

Lung Screen Uptake Trial (LSUT): Randomised Controlled Trial Testing Targeted Invitation

Materials

Running title: Lung Screen Uptake Trial

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ABSTRACT

Rationale: Low uptake of low-dose CT (LDCT) lung cancer screening, particularly by current smokers of a low socioeconomic position, compromises effectiveness and equity.

Objectives: To compare the effect of a ‘targeted, low burden and stepped’ invitation strategy versus control, on uptake of hospital-based ‘Lung Health Check’ appointments offering (LDCT) screening.

Methods: A two-arm, blinded, between-subjects, randomised controlled trial. 2012 participants were selected from 16 primary care practices using these criteria: i) aged 60-75, ii) recorded as a current smoker within the last seven years, iii) no pre-specified exclusion criteria contraindicating LDCT screening. Both groups received a stepped sequence of pre-invitation, invitation and reminder letters from their Primary Care Practitioner offering pre-scheduled appointments. The key manipulation was the accompanying leaflet. The intervention group’s leaflet targeted psychological barriers and provided low burden information, mimicking the concept of the UK Ministry of Transport’s annual vehicle test (‘MOT for your lungs’).

Measurements and Main Results: Uptake was 52.6%, with no difference between intervention (52.3%) and control (52.9%) groups in unadjusted (OR: 0.98, 0.82-1.16) or adjusted (aOR: 0.98, 0.82-1.17) analyses. Current smokers were less likely to attend (aOR: 0.70, 0.56-0.86) than former smokers. Socioeconomic deprivation was significantly associated with lower uptake for the control group only ($p < .01$).

Conclusions: The intervention did not improve uptake. Regardless of trial arm, uptake was considerably higher than previous clinical and real world studies, particularly given the

sample were predominantly lower socioeconomic position smokers. Strategies common to both groups, including a Lung Health Check approach, could represent a minimum standard.

KEY WORDS (MeSH): Lung Neoplasms, Early Detection of Cancer, Behavioural Sciences, Socioeconomic Factors

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Trial registration: This study was registered prospectively with the ISRCTN (International Standard Registered Clinical/soCial sTudy Number: ISRCTN21774741) on 23rd September 2015 and the NIH ClinicalTrials.gov database (NCT02558101) on 22nd September 2015).

INTRODUCTION

Lung cancer leads cancer mortality globally(1). While tobacco control strategies are the primary means to reduce incidence, early diagnosis markedly increases five-year survival from 6% to 82% (stage IV vs. 1A non-small cell)(2). Currently though, most (66%) diagnoses in the UK are made at an advanced stage(3). The US National Lung Screening Trial (NLST; n=53,454) demonstrated that screening asymptomatic high-risk adults using low-dose computed tomography (LDCT) reduced the risk of mortality from lung cancer by 20% compared with chest X-ray(4). Consequently, the US Preventive Services Task Force (USPSTF) recommended screening for high-risk adults. The UK's National Screening Committee are awaiting the Dutch-Belgian trial NELSON's findings (n=15,822), but early data suggest a mortality benefit(5).

Engaging those at high risk improves the risk-benefit ratio of screening. However, enrolment into lung screening trials has been low (<5%)(6) and skewed towards those at lower risk. Long-term smokers are overrepresented within lower socioeconomic position (SEP) communities, yet both current smoking status and low SEP are negatively associated with uptake(7,8) and positively associated with risk(9). Indeed, despite the USPSTF's recommendation, just 1.9% of eligible, high-risk individuals have been screened in the US(10). Attendance of pilot 'Lung Health Check' services in England has been relatively higher at 27% (Nottingham), 26% (Manchester), and 40% (Liverpool). Due to non-eligibility of some attenders, this translated to LDCT uptake by 13%, 14% and 9% respectively(11,12). Psychological barriers to participation were identified by research(13) that we undertook to inform the present intervention. Together with existing studies, findings suggested smokers (compared with non-smokers) are more fatalistic about lung cancer, perceive treatment

efficacy as lower (13–17), feel stigmatised (13,18), hold higher affective risk perceptions, and fear diagnosis(13,19). Previous studies in colorectal cancer screening suggest tailoring leaflets to modify attitudinal barriers(20) may improve uptake(20–22). From a translational perspective, leaflets provide a low cost and scalable intervention.

In addition to targeting psychological barriers, behavioural science theory such as the Precaution Adoption Process Model(23), proposes that different types of information are needed depending on an individual's state of engagement, decision-making and behaviour. A first-time invitation might primarily focus on engaging individuals in considering the offer using a low burden approach, with subsequent communication promoting informed choice and reducing practical barriers. This stepped approach may be particularly important if the offer is anticipated to provoke fear, which can reduce receptivity (24,25), and for those with lower literacy, because information burden can reduce comprehension and promote distrust (23-26). However to-date, recruitment methods for trials have been cognitively and practically demanding.

Therefore, this trial primarily aimed to test the effect of targeted, stepped and low burden invitation materials on uptake of 'Lung Health Check' appointments offered in a real-world context. The secondary aims were to explore whether the intervention materials affected informed decision-making outcomes, to gauge likely uptake of a national programme and to examine the feasibility of invitation via primary care. Some results have been reported as an abstract(26).

METHODS

Design

A two-arm, blinded, between-subjects, randomised controlled trial design tested the effect of intervention invitation materials on uptake of a pre-scheduled Lung Health Check appointment, at which LDCT screening might be offered. A protocol has been published(27) with potential overlap. Eligible individuals were identified from primary care practices in London using electronic searches carried out between October 2015 and March 2017.

Eligibility criteria

The searches extracted individuals (n=147,015) aged 60-75 who had been recorded as a smoker since April 2010 (within 7 years of invitation). This was the date smoking status became a Quality and Outcomes Framework (QoF) indicator to ensure completeness and identify current and recent ex-smokers. The searches excluded individuals who had an active lung cancer diagnosis or metastatic cancer, were on the palliative care register, had undergone a recent CT thorax (≤ 12 months), lacked capacity, had insufficient English or a comorbidity contraindicating screening or treatment. Lists were then screened by GPs. To avoid contamination, only one eligible individual per household was invited.

Randomisation

A web-based programme individually randomised participants (1:1) using permuted blocks to balance group allocation by practice. Identifiable details were concealed during assignment, which was carried out by a blinded researcher. Invited individuals were blind to the research nature at the invitation stage, to avoid undermining the primary outcome.

Intervention and control invitation materials

Our invitation methods and evidence are published(13,27) and appended (Supplementary File 1). Briefly, evidence-based methods were used for both invitation groups, including GP endorsement(21,28), pre-notification(29), reminders(30,31) and pre-scheduled appointments(32,33). The screening offer was framed within a 'Lung Health Check'. All participants received the same postal invitation letters from their primary care practice: pre-invitation letter, invitation letter with scheduled appointment, and reminder re-invitation letter with a second scheduled appointment (sent to non-responders ≥ 4 weeks after missed appointment). The letters were identical with two exceptions: 1) the intervention group's letters referred to 'ever smokers' whereas the control group's referred to 'current and former smokers', and 2) the intervention group's invitation letter included a bullet-pointed summary of the Lung Health Check, including LDCT scan offer, on the reverse side.

The key manipulation was the accompanying leaflet. The control group received an information booklet mimicking 'the facts' booklets of NHS cancer screening programmes. The intervention group received an 'M.O.T. for your lungs' leaflet, designed to target psychological barriers to attendance (fear, fatalism and stigma), to be low burden (sufficient for deciding to attend and consider the screening offer) and stepped (full information given at the appointment using the control group's booklet, or available before via a website, phone or post). An 'M.O.T.' is an annual roadworthy test for vehicles and was a lay concept perceived to be analogous to a medical check-up preferred by patient and public involvement groups.

Lung Health Check appointment

The appointments were run by research nurses and clinical trial practitioners at two London hospital outpatient clinics. The appointment included a medical and smoking history to determine risk-based eligibility for the LDCT scan according to one of three criteria: i) NLST ≥ 30 pack year smoking history and still smoking or quit ≤ 15 years; ii) Prostate, Lung, Colorectal and Ovarian (PLCO) score $\geq 1.51\%$, or iii) Liverpool Lung Project (LLP) score $\geq 2.5\%$. Full information about the risks and benefits of screening was provided to all using the control group's leaflet and supported by the nurse consultation. A spirometry test and carbon monoxide (CO) reading were also carried out. Participants self-reporting as current smokers or with a CO reading ≥ 10 ppm were given accredited 'Very Brief Advice' on smoking (National Centre for Smoking Cessation and Training(34)) and randomised to an opt-out or opt-in referral intervention.

Ethics

Approval was granted by an NHS Research Ethics Committee (Reference:15/LO/1186).

Primary outcome measure

Attendance of the Lung Health Check appointment (% of those invited) to measure whether individuals could be engaged in considering a screening offer.

Secondary outcome measures

The pre-specified secondary endpoints in our statistical analysis plan (SAP) include comparison of uptake by demographic and smoking status sub-groups, uptake of LDCT screening for those eligible (and willingness among those ineligible), and informed decision-

making outcomes. Data on participants' engagement with the invitation materials were also collected. Further pre-specified endpoints are LDCT scan results, resource use, and psychological outcomes.

Demographic data

Pseudonymised data on age, sex, ethnicity and area-level socioeconomic deprivation (Index of Multiple Deprivation (IMD) score and rank), were collected from the primary care records of all those invited and again from attenders using self-report measures. Attenders also reported their education level and marital status. Hospital site of the screening offer was recorded.

Smoking data

Last recorded smoking status was extracted from primary care records (recoded as current/occasional, former and never). Self-reported smoking status and smoking history were collected from attenders. Smoking duration and pack-years were calculated by the research nurse in combination with participants' quit histories. For current smokers, the number of previous 'serious' quit attempts, tobacco dependence(35) and perceived chances of quitting(36) were measured.

Uptake data

Secondary outcomes included uptake of LDCT screening for those eligible, and willingness to be screened for those ineligible.

Decision-making outcomes

A self-complete paper questionnaire given at the appointment included adapted items from the Satisfaction with Decision (SWD) scale(37) and the low literacy version of the Decisional Conflict Scale (DCS)(38,39). A further nine items measured conceptual and numerical knowledge of lung cancer screening; including original and adapted items(40). Responses were dichotomised as correct vs. incorrect/not sure and summed.

Engagement with the invitation leaflets

Participants were asked whether they remembered, read and understood their respective leaflet, and whether they had been ‘useful’, ‘difficult to understand’, ‘informative’, ‘too complicated’, or had ‘too little information’. Research nurses rated participants’ background knowledge of screening subjectively as: ‘none’, ‘very little’, ‘moderate’, ‘fairly good’, and ‘very comprehensive/near perfect’.

Statistical analyses

Sample size

Uptake for the control group was estimated to be 35% based on first-time uptake of the faecal occult blood test (FOBT) colorectal cancer screening programme in London within the two most deprived quintiles(41). With a target sample size of 2000 participants randomised evenly into two arms, the study was statistically powered (at 90%) to detect a 7% increase in uptake using two-sided tests at the 5% significance threshold. The 7% figure was based on studies testing targeted ‘psycho-educational’ invitations in colorectal screening(20,21) and considered a clinically meaningful benefit.

Primary analyses

Data were analysed using IBM SPSS (v.25). Analyses followed a prospectively registered SAP (DOI:10.17605/OSF.IO/HKEMM) and the trial protocol(27). The primary outcome was analysed using an intention-to-treat approach (n=2012). Attendance was compared by invitation group using logistic regression and a deviance chi-squared test for statistical significance.

Secondary analyses

Analyses tested for associations between demographic characteristics, smoking status, and attendance, using bivariate and then multivariable logistic regression models to calculate adjusted odds ratios (n=1970). Study-specific quintiles for IMD rank were calculated because the sample was skewed toward above average deprivation.

Logistic regression analyses then explored correlates of LDCT uptake among eligible participants. The decision-making outcomes were compared by invitation group, using chi-squared tests or T-tests. For data collected after attendance, 'prefer not to say', 'not stated' or 'don't know' responses were treated as missing.

RESULTS

Characteristics of the invited sample

The average age was 66.0 (SD:4.3), 53.7% were male, and the majority (79.7%) were from a White ethnic group (Table 1). Overall, there was higher representation of ethnic minority groups compared with the general population (14%) but lower than in London (40%), likely due to the younger age structure and differences in smoking prevalence(42). Nearly all

those invited (96.2%) were categorised within the most deprived (60.9%) or second most deprived (35.3%) IMD quintile. Three quarters (74.5%) were current smokers.

Primary analyses

Uptake of the Lung Health Check

Sixteen GP practices participated with a combined population of 147,015 patients (Figure 1). 2012 individuals were randomised in equal numbers (n=1006) to the invitation groups. Over half 52.6% (1058) attended their appointment (Table 1).

Individuals predominantly attended the first appointment offered (40.3%), but 9.6% attended the second appointment offered with their reminder. There was no response from 42.1%. There was no statistically significant difference in uptake by hospital site (53.0% vs. 50.8%). Most (94.9%) attenders enrolled.

Near equal numbers from the intervention (52.3%) and control groups (52.9%: 526 vs. 532, respectively) attended. In unadjusted analyses, there was no association between invitation group and uptake (OR: 0.98; 0.82-1.16; Table 2).

Secondary analyses

Correlates of uptake of the Lung Health Check

Neither gender nor age were associated with uptake (Table 2). Ethnicity was associated with uptake across groups ($p < .001$). Compared with those of a White ethnic background, individuals of an Other ethnic background were more likely to attend (aOR: 2.34; 95% CI: 1.30-4.20) and those with no recorded ethnic group were less likely to attend (aOR: 0.09; 0.04-0.19). Higher deprivation was associated with lower uptake across study-specific IMD

quintiles ($p < .01$). Individuals categorised within the three least deprived study-specific quintiles had higher odds of attendance compared with those in the most deprived quintile (aOR: 1.62; 1.21-2.15 and aOR: 1.68; 1.26-2.25). Current smokers were significantly less likely to attend than former smokers (aOR: 0.70; 0.56-0.86).

When analyses of uptake were stratified by invitation group, there were again no associations with gender, age or hospital site. For the control group, the same associations with Other (vs. White) ethnicity (aOR: 3.23; 1.28-8.14) and not stated ethnicity (aOR: 0.03; 0.00-0.19) were observed. Deprivation was significantly associated with increasingly lower odds of attendance across quintiles ($p < .05$). For example, the odds of uptake for the least deprived quintile were nearly twice as high as those for the most deprived (aOR: 1.93; 1.28-2.93). Ethnicity was also associated with uptake for the intervention group ($p < .001$), with lower odds of uptake for those with no stated ethnic group (aOR: 0.15; 0.06-0.35). Conversely, deprivation did not significantly differentiate uptake in the intervention invitation group.

Figure 2 presents the absolute percent uptake by study-specific IMD quintile and invitation group. The gradient appears relatively less steep in the intervention group, with uptake relatively higher for the two most deprived quintiles in the intervention group (47.9% and 53.5%) compared with the control group (42.8% and 49.7%), and relatively lower for the two least deprived quintiles (46.8% and 56.1% vs. 55.8% and 60.4%, respectively).

Smoking characteristics and eligibility for screening

On average, attenders reported beginning smoking aged 17.9 (SD: 5.8) and accumulated a 39.4 (SD: 25.0) pack-year history (Table 3). Most current smokers had tried to quit

previously (78.7%) and had low confidence in their chances of quitting (58.7%). The majority (84.5%) were eligible for LDCT screening. Among those ineligible (n=160), willingness to be screened was high (81.9%).

Uptake of the LDCT scan

Most (91.2%) of those eligible chose to have the scan (Table 4). Gender, age and marital status were not associated with LDCT uptake. For ethnicity, Asian ethnicity predicted lower odds of uptake compared with White ethnicity (aOR: 0.09; 0.02-0.31), but there were few Asian participants (n=13). There was no association with Black ethnicity, and too few non-cases within the other ethnic groups. Deprivation was not associated with LDCT uptake. In unadjusted analyses, current smokers were less likely to opt for the LDCT scan than former smokers, but the association was not statistically significant in adjusted analyses (aOR: 0.52; 0.27-1.01). Invitation group did not affect the likelihood of LDCT uptake.

Engagement with the invitation leaflets

A higher number of control participants (81.3%) remembered receiving their respective leaflet compared with the intervention group (64.1%, $p<.001$). Intervention participants understood more of their leaflet ($p<.05$) but there were no differences in background knowledge. Supplementary File 2 presents further analyses.

Decision-making outcomes

There was no difference in mean scores for conceptual and numerical knowledge by invitation group (Supplementary File 2). Across both groups, endorsement of the DCS was high ($\geq 76.2\%$) indicating low conflict. Most participants reported awareness of the benefits of screening, knew which they valued, felt supported, and were clear about their choice (all

≥89.6%). The risks were less well understood. Fewer control participants reported that they knew what the risks were compared with intervention participants (76.2% vs. 83.2%, $p<.05$), but similar numbers knew which they valued (84.6% and 84.2%, respectively). Decisional satisfaction was high across groups; both self-reported and nurse-rated (all ≥97.3%).

DISCUSSION

Uptake of the Lung Health Check was 53% which is an important finding in itself, considerably higher than previously observed. The population was high-risk, with the majority eligible for LDCT screening. The intervention made no difference to uptake overall or by smoking status, with uptake biased in favour of former (compared with current) smokers. However, there was evidence that the targeted, stepped and low burden materials were relatively more effective at engaging the most deprived individuals.

A major strength of this study is its ecological validity. The design simulated a real-world service using practically feasible invitation methods via primary care, with the invited sample unaware their attendance was under study. Collecting individual-level demographic and smoking data provided a comprehensive understanding of non-responders. A census-derived, area-based measure of deprivation allowed national comparison, but is less sensitive to individual variation. Moreover, the generalisability of these findings to affluent high-risk groups, a wider age range and ethnic minority groups may be limited. We had complete data on most variables but there were 26 (1.3%) missing deprivation scores. Sensitivity analysis using multiple imputation made no difference to the findings.

Fifty-three percent uptake is an encouraging figure compared with trials and pilot services to-date(11,12); especially given the invited sample was predominantly comprised of lower

SEP current smokers. In UKLS, interest from the most deprived quintile did not reach 20%(9). Indeed, attenders were high-risk, with 84% eligible for LDCT screening. Furthermore, this was a first-time invitation with no wider publicity or community engagement(11,12). Uptake also compares favourably with first-time uptake of colorectal screening by Faecal Occult Blood Test (FOBT) in London (41%) and is on a par with national FOBT uptake (54%) when launched in 2006(41). However, uptake is lower than current national figures for breast (71%) and cervical (72%) cancer, but seemingly not because men were less likely to attend.

Finding a reduced socioeconomic gradient in uptake for the intervention group suggests that targeted and low burden invitation materials show promise for better engaging high-risk individuals living in the most socioeconomically deprived areas. Nevertheless, it was the control invitation strategy that achieved the highest uptake for the least deprived quintile. These results suggest that the intervention invitation approach may be the more equitable; holding potential for reducing inequalities and achieving a greater reduction in lung cancer mortality by engaging those at highest risk. Future research should examine the feasibility and acceptability of stratifying invitation materials by area-level deprivation.

Related to this, intervention and control participants achieved similar decision-making outcomes, suggesting the 'low information burden' component did not compromise decision-making. In fact, it was control participants who less frequently felt informed about the risks of screening despite receiving this information in advance. Our 'low burden' component was informed by evidence that information burden can deter individuals with low literacy(43–45) and that a third of non-participants in colorectal screening have not read the information booklet(46). Moreover, information receptivity and comprehension may be

adversely affected by a fearful emotional state(24,25), which a first-time lung screening invitation could provoke(13). Perhaps the appointment was a better environment to achieve comprehension, with the research nurse's support and time to mentally adjust to the offer. Alternatively, control participants may have paid less attention to the booklet at their appointment because the information was not novel. Nevertheless, these findings suggest that providing detailed information with screening invitations may neither be sufficient for supporting informed choice nor an equitable invitation approach. A low burden approach that builds up information in steps to full information provision during the appointment could be further tested for decision-making and inequalities in participation.

The intervention had no effect on smoking-related inequalities, with uptake skewed in favour of former smokers as in previous trials(7–9) and screening programmes for other cancer types(47–50). Research suggests that fatalism, fear and stigma are deep-rooted attitudes(13,17), which may be particularly resistant to change among current smokers. Alternatively, perhaps addiction-specific factors are more instrumental. As this was a multifactorial intervention with no process evaluation, we cannot draw conclusions about individual components. It does however highlight there to be both independent and shared barriers to participation associated with lower SEP and current smoking status.

A simple primary care record search effectively identified a largely screening-eligible population, suggesting invitation through primary care is feasible for a population-based programme, as well as a strategy likely to improve uptake. Indeed, adopting the invitation methods common to both groups may optimise participation. This includes a Lung Health Check approach, GP endorsement(21,23), pre-invitations(29), postal reminders(30), and scheduled appointments(34,51). The reminder re-invitations offering a second scheduled

appointment prompted uptake by a further 10%, suggesting that lowering practical demands helps non-responders overcome non-intentional barriers. While offering scheduled appointments appears to have been effective, 47% of invited individuals did not attend which has resource implications. We mitigated the impact by over-booking appointments and other strategies might include asking invitees to confirm attendance. Lessons could be learned from the UK's NHS Breast Cancer Screening Programme which sends timed appointments(30). Overall, the likely effectiveness of the methods shared by both trial arms suggests that translating intention into action may be easier to achieve than changing attitudes.

There remains a gap in knowledge of the most effective means of modifying psychological barriers to participation. More foundational and experimental research is needed to isolate and test different approaches. It is likely that a multi-pronged screening communication strategy would be needed as well as interventions at the wider healthcare system level, to ensure that the screening pathway optimises individuals' screening experience.

Uptake of LDCT screening is likely to increase if offered as an organised Lung Health Check programme and individuals are invited via primary care. It is possible to engage a high-risk, screening-eligible sample of lower SEP current smokers using feasible, population-based and low-cost methods. A targeted, stepped and low burden invitation approach shows promise for reducing the social gradient in uptake by engaging individuals living in areas of highest deprivation, without compromised decision-making. Further research is critical to understand how to further reduce inequalities; especially for current smokers.

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LEGENDS

Figure 1 CONSORT trial flow diagram

Figure 2 Uptake by study-specific^a deprivation quintile (IMD) for each invitation group

Table 1 Sample characteristics of all those invited, overall and by invitation group

Table 2 Frequencies and logistic regression analyses examining the correlates of uptake

Table 3 Smoking characteristics of attenders consenting to LSUT and eligibility for LDCT

Table 4 Frequencies and logistic regression analyses examining the correlates of uptake of the LDCT scan among LDCT-eligible attenders

FOOTNOTES

Declaration of interests

All authors have completed the ICMJE uniform disclosure form at www.icmje.org/coi_disclosure_pdf and declare financial support from Cancer Research UK for the submitted work. SLQ, JD, MR, RJB, DRB, AB, NN, KS, SWD and JW declare no support from financial organisations that might have an interest in the submitted work in the previous three years. SMJ, JD and MR receive funding from a commercial US healthcare company (GRAIL Inc.) as part of funding for a large trial of low dose CT screening, called the 'SUMMIT Study'. SQ collaborates on the SUMMIT Study. SMJ has been paid by Astra Zeneca, BARD1 Bioscience and Achilles Therapeutics for being an Advisory Board Expert and travel to one US conference. SMJ receives grant funding from Owlstone for a separate research study. MR has received travel funding for a conference and educational meeting from Takeda and Astra Zenica. RJB has received grant funding from Vanilla Blush for a separate research study. AM has received travel funding, honorariums and consultancy payments from manufacturers of smoking cessation products (Pfizer Ltd, Novartis UK and GSK Consumer Healthcare Ltd) and hospitality from North51 who provide online and database services. AM also receives payment for providing training to smoking cessation specialists and receives royalties from books on smoking cessation. AM is an Associate of the New Nicotine Alliance (NNA) that works to foster greater understanding of safer nicotine products and technologies. All authors perceive that these disclosures pose no academic conflict for this study. All authors declare no other relationships or activities that could appear to have influenced the submitted work.

Role of the funding source

The funders had no role in the study design, data collection, data analysis and interpretation, the writing of the manuscript, or in the decision to submit the manuscript for publication. All authors and researchers are independent of the study funders. The corresponding author had full access to all data and had final responsibility for the decision to submit for publication.

Data sharing statement

Relevant individual de-identified participant data (including data dictionaries) will be made available upon reasonable request to SMJ. Data will be available to share after the publication of the study primary and secondary endpoints. The study protocol and SAP are openly available online and referenced in this manuscript.

Table 1 Sample characteristics of all those invited, overall and by invitation group

	All (n=2012)	Intervention (n=1006)	Control (n=1006)
Gender, % (n)			
Female	46.3 (931)	44.7 (450)	47.8 (481)
Male	53.7 (1081)	55.3 (556)	52.2 (525)
Age, mean (SD)	66.0 (4.3)	66.1 (4.3)	65.9 (4.3)
Ethnicity, % (n)			
Asian	2.1 (42)	2.3 (23)	1.9 (19)
Black	9.6 (193)	9.4 (95)	9.7 (98)
Mixed	1.7 (34)	1.4 (14)	2.0 (20)
White	79.7 (1604)	79.6 (801)	79.8 (803)
Other	2.9 (59)	3.1 (31)	2.8 (28)
Not stated	4.0 (80)	4.2 (42)	3.8 (38)
National IMD quintile, % (n)			
Quintile 1 (1-6496) most deprived	60.9 (1226)	60.5 (609)	61.3 (617)
Quintile 2 (6497-12993)	35.3 (711)	35.4 (356)	35.3 (355)
Quintile 3 (12994-19489)	2.3 (47)	2.5 (25)	2.2 (22)
Quintile 4 (19490-25986)	0.1 (2)	0.1 (1)	0.1 (1)
Quintile 5 (25987-32482) least deprived	-	-	-
Missing	1.3 (26)	1.5 (15)	1.1 (11)
Smoking status, % (n)			
Current smoker	74.5 (1499)	76.2 (767)	72.8 (732)
Former smoker	24.7 (497)	23.0 (231)	26.4 (266)
Never smoked tobacco	0.6 (13)	0.8 (8)	0.5 (5)
Refused/Not stated	0.1 (2)	-	0.2 (2)
Missing	0.0 (1)	-	0.1 (1)
Attendance, % (n) of all invited			
Overall	52.6 (1058)	52.3 (526)	52.9 (532)
Attended first appointment	40.3 (811)	39.7 (399)	41.0 (412)
Cancelled first appointment	5.0 (100)	4.6 (46)	5.4 (54)
Sent reminder (no response to first invitation)	54.7 (1101)	55.8 (561)	53.7 (540)
Attended second (reminder) appointment	9.6 (194)	9.4 (95)	9.8 (99)
Cancelled second (reminder) appointment	2.9 (59)	3.4 (34)	2.5 (25)
No response to reminder invitation	42.1 (848)	42.9 (432)	41.4 (416)

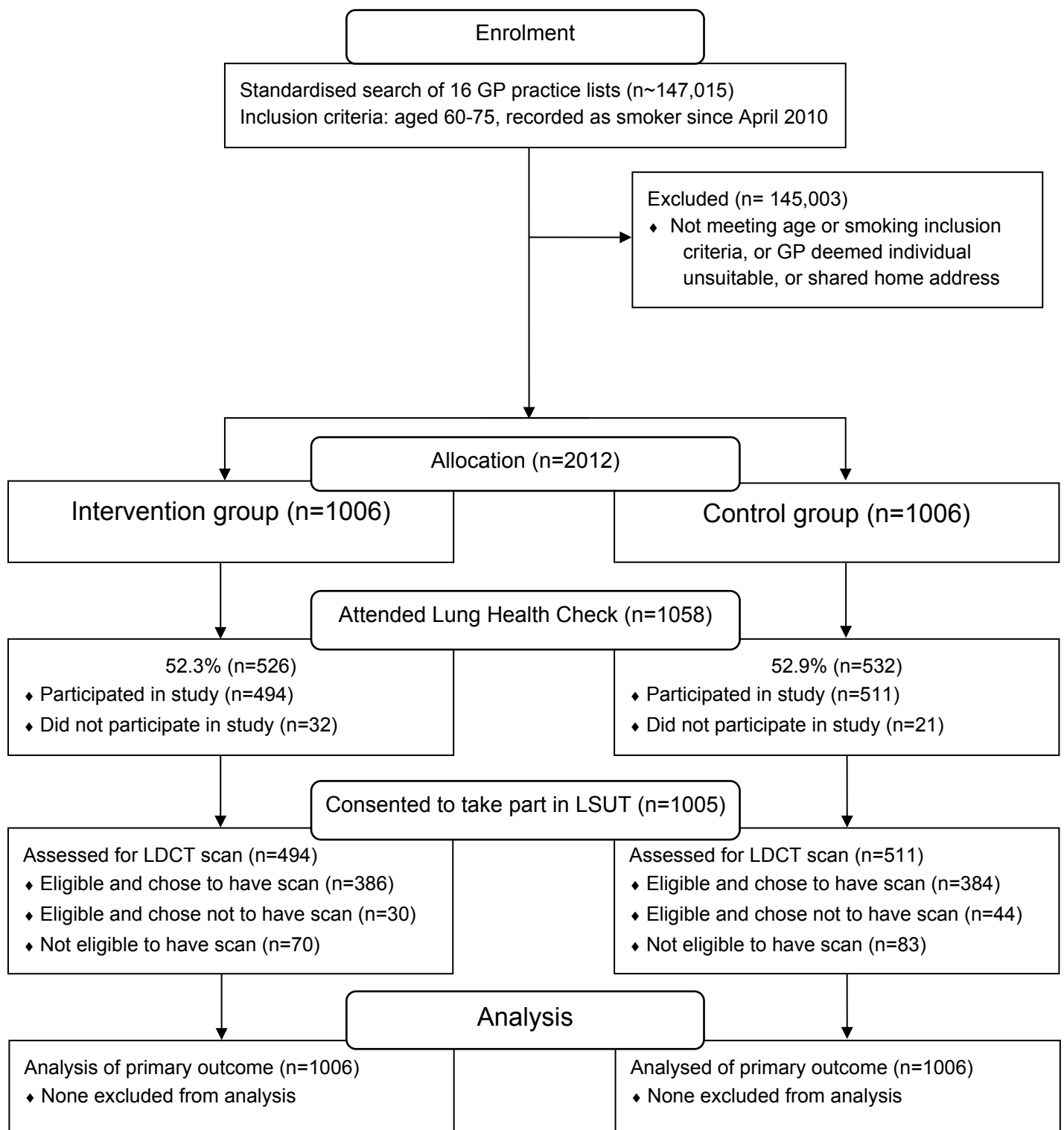
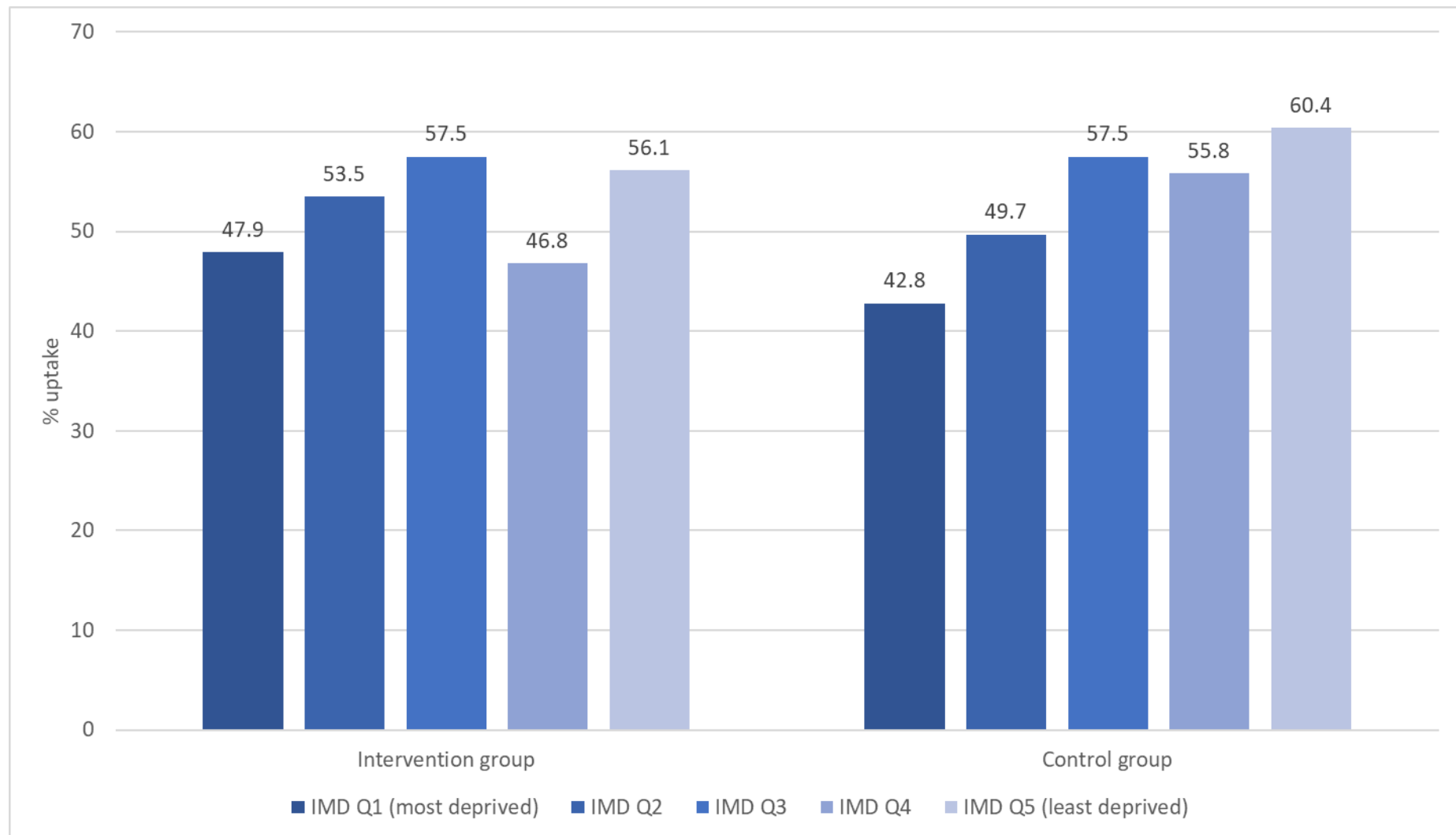
Figure 1 CONSORT trial flow diagram

Table 2 Frequencies and logistic regression analyses examining the correlates of uptake

	All			Intervention		Control	
	Attended % (n) (n=2012)	Unadjusted OR (95% CI) (n=2012)	Adjusted OR (95% CI) (n=1970)	Unadjusted OR (95% CI) (n=1006)	Adjusted OR (95% CI) (n=983)	Unadjusted OR (95% CI) (n=1006)	Adjusted OR (95% CI) (n=987)
Gender		p=.557	p=.433	p=.828	p=.944	p=.290	p=.237
Female	52.0 (479)	1.00	1.00	1.00	1.00	1.00	1.00
Male	53.4 (574)	1.05 (0.88, 1.26)	1.08 (0.90, 1.29)	0.97 (0.76, 1.25)	0.99 (0.76, 1.29)	1.14 (0.89, 1.47)	1.17 (0.90, 1.52)
Age		p=.857	p=.879	p=.484	p=.365	p=.331	p=.188
		1.00 (0.98, 1.02)	1.00 (0.98, 1.02)	0.99 (0.96, 1.02)	0.99 (0.96, 1.02)	1.02 (0.99, 1.05)	1.02 (0.99, 1.05)
Ethnicity		p<.001	p<.001	p<.001	p<.001	p<.001	p<.001
White	54.1 (864)	1.00	1.00	1.00	1.00	1.00	1.00
Asian	52.6 (20)	0.85 (0.46, 1.57)	0.87 (0.45, 1.69)	1.13 (0.49, 2.60)	1.44 (0.56, 3.75)	0.61 (0.24, 1.53)	0.52 (0.20, 1.37)
Black	56.0 (107)	1.11 (0.82, 1.49)	1.11 (0.82, 1.51)	1.09 (0.71, 1.68)	1.06 (0.68, 1.65)	1.12 (0.73, 1.71)	1.17 (0.76, 1.81)
Mixed	36.4 (12)	0.47 (0.23, 0.95)	0.48 (0.24, 1.00)	0.35 (0.11, 1.12)	0.37 (0.11, 1.23)	0.56 (0.23, 1.38)	0.57 (0.23, 1.43)
Other	72.9 (43)	2.29 (1.28, 4.10)	2.34 (1.30, 4.20)	1.82 (0.85, 3.92)	1.92 (0.89, 4.15)	3.07 (1.23, 7.66)	3.23 (1.28, 8.14)
Not stated ^a	8.9 (7)	0.08 (0.04, 0.18)	0.09 (0.04, 0.19)	0.15 (0.06, 0.35)	0.15 (0.06, 0.35)	0.02 (0.00, 0.17)	0.03 (0.00, 0.19)
Study-specific deprivation quintile^b		p<.01 ^c	p<.01	p=.154 ^c	p=.100	p<.01 ^c	p<.05
Quintile 1 (most deprived)	45.2 (179)	1.00	1.00	1.00	1.00	1.00	1.00
Quintile 2	51.6 (205)	1.29 (0.97, 1.70)	1.28 (0.96, 1.71)	1.25 (0.84, 1.86)	1.28 (0.85, 1.92)	1.31 (0.89, 1.93)	1.31 (0.87, 1.96)
Quintile 3	57.5 (234)	1.63 (1.23, 2.15)	1.62 (1.21, 2.15)	1.49 (1.00, 2.21)	1.49 (0.99, 2.24)	1.77 (1.20, 2.62)	1.74 (1.16, 2.61)
Quintile 4	51.3 (195)	1.27 (0.96, 1.68)	1.23 (0.92, 1.64)	0.98 (0.66, 1.47)	0.96 (0.64, 1.45)	1.63 (1.10, 2.42)	1.60 (1.06, 2.41)
Quintile 5 (least deprived)	58.2 (227)	1.65 (1.25, 2.19)	1.68 (1.26, 2.25)	1.36 (0.91, 2.02)	1.44 (0.96, 2.17)	2.01 (1.35, 2.99)	1.93 (1.28, 2.93)
Smoking status		p<.001 ^d	p<.01	p<.05 ^d	p<.05	p<.01 ^d	p<.05
Former smoker	60.2 (299)	1.00	1.00	1.00	1.00	1.00	1.00
Current smoker	50.3 (754)	0.67 (0.55, 0.82)	0.70 (0.56, 0.86)	0.70 (0.52, 0.94)	0.72, 0.53, 0.97)	0.65 (0.49, 0.86)	0.68 (0.51, 0.92)
Invitation group		p=.789	p=.843				
Control	53.0 (529)	1.00	1.00	-	-	-	-
Intervention	52.5 (524)	0.98 (0.82, 1.16)	0.98 (0.82, 1.18)	-	-	-	-

NOTE: ^aNo record of ethnic group in primary care; ^b2010 IMD rank quintile with cut-offs based on distribution in LSUT sample; ^cCases with no IMD rank/score were excluded (n=26 in full sample); ^dNever smokers (n=13 in full sample) and refused/missing smoking status (n=3 in full sample) were excluded

Figure 2 Uptake by study-specific^a deprivation quintile (IMD) for each invitation group (n=2012)

NOTE: ^a2010 IMD rank quintile with cut-offs based on distribution in LSUT sample

Table 3 Smoking characteristics of attenders consenting to LSUT and eligibility for LDCT

	All (n=1000) ^a	Intervention (n=492)	Control (n=508)
Age started smoking, mean (SD, range)	17.9 (5.8, 6-55)	17.9 (5.5, 7-55)	17.9 (6.1, 6-55)
Age stopped smoking^b, mean (SD, range)	59.4 (10.7, 0-75)	59.8 (10.4, 21-75)	59.1 (11.0, 0-75)
Number of years smoked, mean (SD, range)	45.5 (9.5, 2-64)	45.6 (9.1, 2-64)	45.4 (9.9, 3-63)
Pack years, mean (SD, range)	39.4 (25.0, 1-171)	38.0 (22.2, 1-128)	40.7 (27.5, 1-171)
Usual daily cigarette consumption^{c,d}, % (n)			
1 to 10	55.7 (395)	55.3 (199)	56.2 (196)
11 to 20	33.3 (236)	34.7 (125)	31.8 (111)
21 to 30	5.9 (42)	5.3 (19)	6.6 (23)
≥31	2.3 (16)	2.2 (8)	2.3 (8)
Missing	2.8 (20)	2.5 (9)	3.2 (11)
Time to first cigarette^d, % (n)			
Within 5 minutes	16.5 (117)	16.9 (61)	16.0 (56)
6-30 minutes	33.4 (237)	33.9 (122)	33.0 (115)
31-60 minutes	16.8 (119)	17.2 (62)	16.3 (57)
>60 minutes	31.5 (223)	31.1 (112)	31.8 (111)
Missing	1.8 (13)	0.8 (3)	2.9 (10)
Nicotine dependence (HSI score)^d, % (n)			
Low dependence	38.9 (276)	38.6 (139)	39.3 (137)
Moderate dependence	42.9 (304)	43.1 (155)	42.7 (149)
High dependence	14.5 (103)	15.3 (55)	13.8 (48)
Missing	3.7 (26)	3.1 (11)	4.3 (15)
Perceived chance of quitting^d, % (n)			
Very low/Low/Not very high	58.7 (416)	56.9 (205)	60.5 (211)
Quite high/Very high/Extremely high	38.5 (273)	41.4 (149)	35.5 (124)
Missing	2.8 (20)	1.7 (6)	4.0 (14)
Previous quit attempts^d, % (n)			
None	20.3 (144)	21.7 (78)	18.9 (66)
1 to 5	59.7 (423)	57.5 (207)	61.9 (216)
>5	19.0 (135)	20.0 (72)	18.1 (63)
Missing	1.0 (7)	0.8 (3)	1.1 (4)
Eligibility for LDCT scan, % (n)	84.5 (845)	84.6 (416)	83.4 (429)
LDCT scan willingness (of ineligible), % (n)			
Yes, definitely	66.9 (107)	71.8 (56)	62.2 (51)
Yes, probably	15.0 (24)	10.3 (8)	19.5 (16)
Probably not	3.8 (6)	1.3 (1)	6.1 (5)
Definitely not	3.8 (6)	5.1 (4)	2.4 (2)
Missing	10.3 (17)	11.5 (9)	9.8 (8)

NOTE: ^aNever smokers (n=4) and missing smokers (n=1) were excluded; ^bFormer smokers only (n=269) ^cFor participants reporting grams of tobacco per week, these were converted to number of cigarettes per day; ^dCurrent smokers only (n=709)

Table 4 Frequencies and logistic regression analyses examining the correlates of uptake of the LDCT scan among LDCT-eligible attenders

	Attenders eligible for LDCT (n=845)		
	LDCT uptake % (n)	Unadjusted OR (95% CI)	Adjusted OR (95% CI)
Overall	91.2 (770)	-	-
Gender		p=.846	p=.979
Female	91.4 (342)	1.00	1.00
Male	91.1 (428)	0.95 (0.59, 1.54)	1.01 (0.60, 1.68)
Age		p=.275	p=.267
	-	0.97 (0.92, 1.03)	0.97 (0.91, 1.03)
Marital status		p=.443	p=.394
Married/Cohabiting	92.2 (320)	1.00	1.00
Single/Separated/Divorced/Widowed	90.7 (449)	0.82 (0.50, 1.35)	0.79 (0.46, 1.36)
Ethnicity		p<.01	p<.01
White	91.3 (642)	1.00	1.00
Asian	53.8 (7)	0.11 (0.04, 0.34)	0.09 (0.02, 0.31)
Black	92.7 (76)	1.20 (0.50, 2.88)	1.28 (0.52, 3.14)
Mixed	100.0 (8)	-	-
Other	97.1 (34)	-	-
Not stated	100.0 (3)	-	-
Study-specific deprivation quintile^a		p=.074	p=.072
Quintile 1 (most deprived)	88.2 (134)	1.00	1.00
Quintile 2	91.7 (154)	1.48 (0.71, 3.08)	1.82 (0.75, 3.49)
Quintile 3	95.6 (172)	2.89 (1.22, 6.85)	2.82 (1.18, 6.78)
Quintile 4	87.7 (136)	0.96 (0.48, 1.91)	0.94 (0.46, 1.91)
Quintile 5 (least deprived)	92.7 (165)	1.71 (0.81, 3.61)	1.74 (0.80, 3.77)
Smoking status		p<.05	p=.052
Former	94.6 (211)	1.00	1.00
Current (incl. occ)	90.0 (559)	0.51 (0.27, 0.97)	0.52 (0.27, 1.01)
Invitation group		p=.177	p=.075
Control	89.7 (384)	1.00	1.00
Intervention	92.8 (386)	1.47 (0.91, 2.40)	0.63 (0.37, 1.05)

NOTE: Missing data were excluded; ^a2010 IMD rank quintile with cut-offs based on distribution in LSUT sample

Online Supplementary File

Table S1 Frequencies and chi square analyses for the educational status of the attenders, their prior knowledge, and their engagement with, and impressions of, the respective leaflets

	Intervention (n = 492) ^a	Control (n = 508) ^a	Sig.
Education, % (n)			
Finished school aged ≤15 years	52.3 (257)	52.8 (268)	.879
CSEs/O'levels	11.2 (55)	9.6 (49)	
A'levels/Further education/Other	15.5 (76)	15.9 (81)	
Degree/Further degree	21.0 (103)	21.7 (110)	
Nurse rating of background knowledge, % (n)			
No knowledge/Virtually no knowledge	9.7 (44)	7.2 (34)	.565
Very little knowledge	36.2 (164)	38.1 (180)	
Moderate level of knowledge	34.2 (155)	34.7 (164)	
Fairly good level of knowledge	16.8 (76)	17.8 (84)	
Very comprehensive/Near perfect knowledge	3.1 (14)	2.1 (10)	
Nurse rating of detail of explanation needed, % (n)			
Very brief discussion required	4.4 (20)	4.2 (20)	.991
Fairly brief discussion required	34.4 (155)	33.8 (159)	
Fairly detailed discussion required	41.5 (187)	42.5 (200)	
Very detailed discussion required	19.7 (89)	19.5 (92)	
Leaflet received in the post, % (n)			
'MOT for your Lungs' leaflet (intervention group)	64.1 (307)	3.1 (15)	.000
'Lung Health Check' leaflet (control group)	11.5 (55)	81.3 (399)	
Both leaflets	1.0 (5)	0.8 (4)	
Neither leaflet	23.4 (112)	14.9 (73)	
Amount read before the appointment^b, % (n)			
None	15.3 (47)	10.3 (41)	.143
A little	5.5 (17)	6.0 (24)	
Some of it	12.4 (38)	15.5 (62)	
Most of it	10.7 (33)	14.8 (59)	
All of it	54.4 (167)	52.8 (211)	
Don't know/Can't remember	1.5 (5)	0.8 (3)	
Amount understood of the leaflet^b, % (n)			
None	3.4 (9)	3.6 (13)	.010
A little	6.1 (16)	2.2 (8)	
Some of it	6.5 (17)	12.9 (47)	
Most of it	14.9 (39)	17.0 (62)	
All of it	69.0 (180)	64.3 (234)	
Overall impression of the leaflet, % (n)			
Useful	92.1 (246)	95.2 (416)	.103
Informative	92.1 (245)	94.7 (414)	.188
Difficult to understand	6.4 (17)	6.9 (30)	.877
Too complicated	5.3 (14)	5.7 (25)	.866
Too little information	14.0 (37)	6.9 (30)	.002

NOTE: ^aMaximum sample size, missing data and 'don't know' responses were excluded on an item-by-item basis; ^bAnalyses restricted to those who recalled receiving the leaflet (n=707); ^cAnalyses restricted to those who recalled receiving the leaflet and excluding 'N/A' responses (n=625)

Table S2 Decision-making outcomes by invitation group

	Intervention (n=388)^a	Control (n=415)^a
<i>Objective knowledge score (out of 9), mean (SD)</i>	5.7 (2.3)	5.5 (2.3)
<i>Low Literacy Decisional Conflict Scale, % (n) answering yes</i>		
<i>Uncertainty</i>		
Do you feel sure about whether to be screened or not?	95.6 (368)	94.6 (389)
Are you clear about whether being screened for lung cancer is the best choice for you?	96.9 (374)	95.9 (394)
<i>Informed</i>		
Do you know the benefits of lung cancer screening?	93.0 (360)	91.1 (377)
Do you know the risks and side effects of lung cancer screening?	83.2 (321)*	76.2 (314)*
<i>Values clarity</i>		
Are you clear about which benefits matter most to you?	91.6 (349)	89.6 (361)
Are you clear about which risks and side effects matter most to you?	84.2 (324)	84.6 (347)
<i>Supported</i>		
Do you have enough support from others to make a choice about whether or not to be screened for lung cancer?	89.0 (340)	88.8 (364)
Are you choosing without pressure from others?	93.0 (358)	91.1 (378)
Do you have enough advice to make a choice about whether or not to be screened for lung cancer?	95.6 (369)	95.4 (393)
<i>Decisional satisfaction</i>		
How satisfied are you with your decision about being screened for lung cancer? % (n) <i>satisfied/very satisfied</i>	99.2 (378)	98.8 (405)
Do you feel the decision you made about being screened was the best choice for you personally? % (n) answering yes	98.7 (376)	97.3 (399)
<i>Nurse satisfaction</i>		
How satisfied are you that the patient has understood the harms and benefits of screening enough to make an informed decision? % (n) <i>satisfied/very satisfied</i>	98.7 (376)	97.3 (399)

NOTE: ^aMaximum sample size, missing data were excluded on an item-by-item basis; *X², p<.05

LSUT Intervention Group

Invitation letters and leaflet

These invitation letters and leaflets were created by the Department of Behavioural Science and Health, and Lungs for Living Research Centre within the Division of Respiratory Medicine, at University College London (UCL), and are licensed under CC BY. Image licenses should be sought separately.

GP LETTERHEAD

<<date4>>

Dear <<Title>> <<Firstname>> <<Surname>>

Free NHS Lung Health Checks

We are working with University College Hospital to start offering Lung Health Checks to patients in your age group. A leaflet with information about the Check is included with this letter.

Your lungs work hard every minute of your life. As you get older, it's worth checking things out.

No need for you to do anything, this letter is for your information only. We will start to invite patients automatically in the next few weeks so look out for an invitation in the post.

Kindly be aware that our GP practice will not be able to answer any questions about the Lung Health Checks because the lung clinic at University College Hospital is organising them.

Contact information for the clinic will be sent to any patients who are invited.

Yours sincerely

<<Usual GP>>

Our ref: <<GP-TPN>>

<<date4>>

Dear <<Title>> <<Firstname>> <<Surname>>

Free NHS Lung Health Check

I'm inviting you for a Lung Health Check at University College Hospital.

Your lungs work hard every minute of your life. As you get older, it's worth checking things out.

The checks are for people age 60 to 75 who have ever smoked. You are invited whether you feel fine or not and whether or not you have any lung problems.

What to expect

A specially trained nurse, who will be able to answer any of your questions, carries out the Lung Health Check. It should take approximately 60 minutes.

During the Lung Health Check you will be asked to blow into two machines. You may also be offered a lung CT scan.

Date and time of your Lung Health Check

<<1st appointment day>>, <<1st appointment date>> at <<1st appointment time>>

What you need to do now

Please read the information on the back of this letter. Then:

- Take a moment to plan your journey so you arrive on time (see the map on the back)
- OR
- If you **do not want** the appointment, or want to **change the date** or time, call the lung clinic for free on **0808 281 9525** or call/text **07469 118 308** or email **lungscreen@ucl.ac.uk** as soon as possible.

Kindly be aware that the GP practice will not be able to answer questions about the appointments - only the lung clinic can cancel or organise appointments, and answer any questions you have. **Please bring this letter to your appointment.**

Yours sincerely

<<Usual GP>>

Please turn over
Our ref: <<GP-TPN>>

Information about the Lung Health Check

For more information, see the leaflet *M.O.T. for your lungs*

What happens during the Lung Health Check?

- You will be welcomed by a nurse who will tell you everything you need to know about the lung health check and answer any questions.
- You will be asked to blow into two machines which show how well your lungs work and whether there are any problems that need taking care of. The nurse will tell you about the benefits and risks.
- You will be asked if the nurse can take samples of blood, breath, sputum and cheek cells (by rubbing something that looks like a cotton wool bud against the cheek). You can choose whether or not you would like to have these samples taken.
- You may also be offered a lung scan. Called a 'CT Scan', it is a type of chest X-ray. It checks for early signs of lung cancer. You don't have to have the scan and you can make your mind up after talking to the nurse.

Need more information before your appointment?

Call us free on **0808 281 9525** or call/text **07469 118 308** or email us at **lungscreen@ucl.ac.uk**

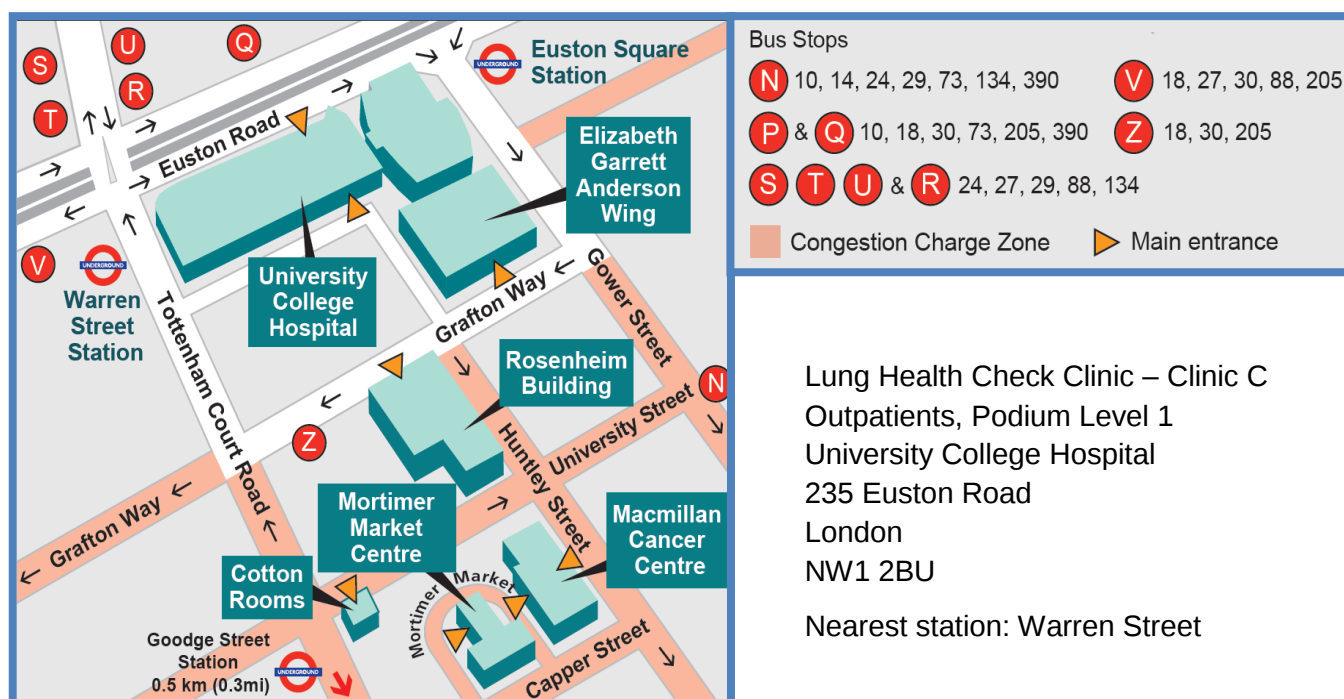
Please contact us if you think you need:

- Help getting to the appointment
- An interpreter
- Any other support

A detailed information booklet will be provided at your appointment, but please visit **www.lunghealthcheck.co.uk** or contact the lung clinic if you would like this information earlier.

If you would like to bring a friend or family member for company, you are welcome to do so.

Planning your journey to University College Hospital



Lung Health Check Clinic – Clinic C
Outpatients, Podium Level 1
University College Hospital
235 Euston Road
London
NW1 2BU

Nearest station: Warren Street

Please go to the 1st floor in the outpatients lift, turn left over the walkway into outpatients. Check the screen for directions or ask at reception.

GP LETTERHEAD

<<date4>>

Dear <<Title>> <<Firstname>> <<Surname>>

Reminder: Free NHS Lung Health Check

I recently wrote to you inviting you for a free Lung Health Check.

The lung clinic records show that you did not attend, so I have made another appointment for you at University College Hospital.

During your appointment you will be offered some tests to better understand how your lungs are working, whether there are any problems, and if necessary, what can be done to help you.

The checks are for people age 60 to 75 who have ever smoked. You are invited whether you feel fine or not and whether or not you have any lung problems.

Date and time of your Lung Health Check

<<2nd appointment day>>, <<2nd appointment date>> at <<2nd appointment time>>

What you need to do now

- Take a moment to plan your journey so you arrive in good time (turn over to see a map)

OR

- If you **do not want** the appointment, or want to **change the date** or time, call the lung clinic for free on **0808 281 9525** or call/text **07469 118 308** or email **lungscreen@ucl.ac.uk** as soon as possible.

Please bring this letter to your appointment.

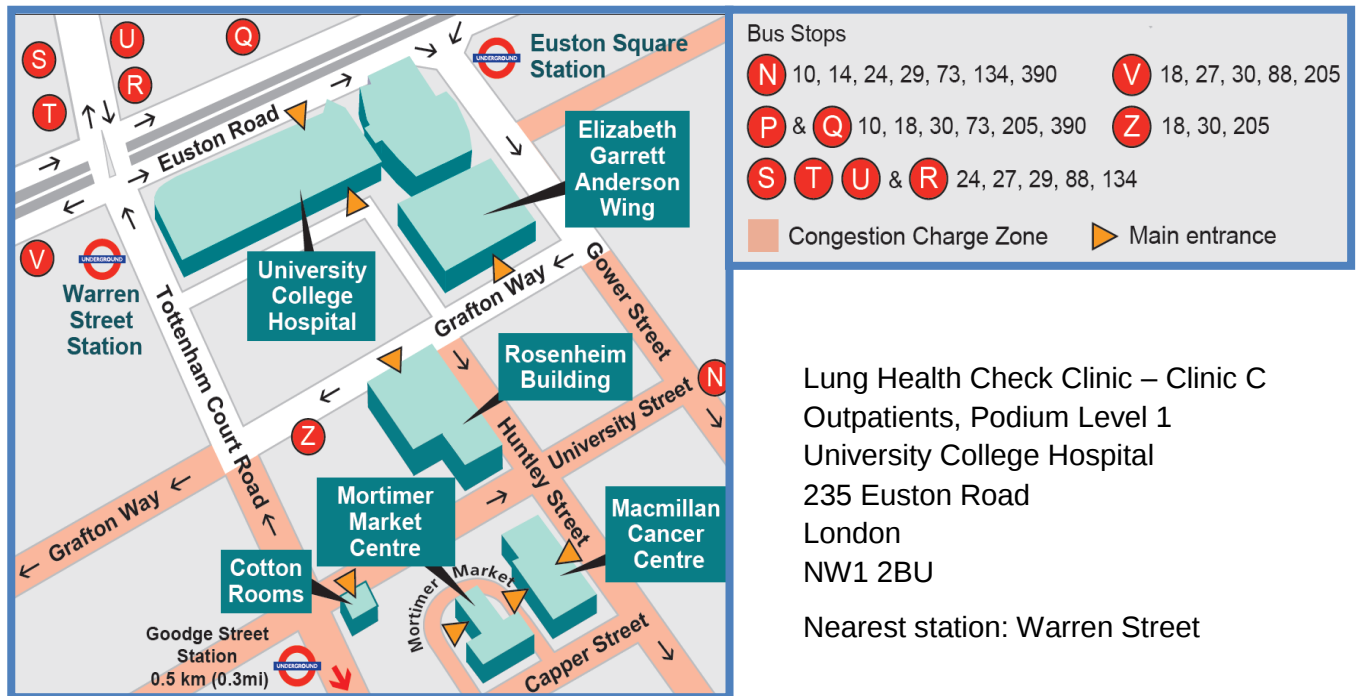
You can bring a friend or family member with you.

Yours sincerely

<<Usual GP>>

Please turn over
Our ref: <<GP-TPN>>

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 235 Euston Road
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Nearest station: Warren Street

Please go to the 1st floor in the outpatients lift, turn left over the walkway into outpatients.
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WHAT YOU’LL GET

First you’ll be asked some questions about your breathing and how you feel to find out about your overall lung health.

Then by blowing into two hand-held machines, you’ll be told whether there are any problems that need taking care of.

The nurse may also talk to you about having a lung scan to check for any early signs of lung cancer, and will ask if they can take samples of blood, breath, sputum and cheek cells (by rubbing a swab along the inside of the cheek). You can decide about this on the day or later.

You’ll have plenty of time to chat to the nurse and ask any questions.

Bring a friend, family member or partner with you on the day if you want to.

“These lung checks are a brilliant idea - a great way to give hard-working lungs a service”

*Bernie, Nurse
University College Hospital*



LUNG HEALTH CHECKS

GPs in the local area are inviting people aged 60 to 75 for the Lung Health Check.

Look out for an invitation in the post.

For more information call our freephone advice service on **0808 281 9525** or call/text **07469 118 308** or email us at lungscreen@ucl.ac.uk



If you are unable to read this leaflet because English is not your first language, please ask someone who speaks English to telephone the Freephone helpline on **0808 281 9525** for further information and help.

Bengali ইংরেজী আপনার প্রথম বা মাতৃভাষা না হওয়ার কারণে আপনি যদি এই চিঠি বা সঙ্গে দেওয়া প্রচারপত্র পড়তে না পারেন, তাহলে ইংরেজী বলতে পারে এমন কাউকে বলুন আরো বিস্তারিত তথ্য ও সাহায্যের জন্য **0808 281 9525** নম্বরে ফ্রীফোন বা বিনা খরচের হেল্পলাইন-এ টেলিফোন করুন।

Turkish İngilizce’nin anadiliniz olmaması nedeniyle bu mektubu veya ilişikteki broşürü okuyamayacak olursanız, daha fazla bilgi ve yardım için, lütfen, İngilizce bilen birisinden, ücretsiz olarak telefon edilebilen **0808 281 9525** numaralı yardım hattını aramasını rica edin.



M.O.T. FOR YOUR LUNGS

A **new** NHS Lung Health Check for people aged 60 to 75



Please read if you are aged 60-75



Lung Health Checks

M.O.T. FOR YOUR LUNGS

People aged 60 to 75 are being offered a new LUNG HEALTH CHECK.

Run by specially trained nurses, they are an easy way to find out how well your lungs are working.

And, if needed, you'll get care and treatment to help breathe new life into your lungs.

The checks are for people aged 60 to 75 who have ever smoked. You are invited whether you feel fine or not, and whether or not you have any lung problems.

You can bring a friend, family member or partner with you, if you'd like.



"If they can give me some extra years with my grandkids, I might even be lucky enough to be able to walk them down the aisle."

Bernard, 69, London

BENEFITS OF THE LUNG HEALTH CHECK

- ✓ **Free**
- ✓ **Local and easy to get to** (at either the Homerton or University College Hospital)
- ✓ **Talk through your questions** over a cup of tea
- ✓ **Find out** about having a lung scan
- ✓ **No judgements** on smoking



"I started smoking when I was 14. When you go back 40-odd years, we didn't know that cigarettes caused all these problems. It's good to know no one is going to give me a hard time at the Lung Health Check."

Maggie, 60, London

LOOKING AFTER YOUR LUNGS

HOW THE NHS CAN HELP

Your lungs work hard every minute of your life.

As you get older, it's worth checking things out.

GOOD IDEA

The Lung Health Check can spot problems early - often before you notice anything, when treatment could be simpler and more successful.

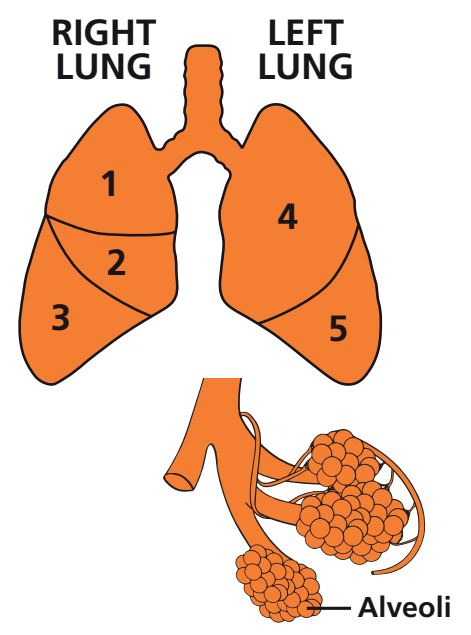


YOUR LUNGS COULD BE EASIER TO FIX THAN YOU THINK

You have two lungs, made up of 5 sections called lobes.

Each lobe is made up of thousands of tiny grape-like sacs, called alveoli.

If there is a problem on one bit of the lung, early treatment can focus just on the bit that is affected.



LSUT Control Group

Invitation letters and leaflet

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Yours sincerely

<<Usual GP>>

Our ref: <<GP-TPN>>

GP LETTERHEAD

<<date4>>

Dear <<Title>> <<Firstname>> <<Surname>>

Free NHS Lung Health Check

I'm inviting you for a Lung Health Check at University College Hospital. Our records show that you are either a smoker or have smoked in the past.

Your lungs work hard every minute of your life. As you get older, it's worth checking things out.

The checks are for smokers and ex-smokers aged 60 to 75. You are invited whether you feel fine or not and whether or not you have any lung problems.

What to expect

A specially trained nurse, who will be able to answer any of your questions, carries out the Lung Health Check. It should take approximately 60 minutes.

During the Lung Health Check you will be asked to blow into two machines. You may also be offered a lung CT scan.

Date and time of your Lung Health Check

<<1st appointment day>>, <<1st appointment date>> at <<1st appointment time>>

What you need to do now

Please read the enclosed information leaflet. Then:

- Take a moment to plan your journey so you arrive on time (see the map on the back)
- OR*
- If you **do not want** the appointment, or want to **change the date** or time, call the lung clinic for free on **0808 281 9525** or call/text **07469 118 308** or email **lungscreen@ucl.ac.uk** as soon as possible.

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Information about the Lung Health Check

For more information, see the leaflet *Lung Health Check: Information on what's involved*

Need more information before your appointment?

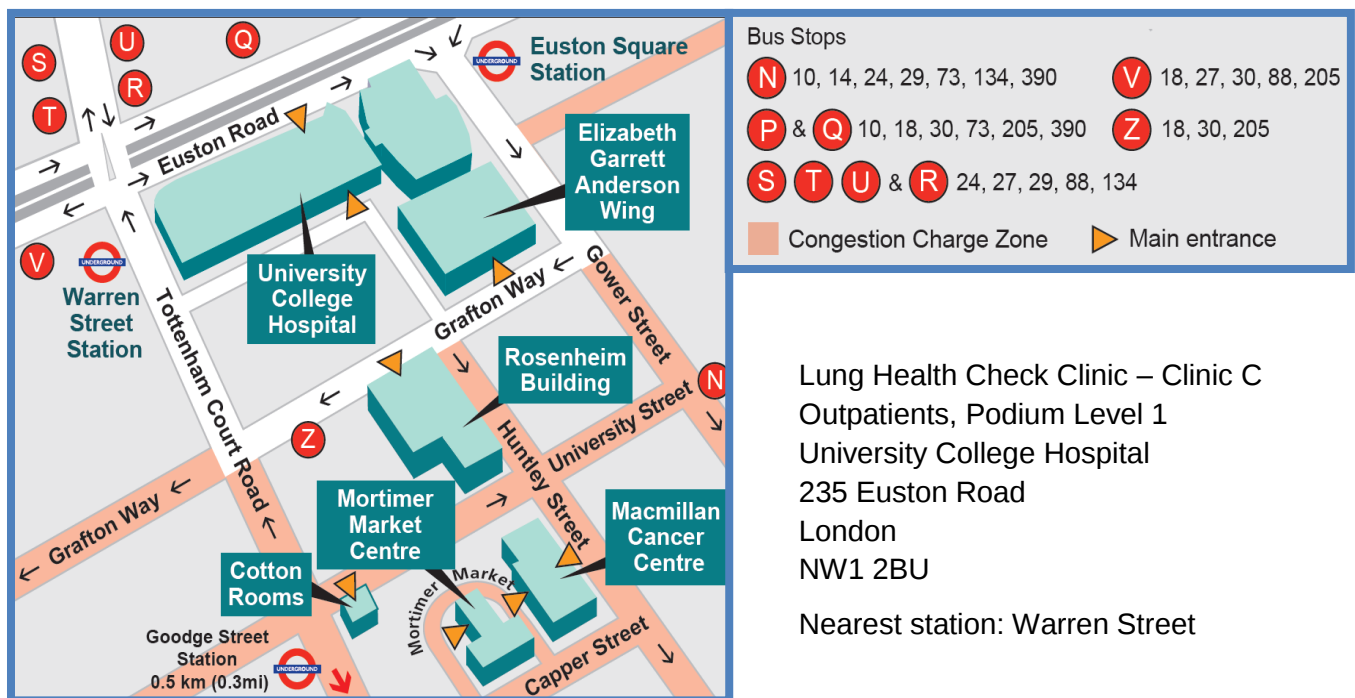
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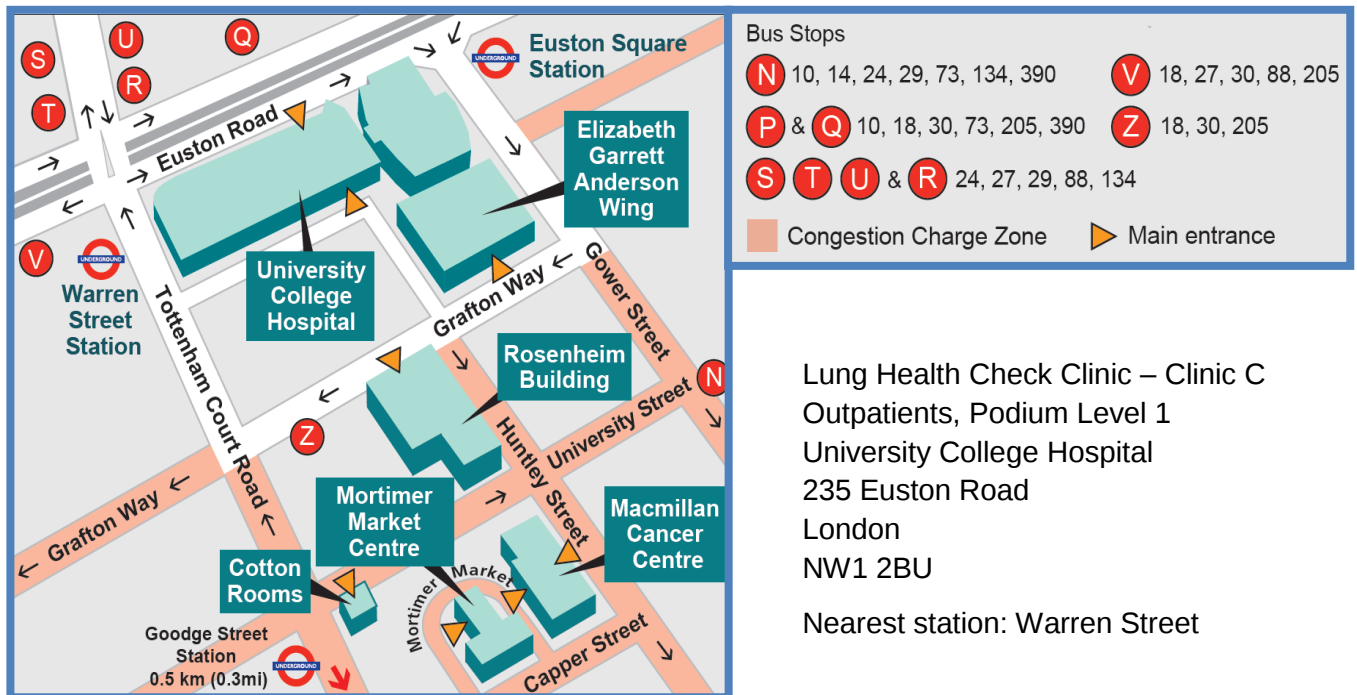
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Lung Health Check:
Information on what's involved

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Lung Health Checks

A new NHS Lung Health Check is being offered to people aged 60 to 75 who smoke or used to smoke.

This booklet is designed to **help you decide** whether to have a lung health check. It is your choice whether you attend.

It aims to answer the following questions:

Why am I being invited?

What happens when I arrive at the appointment?

What are the different tests?

What are the possible benefits and risks?

What is lung cancer?

Who can I contact if I have a question?

Signs and symptoms of lung cancer

In the very early stages of lung cancer, there are **often no symptoms**. This is partly because the lungs are large and do not feel pain.

Warning signs to look out for include:

a **persistent cough** or change in an existing cough

feeling **short of breath**

coughing up **blood**

pain or ache when breathing or coughing

unexplained **tiredness** or **weight loss**

What is lung cancer?

Lung cancer begins when **cells** in the lungs, windpipe (trachea) or airways (bronchi) **start to grow abnormally**.

The cells form a cluster (known as a nodule), which grows bigger and turns into a tumour.

In most cases this happens slowly and (without screening) can take up to five years before it is diagnosed.

How common is it?

Lung cancer is the **second most common** cancer in the UK. Survival from lung cancer improves the earlier it is found. Over eight out of ten lung cancers are caused by smoking. Risk of lung cancer is also increased in those who are older, have been exposed to other people's smoke, have been exposed to asbestos, or have been diagnosed with a lung problem like COPD (which includes chronic bronchitis and emphysema).

What can I do to reduce my risk?

The single best thing you can do to prevent lung cancer is not smoke. If you do smoke and would like to stop there is lots of help out there.

Ask your GP about free local support available, or contact **NHS smokefree** on 0800 0224 332 or visit www.nhs.uk/smokefree

What is a lung health check?

Lung health checks test for the early signs of lung conditions. Lung conditions and lung cancer are easier to treat when found early, and there is now good evidence that screening for early stage lung cancer using CT scans saves lives.

Why am I being invited?

Lung health checks are being offered to people aged 60 to 75 who smoke or used to smoke. These people are most likely to benefit because they are more at risk of lung disease. Medical records indicate that you are either a smoker or have smoked in the past.

It does not matter if you already have a lung problem. Please let the nurse know about this at your appointment.

What happens when I arrive at the appointment?

A nurse will greet you, discuss all the different tests and answer any questions. The nurse will help you choose which tests you would like by explaining how you might benefit from them. You can choose when you want to have the tests - then or at a later date. You may not be offered a CT scan if it is not suitable for you and the nurse will discuss this with you.

What are the different tests?

Lung function test

This is a simple test (called spirometry) for which you blow into a hand-held machine. The test **checks for problems with the lungs** that may be caused by conditions like asthma, lung tissue scarring, sarcoidosis and COPD (which includes chronic bronchitis and emphysema). It measures:

How much air you can take into and blow out of your lungs

How strong your breathing muscles are

CO (carbon monoxide) test

The nurse will ask you to hold your breath for 15 seconds (or as long as you can) and then blow into a hand-held machine. It measures the level of carbon monoxide in your breath, to find out how much there is in your blood. Carbon monoxide is a poisonous gas produced by tobacco smoke, unsafe gas boilers and pollution.

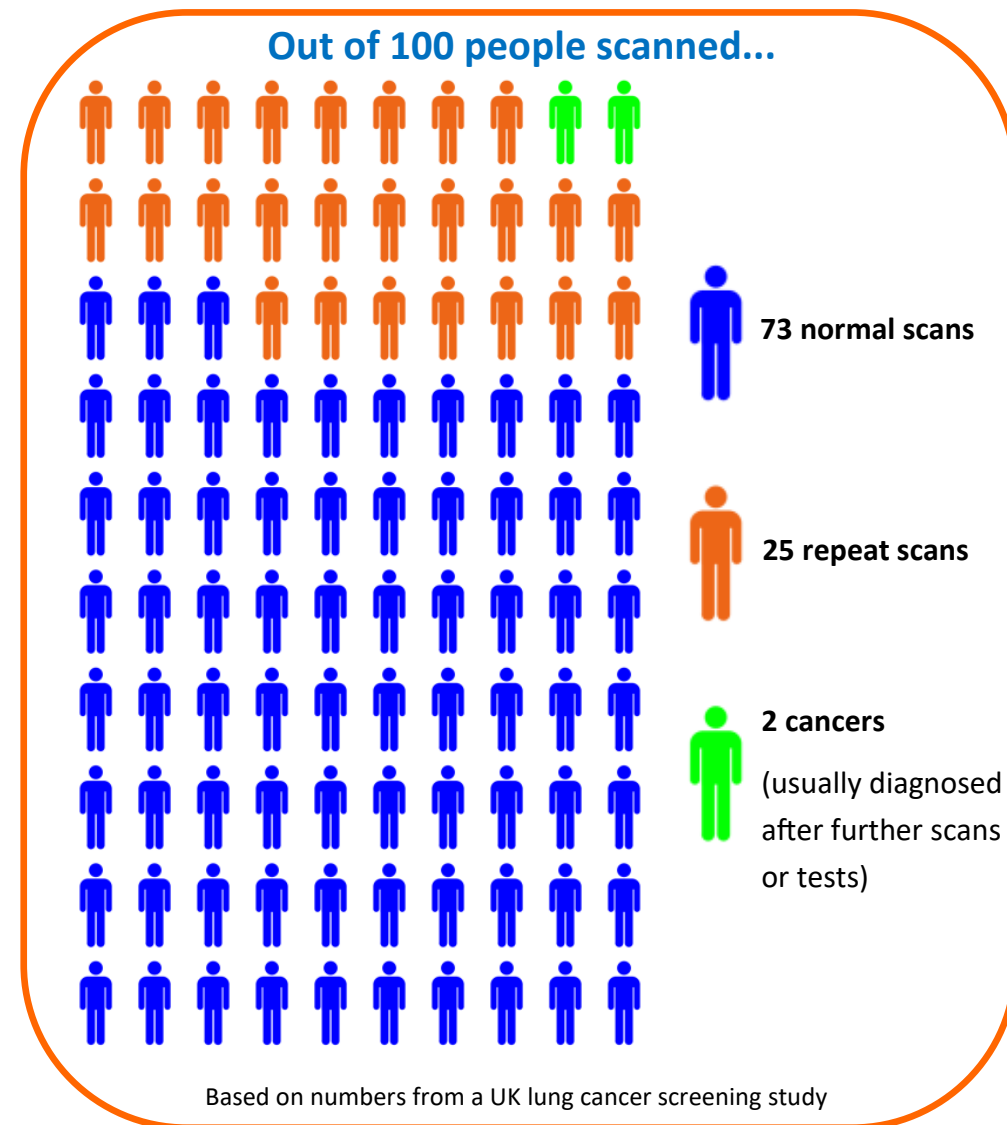
Samples of blood, breath, sputum and cheek cells

We are carrying out research to see whether the early signs of lung disease can be found in the blood, breath, cells from the lining of the cheek and sputum samples. These tests are not part of your lung health check and it is completely up to if you want to have them.

Samples of breath are taken by breathing normally into a machine

Cheek cells are collected by rubbing a swab (which looks a bit like a large cotton wool bud) against the inside of the cheek

Any sputum brought up by an existing cough is collected in a pot



How reliable is lung cancer screening?

Like all cancer screening tests, lung cancer screening is not completely accurate and some cancers will be missed. Nodules found in the middle of the chest and some small cancers are harder to see. Some cancers start to grow after screening.

What are the possible benefits?

When found early, lung conditions are **easier to treat** and lung cancer is **more likely to be cured**.

A study in North America has shown that using CT scans to find lung cancer early **saves lives** of people aged 55 to 75 who smoke or used to smoke. Screening using CT scans prevented 20% more deaths from lung cancer than using chest x-rays.

What are the possible risks?

The low dose CT scan will expose you to a **small amount of radiation**. It is the same as about one year's worth of radiation from the natural environment. The risk of a CT scan causing a cancer is very low compared with the benefits of detecting lung cancer early. If a further CT scan is needed then this will expose you to more radiation.

In some cases, people will be **diagnosed and treated for lung cancer that would never have caused the person harm**. If they had not been screened, they would never have known about the cancer or have had any treatment.

Waiting for the results of these tests can be worrying. People with an unclear result will need to be monitored and have a further scan. This can be a worrying time and in most cases they will not have lung cancer. If you are confused about any of the tests or have any concerns at any point, please contact the lung clinic and we will help.

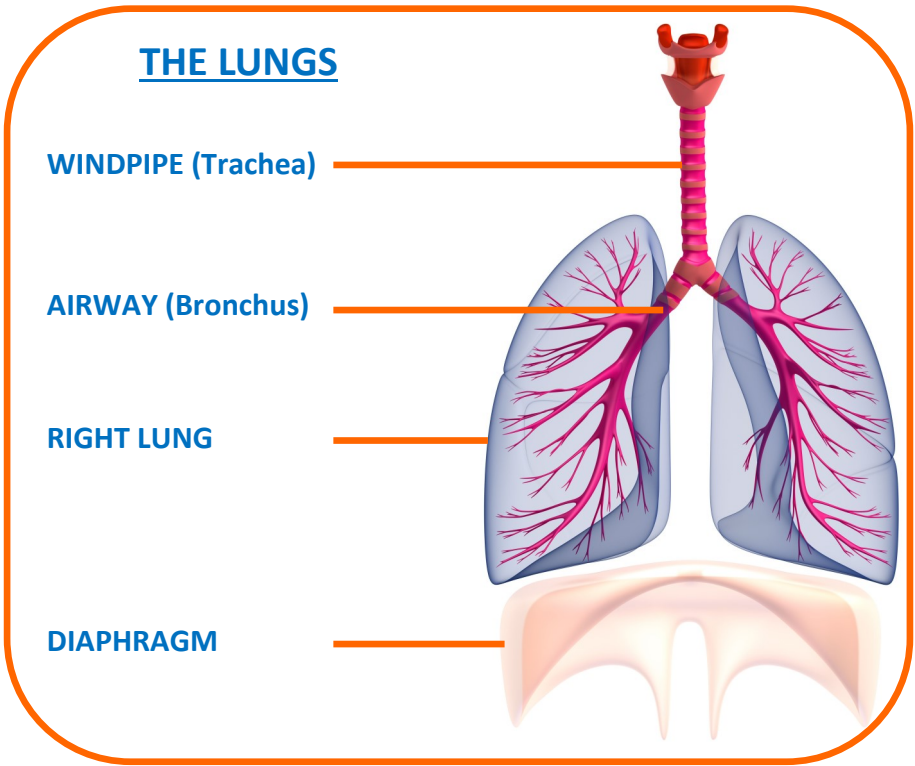
Further tests and treatment all carry risks as well as benefits.

Should you be offered any of these, a specialist NHS doctor will discuss the risks and benefits. If you would like to know more information about these before having a CT scan, please speak to the nurse during your appointment.

Low dose chest CT (computed tomography) scan

A chest CT scan is a **type of x-ray** which takes detailed pictures of the lungs. These pictures are processed by a computer and then checked for the early signs of lung cancer by specially trained doctors (known as radiologists).

Whether or not you are offered a CT scan will **depend on your lifestyle, medical and family history**. The nurse will help you to choose whether the test is right for you and you may want to postpone it to a different day.





What is having a chest CT scan like?

The CT scan will take about **10 minutes**. You will be asked to lie flat on the bed of the scanner. The bed will move slowly backwards and forwards while the scanner circles your chest. Specially trained staff will sit the other side of a screen where they can talk to you and control the scanner.

Only your chest will be scanned and you will not go into a tunnel (this is for a different scan called an MRI scan). The scan is pain free and you will not need an injection. If you do have any concerns about the scan then please contact the lung clinic or speak to the nurse at your appointment.

RESULTS WILL BE SENT TO YOU & YOUR GP IN 2 WEEKS

Normal result This means that no signs of lung cancer or other abnormalities could be seen on the scan. Approximately three quarters of people will have a normal result. While this is good news, it is still possible that lung cancer could develop in the future or that the scan may have missed it. It is important to be aware of the symptoms of lung cancer and to go to your GP quickly if you have any concerns.

Unclear result This usually means the scan has shown a small area of white shadowing in the lung, This is probably something harmless but there is a chance it might be something serious. You will be invited to an appointment with a specialist doctor to discuss the result. The best way to make sure that there is nothing to worry about is to have another scan after an interval to make sure there are no signs of lung cancer. **Most people with an unclear result will not have lung cancer.**

Abnormal result This means there is something abnormal on the scan that needs more tests to find out what it is. It could be cancerous or it could be harmless. You will be invited to an appointment with a specialist doctor who will discuss the results and arrange further tests.

Incidental finding This means there are signs of other problems on the scan that may need treatment or medical advice. If you already have a lung problem, this might be why and you may not need any extra care. You may be advised to make contact with your GP to make an appointment to find out more.