

Supplementary Section 1

UK Lung Cancer Screening Questionnaire.

SECTION 1 Questions about your health and job

1. Have you ever been diagnosed with any of the following conditions?

(If yes, please indicate the age at diagnosis for that condition)

	Yes	No	Age at Diagnosis						
			Less than 40	40-49	50-55	56-60	61-65	66-70	70+
Asthma	<input type="checkbox"/>								
Bronchitis	<input type="checkbox"/>								
Emphysema	<input type="checkbox"/>								
Pneumonia	<input type="checkbox"/>								
Tuberculosis	<input type="checkbox"/>								
COPD	<input type="checkbox"/>								

2. Have you ever had any of the following masses, lumps or tumours that were diagnosed as malignant or cancerous?

	Yes	No
Hodgkins Disease	<input type="checkbox"/>	<input type="checkbox"/>
Leukaemia	<input type="checkbox"/>	<input type="checkbox"/>
Lymphoma	<input type="checkbox"/>	<input type="checkbox"/>
Mesothelioma	<input type="checkbox"/>	<input type="checkbox"/>
Skin growths	<input type="checkbox"/>	<input type="checkbox"/>

If Cancer see question 3

3. Complete a separate section for each Cancer

Type of cancer	Tumour	Years since diagnosis	
		Within 5 years	Greater than 5 years
Brain	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Head/Neck	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Oesophagus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lung	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Breast	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Colon (Bowel)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

4. Can you recall any job or activity in which you were exposed to asbestos?

Yes No

If yes, how many years in total were you exposed to asbestos?

1 2 3 4+

SECTION 2 Family history of cancer

1. How many brothers, sisters, sons and daughters (first degree relatives) do you have?

	1	2	3	4+
Brothers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sisters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Sons	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Daughters	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

2. Have any of your first degree relatives (including parents) had a diagnosis of cancer?

Yes No (If Yes, please provide details below. If No please go to section 3)

Type of cancer Age at diagnosis	Father		Mother		First brother		First sister		First son or daughter
	less than 60 yrs	greater than 60 yrs							
Brain	<input type="checkbox"/>								
Head/Neck	<input type="checkbox"/>								
Oesophagus	<input type="checkbox"/>								
Lung	<input type="checkbox"/>								
Breast	<input type="checkbox"/>								
Colon (Bowel)	<input type="checkbox"/>								
Other	<input type="checkbox"/>								

SECTION 3 Questions about your smoking history

1. Have you ever smoked more than 10 cigarettes per week regularly?

Yes No (If No please go to question 5)

2. How old were you when you first started smoking more than 10 cigarettes each week?

10-19 20-29 30-39 40-49 50+

3. How old were you when you stopped smoking cigarettes?

10-19 20-29 30-39 40-49 50+ Still smoking

4. Please indicate which types of cigarette and the number you have smoked

	Filter	Plain	Hand rolled	Number per day					
				0-9	10-19	20-29	30-39	40-49	50+
High Tar	<input type="checkbox"/>								
Low Tar	<input type="checkbox"/>								
Don't know	<input type="checkbox"/>								

5. Have you ever smoked one or more cigars per day regularly?

Yes No (If No please go to question 9 below)

6. How old were you when you first started smoking one or more cigars per day?

10-19 20-29 30-39 40-49 50+

7. How old were you when you stopped smoking cigars?

10-19 20-29 30-39 40-49 50+ Still smoking

8. How many cigars did you smoke per day?

1-5 6-10 11-15 More than 15

9. Have you ever smoked one or more pipes of tobacco per day regularly?

Yes No (If No please go to section 4)

10. How old were you when you first started smoking a pipe?

10-19 20-29 30-39 40-49 50+

11. How old were you when you stopped smoking a pipe?

10-19 20-29 30-39 40-49 50+ Still smoking

12. How many ozs did you smoke each day?

1/2 1 2 More than 2

SECTION 4 PREVIOUS X RAYS**1. Have you had a previous X Ray in the Last 12 months**

Yes No

2. Have you had a previous CT scan in the last 12 months

Yes No

SECTION 5 Lung Cancer Screening**1. If you are invited to have Lung Cancer Screening using a CT scan, how likely is it that you will accept an invitation?**

Highly likely

Quite likely

Unlikely

Definitely not

2. If you are a smoker, are you considering giving up smoking?

Yes definitely

Yes possibly

Not really

Definitely not

Supplementary Material 2

Derivation of α values for LLPv3

The original LLP model resulted in a risk score r of the form

$$\ln\left(\frac{r}{1-r}\right) = \alpha + \sum_i \beta_i$$

where β_i are a series of factors relating to particular risks, derived from the multivariate logistic regression model, and α is an age- and sex-specific factor derived from lung cancer incidence rates in the Liverpool area.

For males, it is necessary to divide the risk score by $1.86 \times 101.4 / 86.8 = 2.173$, which is equivalent to deducting the natural logarithm of this value ie 0.78. For females, the adjustment factor is $1.86 \times 57.9 / 67.0 = 1.607$, with a corresponding natural logarithm of 0.47.

The β_i in LLPv3 are unchanged from the previous version of the model, and are shown in Table S1.

Table S1

Risk factor / category	β -values
<i>Smoking duration</i>	
Never	0
1-19 years	0.7692
20-39 years	1.4516
40-59 years	2.5072
60 years or more	2.7243
<i>History of pneumonia or other lung conditions</i>	
No	0
Yes	0.6025
<i>Personal history of cancer</i>	
No	0
Yes	0.6754
<i>Asbestos exposure</i>	
No	0
Yes	0.6343
<i>Family history of lung cancer</i>	
None	0
Early onset (before age 60)	0.7034
Late onset (on or after age 60)	0.1677

It is therefore necessary to reduce each α value by 0.78 or 0.47 for males and females respectively. The original (LLPv2) and adjusted (LLP v3) α values are shown in Table S2.

Table S2 **α -values relating to 5-year absolute risk**

Age group	Male		Female	
	LLPv2	LLPv3	LLPv2	LLP 3
40-44	-9.06	-9.84	-9.90	-10.37
45-49	-8.16	-8.94	-8.06	-8.53
50-54	-7.31	-8.09	-7.46	-7.93
55-59	-6.63	-7.41	-6.50	-6.97
60-64	-5.97	-6.75	-6.22	-6.69
65-69	-5.56	-6.34	-5.99	-6.46
70-74	-5.31	-6.09	-5.49	-5.96
75-79	-4.83	-5.61	-5.23	-5.70
80-84	-4.68	-5.46	-5.42	-5.89

Supplementary Material 3

Derivation of input variables

Input variable	Derivation		
Age	Provided by PCT at time of recruitment		
Sex	Provided by PCT at time of recruitment		
Non-malignant lung disease	[Section 1 of questionnaire, question 1] YES , if EITHER : <ul style="list-style-type: none"> - Answered 'yes' to having had one or more of bronchitis, emphysema, pneumonia, tuberculosis or COPD; AND/OR - Specified an age at diagnosis for one or more of the above NO otherwise		
Personal history of cancer	[Section 1 of questionnaire, questions 2 and 3] YES , if answered 'yes' to having had one or more of the following types of cancer: <ul style="list-style-type: none"> - Hodgkins disease, leukaemia, lymphoma, mesothelioma, brain, head/neck, oesophagus, lung, breast, colon (bowel), other (but <u>excluding</u> skin) NO otherwise		
Exposure to asbestos	[Section 1 of questionnaire, question 4] YES , if EITHER : <ul style="list-style-type: none"> - Answered 'yes' to having had a job or activity involving exposure to asbestos; AND/OR - Specified a period of exposure to asbestos NO otherwise		
Family history of cancer	[Section 2 of questionnaire, question 2] YES, EARLY ONSET , if at least one parent or sibling was diagnosed with at least one cancer before age 60, or a child at any age YES, LATE ONSET , if above conditions not met, but at least one parent or sibling was diagnosed with at least one cancer at age 60 or later NO otherwise		
Smoking duration	[Section 3 of questionnaire] Set smoking duration to 0 if start age range and finish age range are <u>both</u> missing (even if answered 'Yes'), for <u>all three</u> categories of smoking material (cigarettes, cigars, pipe) Otherwise, for each category of smoking material: <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> Set start age based on specified range: <ul style="list-style-type: none"> ○ Missing or 10-19 => 15 ○ 20-29 => 25 ○ 30-39 => 35 ○ 40-49 => 45 ○ 50+ => 50 </td> <td style="width: 50%; vertical-align: top;"> Set finish age based on specified range: <ul style="list-style-type: none"> ○ 10-19 => 15 ○ 20-29 => 25 ○ 30-39 => 35 ○ 40-49 => 45 ○ 50+ => average of 50 and current age ○ Missing or still smoking => current age </td> </tr> </table> Determine earliest start age across the three categories (ignoring any for which start age range and finish age range are both missing) Determine latest finish age across the three categories (ignoring any for which start age range and finish age range are both missing) Calculate duration as (latest finish age) – (earliest start age), subject to a minimum of 1 Assign to appropriate smoking duration range (1-19 years, 20-39 years, 40-59 years, 60 years or more)	Set start age based on specified range: <ul style="list-style-type: none"> ○ Missing or 10-19 => 15 ○ 20-29 => 25 ○ 30-39 => 35 ○ 40-49 => 45 ○ 50+ => 50 	Set finish age based on specified range: <ul style="list-style-type: none"> ○ 10-19 => 15 ○ 20-29 => 25 ○ 30-39 => 35 ○ 40-49 => 45 ○ 50+ => average of 50 and current age ○ Missing or still smoking => current age
Set start age based on specified range: <ul style="list-style-type: none"> ○ Missing or 10-19 => 15 ○ 20-29 => 25 ○ 30-39 => 35 ○ 40-49 => 45 ○ 50+ => 50 	Set finish age based on specified range: <ul style="list-style-type: none"> ○ 10-19 => 15 ○ 20-29 => 25 ○ 30-39 => 35 ○ 40-49 => 45 ○ 50+ => average of 50 and current age ○ Missing or still smoking => current age 		

Supplementary Material 4

Risk score ranges and observed and expected lung cancers by risk decile for LLPv2 and LLPv3, for males and females separately

(a) LLPv2

Decile	LLPv2 males				LLPv2 females			
	Size of decile group*	Range of risk score (%)	Number of cancers observed (%)	Expected number of cancers	Size of decile group*	Range of risk score (%)	Number of cancers observed	Expected number of cancers
1 (lowest risk)	3,849	0.07-0.20	0 (0)	5	4,149	0.06-0.16	0 (0)	5
2	3,924	0.21-0.35	6 (2)	11	3,987	0.17-0.23	9 (3)	8
3	3,577	0.36-0.48	6 (2)	15	3,526	0.24-0.30	5 (2)	9
4	3,714	0.49-0.69	10 (3)	22	3,759	0.31-0.40	6 (2)	13
5	3,928	0.70-1.01	10 (3)	32	3,914	0.41-0.50	12 (4)	18
6	3,881	1.02-1.55	21 (6)	50	3,854	0.51-0.71	10 (4)	23
7	3,501	1.56-2.26	22 (7)	65	3,765	0.72-1.01	12 (4)	33
8	3,711	2.27-3.70	45 (14)	114	3,814	1.02-1.75	31 (11)	50
9	3,723	3.71-6.57	69 (21)	187	3,843	1.76-3.36	57 (21)	91
10 (highest risk)	3,717	6.58-53.71	138 (42)	439	3,822	3.37-39.72	130 (48)	245
All	37,525		327	940	38,433		272	495

(b) LLPv3

Decile	LLPv3 males				LLPv3 females			
	Size of decile group*	Range of risk score (%)	Number of cancers observed (%)	Expected number of cancers	Size of decile group*	Range of risk score (%)	Number of cancers observed	Expected number of cancers
1 (lowest risk)	3,849	0.03 – 0.09	0 (0)	2	4,239	0.04 – 0.10	0 (0)	3
2	3,924	0.10 – 0.16	6 (2)	5	4,806	0.11 – 0.15	9 (3)	6
3	3,577	0.17 – 0.22	6 (2)	7	2,775	0.16 – 0.19	5 (2)	5
4	3,714	0.23 – 0.32	10 (3)	10	3,742	0.20 – 0.25	6 (2)	8
5	3,928	0.33 – 0.47	10 (3)	15	3,767	0.26 – 0.31	12 (4)	11
6	3,881	0.48 – 0.72	21 (6)	23	3,959	0.32 – 0.45	10 (4)	15
7	3,501	0.73 – 1.05	22 (7)	31	3,635	0.46 – 0.63	12 (4)	20
8	3,711	1.06 – 1.73	45 (14)	52	3,845	0.64 – 1.10	31 (11)	32
9	3,723	1.74 – 3.12	69 (21)	88	3,843	1.11 – 2.13	57 (21)	57
10 (highest risk)	3,717	3.13 – 34.72	138 (42)	219	3,822	2.14 – 29.17	130 (48)	158
All	37,525		327	453	38,433		272	315