process is provided in Figure 2.

Incidental Findings

An "S" modifier, which is used to indicate the presence of potentially clinically significant non–lung cancer findings, was assigned to 61 patients (28.2%; Table 2). Figure 3 describes the specific reasons for using the "S"-modifier designation, most commonly moderate-severe coronary artery calcification (32 cases, 52.5%) and moderate-severe emphysema (9 cases, 14.8%). For patients already under the care of a PCP, cardiologist, or pulmonologist, we contacted their physician to communicate findings, and we instructed patients to follow-up with their respective providers. Referral and navigation services were provided for all patients who were not under the care of a physician, and the nurse navigator followed up with all patients to ensure continuity of care. The presence of lung consolidation or ground-glass opacity, favored to be pneumonia, was the second most common reason for use of the "S"-modifier designation. A total of 17 abdominal findings were also identified, including 13 abdominal nodules or masses, 2 soft tissue lesions, and 1 renal artery aneurysm. Again, patients were instructed to follow-up with their PCPs and were contacted by the nurse navigator to ensure complete care management. Follow-up of these initial 216 patients is ongoing.

DISCUSSION

The intent of this pilot program was to identify obstacles to running outreach of a mobile LDCT screening program in an urban setting and applying broader eligibility criteria to engage large numbers of high-risk individuals in SDM discussions, LDCT screening, and care navigation. Over approximately 6 weeks, we successfully completed SDM discussions and LDCT scans for 216 patients (nearly all baseline examinations), subsequently diagnosing early-stage lung cancer in 2 patients and identifying potentially clinically significant non–lung cancer findings in nearly one third, thereby demonstrating the clinical importance of mobile screening in a diverse urban setting. Our cancer detection rate is consistent with the initial detection rates in the Levine Cancer Institute Mobile Trial by Raghavan and colleagues, as well as the NLST and NELSON Trials in which screening was performed at brick-and-mortar facilities [1,2,15]. Additionally, the proportion of patients in our study who had moderate or severe coronary calcium and emphysema detected on LDCT is similar to that identified by Raghavan et al [15], and all patients were similarly followed and were provided with care-navigation services to facilitate continuity of care and complete management. As part of a larger rollout, we believe a CT technologist, a patient coordinator, and someone with a commercial driver's license are necessary in-person, onboard the mobile unit, and a scheduler, NP, nurse navigator, and radiologist may support the workflow remotely.

Table 3. Population by race for mobile and hospital-based screening cohorts, New York City, and mobile unit location in downtown Brooklyn and bordering and nearby neighborhoods

Population	Race/Ethnicity, % Population				
	White	Black	Asian	Mixed/Other	Hispanic
Mobile screening	37.5	28.2	2.8	6.0	13.4
Hospital-based screening	52.3	20.3	2.3	18.8	21.9
New York City	41.3	23.8	14.3	5.6	28.9
Downtown Brooklyn (mobile unit location)	63.4	12.8	6.1	8.1	9.6
Bordering neighborhoods					
Boerum Hill	43.3	21.2	5.1	17.1	13.2
Brooklyn Heights	80.6	6.8	6.4	2.7	3.6
DUMBO	75.0	3.6	11.0	2.4	8.0
Fort Greene	14.5	52.8	11.3	13.0	8.4
Nearby neighborhoods					
Carroll Garden	75.4	3.0	5.3	8.6	7.7
Clinton Hill	17.4	73.4	1.3	4.5	3.4
Cobble Hill	73.7	6.4	2.7	8.9	8.4
Columbia Street Waterfront District	41.5	16.3	7.1	14.1	21.0
Financial District	62.1	5.8	24.4	3.2	4.6
Gowanus	39.0	17.3	4.4	21.5	17.8
Navy Yard	73.9	4.0	13.0	2.1	7.0
Park Slope	66.9	9.2	4.8	10.8	8.3
Prospect Heights	36.4	50.4	5.1	4.4	3.7
Vinegar Hill	75.3	3.8	10.7	2.3	7.9

Populations of downtown Brooklyn, bordering neighborhoods and nearby neighborhoods are limited to individuals aged 55-84 years; populations of New York City are not age-restricted. New York City population race and ethnicity data were obtained from [16]. Neighborhood-level population race and ethnicity data were obtained from [17].

Comparisons between mobile and hospital screening populations, NYC, the mobile unit location of downtown Brooklyn, and neighborhoods surrounding downtown Brooklyn, by race and ethnicity, are available in Table 3 [16,17]. Our cohort, whose racial and ethnic makeup was similar to that of NYC, with regard to the proportion of White and Black individuals and individuals of mixed or "other" race, was more diverse than cohorts in the aforementioned studies. Although the proportion of Hispanic individuals screened was substantially lower than that in NYC, the proportion was similar to or higher than that in downtown Brooklyn and most bordering neighborhoods. Unfortunately, Asian Americans, who represent 16% of New Yorkers aged ≥50 years, were substantially underrepresented in both screening cohorts [18]. The proportion of White individuals also was lower in the mobile cohort relative to that in downtown Brooklyn and most surrounding neighborhoods, but the proportion of Black participants was higher. Reasons for the aforementioned racial and ethnic differences among participants likely are multifactorial. For example, most patients learned about the mobile unit from media and internet marketing, which was primarily in English, yielding a majority English-speaking cohort. Low mobile unit and hospital screening uptake by Asian and Hispanic New Yorkers speaks to the imperative of better understanding the unique needs and cultural and language challenges of diverse patient populations. Future strategies should be grounded in theoretical frameworks aimed at better understanding complexities of individual and group health behaviors and improving outcomes.

Few patients came from the ZIP code of the mobile unit location and surrounding neighborhoods, suggesting that although close proximity to LCS facilities is a top factor driving participation in LCS [19], other factors are important in influencing uptake. For example, the fact that a majority of participants reported having a PCP, but nearly all these individuals had not undergone LCS previously, speaks to the likelihood of significant provider- and patient-level barriers (eg, time constraints for physicians, and lack of awareness of LCS generally, including guidelines, benefits, and costs, among both physicians and patients) [4,20]. In fact, high-risk patient focus groups led by Simmons and colleagues revealed that a majority of participants had never heard of LDCT screening [20]. Other well-established provider-level barriers include concerns about management and false-positive results and concerns about patient fear and resistance [20]. Known patient-level barriers include lack of insurance, competing priorities, fatalism, nihilism, and the blame and stigma associated with lung cancer as a self-inflicted disease [7]. In our study, most participants heard about the program through media advertising and internet outreach, suggesting that effective marketing may be an important facilitator. To that end, the messaging in advertising campaigns is key, with the most-effective campaigns being those built on multiple framings [21]. Advertisements for the mobile unit focused on the benefits of LCS and the pilot program, including emphasizing the free and easy nature of screening (one scan every year that takes less than 5 minutes), the curability of early-stage lung cancer, and the fact that LCS can save lives.

Despite offering no-cost screening, the mobile screening program drew in a higher proportion of insured than uninsured individuals, although the proportion of uninsured patients was significantly higher than that in our hospital-based cohort, and most participants were in a lower-income bracket. Additionally, all but one of the mobile LDCT scans were baseline examinations, a significantly higher proportion than that in the hospital-based cohort. These findings suggest that we were able to engage significantly more individuals who had not previously accessed (or did not have access to) screening. Notably, all participants hailed from states where screening is covered by private insurance, Medicare, and Medicaid fee-for-service, which may further indicate a lack of patient and/or provider knowledge of LCS coverage. Potential future follow-up and downstream care out-of-pocket expenses are also known barriers to care for low-income patients [22] and may explain our lower rates of uninsured participants. At the same time, our results suggest that patients who are aware of screening are willing to travel for these services. Thus, many factors influence screening uptake, including financial, cognitive, and structural barriers, as described by the Heath Care Access Barriers Model [23], which emphasizes mitigation of modifiable health care access barriers. Critically important are effective follow-up and care-navigation services, such as those provided in our mobile screening program, that facilitate patient–physician communication and establish care for all patients despite their insurance status.

Although our experience has been limited to date, we feel strongly that a cancer screening program should include a robust educational program and downstream navigation pathways, and should offer cost effective care that does not compromise clinical outcomes. We hope that this communication will used as a framework for those interested in creating or optimizing their screening programs and offers a novel means to increase community outreach. Clearly, our engagement strategy could benefit from closer community partnerships, such as those with community centers, leaders, and organizations such as federally qualified health centers. We hope that expanded accessibility strategies, such as mobile screening, will allow the lung screening community to further elucidate and expand upon the eligibility criteria for LCS, although we acknowledge the clear limitations of age and smoking history.

Limitations

Our study has a few limitations. First, comparisons between mobile and hospital-based screening cohorts are limited by the nonrandomized study design. Furthermore, due to the retrospective data analysis performed in both studies, some patient data were missing for both cohorts, precluding complete data analysis and comparison. Race data, in particular, were missing from approximately 25% of patients in the mobile cohort, so more caution than usual is needed in interpreting race-related results. Additionally, the pilot was conducted over a short time interval, which likely limited the sample size. A pilot study conducted over a longer duration might have yielded different results. Lastly, although the nurse navigator sent e-mail and phone reminders for follow-up and annual appointments, many patients were unable to complete follow-up and annual examinations, owing to the COVID-19 pandemic, thereby precluding assessment of adherence rates in the mobile screening cohort.

Our pilot study was performed in an urban setting with several hospitals and hospital systems within walking distance of those who sought care with us. We believe that mobile screening presents unique challenges in urban versus rural environments, but we hope our framework addresses common themes, such as the importance of education and navigation.

Conclusions

This pilot study demonstrates the utility of mobile LDCT screening and care-navigation processes in engaging a large number of patients in a diverse urban setting using expanded eligibility guidelines. Notwithstanding the overall success of the pilot program, our results underscore an imperative to develop strategies to engage all patients, particularly Asian and Hispanic individuals and patients who are underinsured or uninsured, all of whom were underrepresented in this study. Moreover, although the proportion of Black participants was higher than their representation in NYC, Black men remain the highest-risk group, with the highest age-adjusted rates of lung cancer incidence and mortality, and efforts to increase screening uptake by this population is a priority. Using our initial results to inform our approach, we plan to offer multiple cancer mobile-screening services to all five NYC boroughs (and eventually on a larger scale) to underserved, high-risk communities who stand to benefit most from early detection and care navigation. As we move forward, engaging and supporting these communities will require fostering relationships with individual and institutional stakeholders.

TAKE-HOME POINTS

- Mobile CT screening, when used within a comprehensive lung screening program, yields clinical outcomes comparable to those of programs tied to hospital systems.
- Community engagement and partnerships are key to a successful and sustainable program.
- Downstream care navigation is even more resource-intensive than expected for a typical screening program secondary to the diverse population this pathway uncovers.
- Strong multidisciplinary engagement with all those caring for thoracic pathology patients should be in place prior to engaging in this endeavor.
- Mobile CT screening provides a forum to further explore strategies aimed at understanding health behaviors and access barriers for diverse populations.
- Mobile LDCT LCS is feasible, safe, and effective but should not be part of a singular intervention strategy.
- Patient navigation services are critical to providing effective screening and follow-up.
- Future strategies should focus on community engagement and partnerships to reach high-risk, sociodemographically diverse communities and be grounded in theoretical frameworks aimed at better understanding individual and group health behaviors and improving outcomes.

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