

Supplementary appendix

Table S1. Smoking code clusters, as per NHS Digital business rules

| ClusterName | SNOMED concept ID | Term |
|-------------|-------------------|--|
| EXSMOK_COD | 1092031000000108 | Ex-smoker amount unknown (finding) |
| EXSMOK_COD | 1092041000000104 | Ex-very heavy smoker (40+/day) (finding) |
| EXSMOK_COD | 1092071000000105 | Ex-heavy smoker (20-39/day) (finding) |
| EXSMOK_COD | 1092091000000109 | Ex-moderate smoker (10-19/day) (finding) |
| EXSMOK_COD | 1092111000000104 | Ex-light smoker (1-9/day) (finding) |
| EXSMOK_COD | 1092131000000107 | Ex-trivial smoker (<1/day) (finding) |
| EXSMOK_COD | 160617001 | Stopped smoking (finding) |
| EXSMOK_COD | 160620009 | Ex-pipe smoker (finding) |
| EXSMOK_COD | 160621008 | Ex-cigar smoker (finding) |
| EXSMOK_COD | 160625004 | Date ceased smoking (observable entity) |
| EXSMOK_COD | 228486009 | Time since stopped smoking (observable entity) |
| EXSMOK_COD | 266921000 | Ex-trivial cigarette smoker (<1/day) (finding) |
| EXSMOK_COD | 266922007 | Ex-light cigarette smoker (1-9/day) (finding) |
| EXSMOK_COD | 266923002 | Ex-moderate cigarette smoker (10-19/day) (finding) |
| EXSMOK_COD | 266924008 | Ex-heavy cigarette smoker (20-39/day) (finding) |
| EXSMOK_COD | 266925009 | Ex-very heavy cigarette smoker (40+/day) (finding) |
| EXSMOK_COD | 266928006 | Ex-cigarette smoker amount unknown (finding) |
| EXSMOK_COD | 281018007 | Ex-cigarette smoker (finding) |
| EXSMOK_COD | 360890004 | Intolerant ex-smoker (finding) |
| EXSMOK_COD | 360900008 | Aggressive ex-smoker (finding) |
| EXSMOK_COD | 48031000119106 | Ex-smoker for more than 1 year (finding) |
| EXSMOK_COD | 492191000000103 | Ex roll-up cigarette smoker (finding) |
| EXSMOK_COD | 53896009 | Tolerant ex-smoker (finding) |
| EXSMOK_COD | 735112005 | Date ceased using moist tobacco (observable entity) |
| EXSMOK_COD | 735128000 | Ex-smoker for less than 1 year (finding) |
| EXSMOK_COD | 8517006 | Ex-smoker (finding) |
| LSMOK_COD | 134406006 | Smoking reduced (finding) |
| LSMOK_COD | 160603005 | Light cigarette smoker (1-9 cigs/day) (finding) |
| LSMOK_COD | 160604004 | Moderate cigarette smoker (10-19 cigs/day) (finding) |
| LSMOK_COD | 160605003 | Heavy cigarette smoker (20-39 cigs/day) (finding) |
| LSMOK_COD | 160606002 | Very heavy cigarette smoker (40+ cigs/day) (finding) |
| LSMOK_COD | 160612007 | Keeps trying to stop smoking (finding) |
| LSMOK_COD | 160613002 | Admitted tobacco consumption possibly untrue (finding) |
| LSMOK_COD | 160616005 | Trying to give up smoking (finding) |
| LSMOK_COD | 160619003 | Rolls own cigarettes (finding) |
| LSMOK_COD | 203191000000107 | Wants to stop smoking (finding) |
| LSMOK_COD | 225934006 | Smokes in bed (finding) |
| LSMOK_COD | 230056004 | Cigarette consumption (observable entity) |
| LSMOK_COD | 230057008 | Cigar consumption (observable entity) |
| LSMOK_COD | 230058003 | Pipe tobacco consumption (observable entity) |
| LSMOK_COD | 230059006 | Occasional cigarette smoker (finding) |
| LSMOK_COD | 230060001 | Light cigarette smoker (finding) |
| LSMOK_COD | 230062009 | Moderate cigarette smoker (finding) |
| LSMOK_COD | 230063004 | Heavy cigarette smoker (finding) |
| LSMOK_COD | 230064005 | Very heavy cigarette smoker (finding) |
| LSMOK_COD | 230065006 | Chain smoker (finding) |
| LSMOK_COD | 266918002 | Tobacco smoking consumption (observable entity) |
| LSMOK_COD | 266920004 | Trivial cigarette smoker (less than one cigarette/day) (finding) |
| LSMOK_COD | 266929003 | Smoking started (finding) |
| LSMOK_COD | 308438006 | Smoking restarted (finding) |
| LSMOK_COD | 394871007 | Thinking about stopping smoking (finding) |
| LSMOK_COD | 394872000 | Ready to stop smoking (finding) |
| LSMOK_COD | 394873005 | Not interested in stopping smoking (finding) |
| LSMOK_COD | 401159003 | Reason for restarting smoking (observable entity) |
| LSMOK_COD | 413173009 | Minutes from waking to first tobacco consumption (observable entity) |
| LSMOK_COD | 428041000124106 | Occasional tobacco smoker (finding) |
| LSMOK_COD | 446172000 | Failed attempt to stop smoking (finding) |
| LSMOK_COD | 449868002 | Smokes tobacco daily (finding) |
| LSMOK_COD | 56578002 | Moderate smoker (20 or less per day) (finding) |
| LSMOK_COD | 56771006 | Heavy smoker (over 20 per day) (finding) |
| LSMOK_COD | 59978006 | Cigar smoker (finding) |
| LSMOK_COD | 65568007 | Cigarette smoker (finding) |
| LSMOK_COD | 77176002 | Smoker (finding) |
| LSMOK_COD | 82302008 | Pipe smoker (finding) |
| LSMOK_COD | 836001000000109 | Waterpipe tobacco consumption (observable entity) |
| NSMOK_COD | 221000119102 | Never smoked any substance (finding) |
| NSMOK_COD | 266919005 | Never smoked tobacco (finding) |

Supplement S2.

Comparison of live smoking codes from primary care and self-reported smoking status is shown in Table S2a, and live & historical codes in Table S2b. If both live and historical codes were used to define primary care smoking status, the proportion classified as ever-smokers increased from 52% to 63% (n=21,451/34,261). The overall rate of discordance between primary care recorded smoking status and self-reported smoking status in those contacting the LHC service was 12% (n=1,861/15,107). Discordance was 11% (n=1,123/10,491) and 16% (n=738/4,616) in primary care recorded ever- and never-smokers respectively. Discordance was highest in those classified as an ever-smoker based on historical codes only (their 'live' status was never-smoker), with 50% (n=896/1,805) self-reporting being a never-smoker, compared to only 2.6% (n=227/8,686) in those with a live ever-smoking status.

We also compared the presence of any ever-smoking status codes (live or historical) in primary care with self-reported ever-smoking status and discordance varied from 6.2% to 30% (median 11%). The proportion of respondents historically coded as never-smokers who self-reported being ever-smokers ranged from 1.3% to 11% between practices (median 4.5%).

Table S2a. Comparison of live primary care smoking statuses (L) with self-reported smoking status among invitees with an available primary care record who responded to invitation.

| | Overall N = 15,545 | GP code: ever-smoker (L) N = 8,686 | GP code: never-smoker (L) N = 6,421 | Absent code N = 438 |
|-----------------------------------|-----------------------|---------------------------------------|--|------------------------|
| Self-reported ever-smoker, n (%) | 10,315 (66%) | 8,459 (97%) | 1,647 (26%) | 209 (48%) |
| Self-reported never-smoker, n (%) | 5,230 (34%) | 227 (2.6%) | 4,774 (74%) | 229 (52%) |

Table S2b. Comparison of live and historical primary care smoking statuses (L&H) with self-reported smoking status among invitees with an available primary care record who responded to invitation.

| | Overall N = 15,545 | Ever-smoker (L&H) GP code N = 10,491 | Never-smoker (L&H) GP code N = 4,616 | Absent code N = 438 |
|-----------------------------------|-----------------------|--|--|------------------------|
| Self-reported ever-smoker, n (%) | 10,315 (66%) | 9,368 (89%) | 738 (16%) | 209 (48%) |
| Self-reported never-smoker, n (%) | 5,230 (34%) | 1,123 (11%) | 3,878 (84%) | 229 (52%) |

Table S3. Comparison of the impact of three invitation strategies along the screening pathway, and key screening outcomes, compared to population invitation strategy used in North & East Manchester, among invitees with an available primary care record.

(L) refers to live smoking status codes; (H) refers to historical smoking status codes.

| Invitation Strategy | Population | Ever-smoker (L&H) & Absent | Ever-smoker (L&H) | Ever-smoker (L) |
|---|------------|-------------------------------|-------------------|-----------------|
| LHC invitations sent | 34,261 | 23,259 | 22,451 | 17,895 |
| Eligible respondents (self-reported ever-smokers) | 10,315 | 9,577 | 9,368 | 8,459 |
| LHC bookings | 9,322 | 8,739 | 8,574 | 7,747 |
| LHC attendances | 8,590 | 8,101 | 7,955 | 7,187 |
| Screen-eligible | 4,396 | 4,364 | 4,225 | 4,160 |
| Participants screened | 4,330 | 4,298 | 4,299 | 4,096 |
| Lung cancers detected | 140 | 138 | 136 | 136 |
| Invitations per lung cancer detected | 244.7 | 157.7 | 142.8 | 131.6 |
| LHCs per lung cancer detected | 61.4 | 58.5 | 53.1 | 52.8 |
| LDCT screenees per lung cancer detected | 30.9 | 31.1 | 30.1 | 30.1 |