




Attendees of Manchester's Lung Health Check pilot express a preference for community-based lung cancer screening

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ABSTRACT

Manchester's 'Lung Health Check' pilot utilised mobile CT scanners in convenient retail locations to deliver lung cancer screening to socioeconomically disadvantaged communities. We assessed whether screening location was an important factor for those attending the service. Location was important for 74.7% (n=701/938) and 23% (n=216/938) reported being less likely to attend an equivalent hospital-based programme. This preference was most common in current smokers (27% current smokers vs 19% former smokers; $_{Adj}OR$ 1.46, 95% CI 1.03 to 2.08, p=0.036) and those in the lowest deprivation quartile (25% lowest quartile vs 17.6% highest quartile; $_{Adj}OR$ 2.0, 95% CI 1.24 to 3.24, p=0.005). Practical issues related to travel were most important in those less willing to attend a hospital-based service, with 83.3% citing at least one travel related barrier to non-attendance. A convenient community-based screening programme may reduce inequalities in screening adherence especially in those at high risk of lung cancer in deprived areas.

INTRODUCTION

Lung cancer is the world's leading cause of cancer mortality, responsible for over 1.6 million deaths annually.¹ Screening high-risk smokers with low-dose computed tomography (LDCT) can reduce lung cancer-specific mortality by 20%,² and screening implementation has recently been recommended in a European position statement.³ Screening is most effective when targeted towards those most at risk, but parameters associated with lung cancer risk, such as smoking and low socioeconomic status, are also associated with reduced screening participation.^{4,5} Several studies, including one conducted in Manchester,⁶ have identified a number of 'barriers' to participation, these may be 'practical' such as inconvenient locations and/or 'emotional' such as anxiety about hospital attendance or fear of a lung cancer diagnosis.^{7–9} Addressing these may reduce health inequality and help to ensure successful implementation of screening programmes, especially in socioeconomically disadvantaged populations.¹⁰ To maximise benefits to those at high risk, lung cancer screening requires attendance at more than one screening round. The recently published Manchester 'Lung Health Check' pilot, a lung cancer screening service, adopted convenient community-based mobile LDCT scanners in

socioeconomically deprived areas of the city.^{11,12}

The majority of participants (75%) were from the lowest quintile of deprivation in England. The aim of this study was to ascertain the views of participants to mobile CT screening and clarify whether this was an important factor when considering participation in the second round of a National Health Service (NHS) screening pilot.

METHODS

Detailed methods of the Manchester screening pilot have previously been described.^{11,12} In brief, all ever smokers, aged 55–74, registered at participating primary care practices, were invited to attend a free Lung Health Check (LHC). These were based in convenient community retail locations in deprived areas of Manchester. Participants underwent a nurse-led symptoms assessment, spirometry and lung cancer risk score using the prostate lung colorectal and ovarian 1 (PLCO_{M2012}) lung cancer risk prediction model. Participants at highest risk of lung cancer (PLCO_{M2012} $\geq 1.51\%$) were invited for annual LDCT screening over two rounds in co-located mobile scanners at the same community locations. All attendees of the second screening round were eligible to participate in this study, the 'Community Lung Health Study', and self-completed a questionnaire in the presence of a research nurse, related to the impact of a community-based service on the individual's decision to participate. Individuals were asked to respond to questions on standard seven-point Likert Scales, including to the questions 'Was the location of the Lung Health Checks and CT scanner in the community important in your decision to attend?' and 'Would you still have attended if the service was in a hospital rather than the community?'. Responses were dichotomised into 'Yes' (scores of 5–7) and 'No' (scores 1–4) for analysis. Reasons for a lack of willingness to attend a hospital-based service were assessed by asking participants to select responses from a list of predetermined options with an ability to expand further through free text if required. Postcodes were recorded to determine Index of Multiple Deprivation 2015 (IMD) rank for England.¹³ Participants were split and compared according to their 'willingness' to attend a hospital-based screening programme. All individuals provided written informed consent to study participation (REC Ref: 17/EE/0092). All statistical analysis was conducted using SPSS V.22. Groups were compared using independent t-test (parametric) or Mann-Whitney U test (non-parametric)



for continuous data and χ^2 or Fisher's exact tests for categorical data. Multivariate analysis including age, sex, smoking status, socioeconomic deprivation (IMD rank as a continuous variable) and lung cancer risk (PLCO_{M2012} score as a continuous variable) was performed to explore associations. Statistical significance was defined as a p value ≤ 0.05 .

RESULTS

Screening adherence was high, 90% of those eligible attended the second screening round.¹² A total of 958 individuals consented to study participation. Twenty were excluded due to incomplete surveys and analysis is therefore based on 938 individuals, representing 78.6% (n=938/1194) of those attending the second screening round. Mean age was 65.6 (± 5.4), 50.6% female, 47.8% current smokers and median IMD deprivation rank was 2848 (IQR 1110–5143). There was no significant difference in characteristics (age, gender, smoking status, IMD deprivation rank, education, medical history or performance status) between study participants and non-participants (data not shown). Three-quarters (74.7%, n=701/938) of study participants stated that 'location was important' (direct question) in their decision to attend. One in four (23%, n=216/938) would have been less likely to have attended an equivalent hospital-based programme. This response was more common in current smokers (56.1% vs 45.3%; p=0.005) and associated with increased deprivation (median IMD rank 1902 vs 2871; p<0.001) and increased lung cancer risk

(median PLCO_{M2012} score 3.84% vs 3.40%; p=0.034) (table 1). After multivariate analysis, smoking status ($_{Adj}$ OR 1.46, 95%CI 1.03 to 2.08; p=0.036) and increased socioeconomic deprivation remained significant after adjusting for age, sex, smoking status, deprivation and lung cancer risk. Those in the lowest deprivation quartile were significantly more likely to report being unwilling to attend a hospital service than those in the highest deprivation quartile ($_{Adj}$ OR 2.0, 95%CI 1.24 to 3.24; p=0.005). More than half (52%, n=492/938) of all participants cited at least one reason for potentially being less likely to attend a hospital-based screening programme. Among those unwilling to attend a hospital-based programme (n=216) travel-related reasons including inconvenience (62%, n=132), lack of parking (46.3%, n=100), parking costs (42.1%, n=91) and poor public transport (31.9%, n=69) were most frequently cited (table 2).

DISCUSSION

The Manchester Lung Health Check pilot used mobile CT scanners in community locations to deliver a targeted lung cancer screening programme in deprived areas. Three quarters of participants stated that scanner location was an important factor in their decision to attend a second-round screening appointment. Almost a quarter (23%) said they would have been less likely to have attended an equivalent hospital-based service. This response was associated with smoking status and increased socioeconomic deprivation when adjusted for covariates, with current smokers

Table 1 Characteristics of participants according to willingness to attend a hospital-based screening programme

Variable	All Participants	Willingness to attend a hospital-based screening programme		P value	
		Willing	Not willing		
Number of participants (%)	938 (100.0)	722 (77.0)	216 (23.0)	–	
Mean age (years \pm SD)	65.6 (5.4)	66.7 (5.4)	65.3 (5.5)	0.662	
Sex M/F (F%)	463/475 (50.6)	360/362 (50.1)	103/113 (52.3)	0.575	
Median IMD rank (IQR)	2848 (1110–5143)	2871 (1250–5311)	1902 (1021–3935)	<0.001*	
Median PLCO _{M2012} score (IQR)	3.49 (2.21–5.84)	3.40 (2.18–5.62)	3.84 (2.41–6.47)	0.034*	
Smoking status (%) (n=919)†	Current	439 (47.8)	320 (45.3)	119 (56.1)	0.005*
	Former	480 (52.2)	387 (54.7)	93 (43.9)	
History of COPD/emphysema (%)	346 (36.9)	264 (36.6)	82 (38.0)	0.709	
History of previous malignancy (%)	133 (14.2)	104 (14.4)	29 (13.4)	0.718	
Family history of lung cancer (%)	263 (28.0)	206 (28.5)	57 (26.4)	0.538	
Performance status (%) (n=918)†	0	385 (41.9)	300 (42.4)	85 (40.3)	0.124
	1	315 (34.3)	251 (35.5)	64 (30.3)	
	2	189 (20.6)	137 (19.4)	52 (24.6)	
	3	27 (2.9)	17 (2.4)	10 (4.7)	
	4	2 (0.2)	2 (0.3)	0 (0.0)	
MRC dyspnoea score (%) (n=908)†	1	366 (40.3)	289 (41.3)	77 (37.0)	0.552
	2	312 (34.4)	233 (33.3)	79 (38.0)	
	3	111 (12.2)	87 (12.4)	24 (11.5)	
	4	101 (11.1)	79 (11.3)	22 (10.6)	
	5	18 (2.0)	12 (1.7)	6 (2.9)	
Stated that 'location was important' in their decision to attend	701 (74.7)	516 (71.5)	185 (85.6)	<0.001*	

MRC dyspnoea score range: 1=least breathless to 5=most breathless; performance status range: 0=best performance to 4=worse performance.

*Statistically significant.

†Reduced numbers due to incomplete survey sections.

IMD, index of multiple deprivation; IQR, interquartile range; MRC, medical research council; PLCO_{M2012}, prostate lung colorectal and ovarian cancer risk prediction model; SD, standard deviation.

Table 2 Self-reported reasons not to attend a hospital-based screening programme

Category	Reason less likely to attend a hospital-based screening programme	Participants unwilling to attend a hospital-based programme (n=216) (%)
Travel	Travelling to hospital is inconvenient	134 (62.0)
	You can never get a parking space	100 (46.3)
	Car parking is too expensive	91 (42.1)
	Public transport is not convenient	69 (31.9)
	At least one travel related reason	180 (83.3)
Hospital	I don't like going to hospitals	65 (30.1)
	Hospital appointments are never on time	74 (34.3)
	At least one hospital related reason	109 (50.5)
Inconvenience or other	It would be difficult because of my health	32 (14.8)
	Work commitments make it inconvenient	34 (15.7)
	I care for someone	18 (8.3)
	Other (not stated)	2 (0.9)
	At least one inconvenience or other related reason	83 (38.4)

and those in the lowest deprivation quartile (compared with the highest quartile) significantly more likely to report being unwilling to attend a hospital-based service. The potential loss of such a significant proportion of participants could have had a significant impact on the results of the Manchester pilot and demonstrates the importance of accessibility and community-based locations in the successful implementation of future lung cancer screening programmes. It is important to stress that there may be differences between stated intentions and actual behaviour, which is well described¹⁴ and without prospective evaluation we do not know if stated intentions would have been enacted. In addition, we did not gather data about the reasons for non-attendance from those who did not attend the second round; location may have been less important in this group with non-attendance potentially related to other factors such as emotional barriers or misunderstanding about why a second scan was offered. Previous studies have described lung cancer screening decision making as 'complex' and multifactorial.^{6,9} Convenient community locations were identified by participants as helpful to participation. Finally, we acknowledge participants had already attended a previous round of community-based screening and may have therefore been favourably disposed to this method and the questions used had not previously been validated. In conclusion our results suggest that convenient community-based screening programmes, using mobile CT scanners, may be one approach to reduce inequalities in screening uptake and adherence especially in those at high risk of lung cancer in deprived areas. Further research prospectively comparing community versus non-community-based screening would be required to answer this more comprehensively.

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Competing interests None declared.

Patient consent for publication Not required.

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