

## Online Supplementary Appendices

### Impact of the NHS Stop Smoking Services on Smoking Prevalence in England: a Simulation Modelling Evaluation

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- **Supplementary appendix 1.** Model structure, data sources and model parameters
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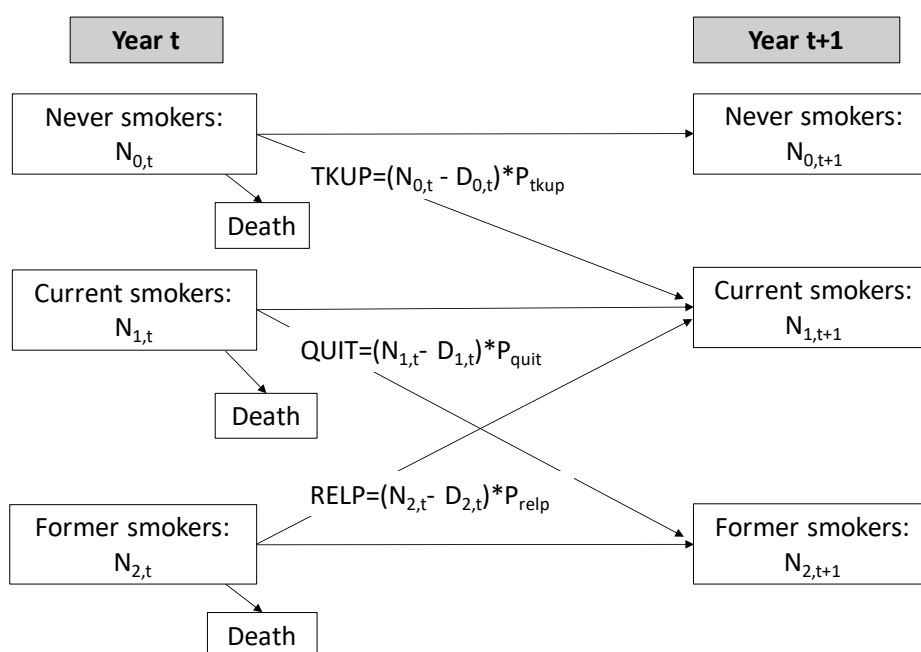
## Supplementary appendix 1.

### Model structure, data sources and model parameters

#### 1 Model framework

We developed a discrete time state-transition model<sup>1</sup> to simulate the adult population ( $\geq 16$ ) in England between 2001 and 2016. The population was separated into subgroups by age, sex, and smoking status. Smoking status was classified as never smokers, current smokers and former smokers. In the present study, former smokers were defined as those who stopped smoking for at least 12 months and were further classified according to time since cessation. The simulation was started using the number of adult population in 2001. Population subgroups by age and sex were updated annually according to the probability of death and smoking status transition (see Figure 1w).

Figure 1w. Outline diagram of possible transitions across smoking status



As shown in Figure 1w, after excluding people who have died in year t, never smokers at the beginning of year t may remain as never smokers or start to smoke in year t. The number of new take-ups in year t is calculated as:  $TKUP = (N_{0,t} - D_{0,t}) * P_{tkup}$ , in which  $N_{0,t}$  is the number of never smokers at the beginning of year t,  $D_{0,t}$  is the number of death in year t, and  $P_{tkup}$  is the probability of taking up in year t. The number of never smokers at the beginning of year t+1 equals:  $N_{0,t+1} = N_{0,t} - D_{0,t} - TKUP$ . Similarly, the current smokers at the beginning of year t who don't die may remain as current smokers or have stopped smoking in year t. The number of quitters in year t is calculated as:  $QUIT = (N_{1,t} - D_{1,t}) * P_{quit}$ , in which  $N_{1,t}$  is the number of current smokers at the beginning of year t,  $D_{1,t}$  is the number of death among current smokers in year t, and  $P_{quit}$  is the probability of quitting in year t. Therefore, the number of current smokers at the beginning of year t+1 equals  $N_{1,t+1} = N_{1,t} - D_{1,t} - QUIT + TKUP$ . Finally, the former smokers at the beginning of year t who don't die may remain as former smokers or have started smoking again in year t. The number of former smokers who relapse in year t is calculated as:  $RELP = (N_{2,t} - D_{2,t}) * P_{relp}$ , in which  $N_{2,t}$  is the number of former smokers at the beginning of year t,  $D_{2,t}$  is the number of deaths among former smokers, and  $P_{relp}$  is the probability of relapse in year t. Then the number of former smokers at the beginning of year t+1 equals:  $N_{2,t+1} = N_{2,t} - D_{2,t} - RELP + QUIT$ .

Note that Figure 1w shows only the main structure of the model, and the actual model is more complex after considering age/sex specific smoking status, years since cessation for former smokers, exogenously adding population aged 16 years and immigrants. In addition, the estimated total number of quitters each year was separated into two groups: quitters who

received support from the NHS SSS and those who didn't. Detailed methods/approaches used to estimate the total and service specific quitters are described in section 4.3.

## 2 Population and death risk

The mid-year population by age and sex in 2001 in England, and age- sex- specific death rates were obtained from the Office for National Statistics.<sup>2</sup> The simulation was started using the number of adult population at the start of the year 2001 in England. To estimate the size of the population at the start of the year 2001, we subtracted half of the difference in the number of population between 2000 and 2001 from the mid-year population in 2001. Then the model was used to update the population subgroups annually according to the probability of death and the transition between smoking status.

Without considering the transition between smoking status, the adult population in subsequent years was estimated using the following equation:

$$N_{c,s,a+1,t+1} = N_{c,s,a,t} \times (1 - d_{c,s,a,t})$$

Where:  $N_{c,s,a,t}$  refers size of the population for a given cigarette smoking status (c), sex (s), and age (a) in year t, and  $d_{c,s,a,t}$  refers the annual risk of death for people given smoking status (c), sex (s), and age (a) at the beginning of year (t).

The following equation was used to estimate the death risk ( $d_a$ ) for the population at the beginning of a year based on central death rates ( $m_a$ ):

$$d_a \cong \frac{m_a}{1+0.5m_a}$$

In the simulation modelling, the change in smoking prevalence in year t+1 was determined by outflow (the number of quitters and deaths among smokers) and inflow (including the number of ex-smokers who relapsed and people who took up smoking) in year t. That is, the transition between smoking status was based on (1) the probability of current smokers who stopped smoking ( $P_{quit}$ ), (2) the probability of ex-smokers who start to smoke regularly again ( $P_{relp}$ ), (3) the probability of never smokers who start to smoke regularly ( $P_{tkup}$ ). Exogenous inputs to the model included the number of people aged 16 and net immigrants, along with their smoking status. Relapse was possible at any stage of the quitting process as well as for all ex-smokers, although it is known that the longer the time since cessation, the lower the relapse risk.

The death risk based on population statistics were average estimates for never, current and former smokers. We used the following equation to estimate the death risk for never smokers:

$$Pd_0 = \frac{Pd_{all}}{Pr_{nev} + Pr_{cur} \times R_{cur} + Pr_{ex} \times R_{ex}}$$

Where  $Pd_{all}$  is the average death risk;  $Pr_{nev}$ ,  $Pr_{cur}$ , and  $Pr_{ex}$  refer the rates of prevalence of never, current and former smokers respectively;  $R_{cur}$  and  $R_{ex}$  refer the relative risk for current and ex-smokers respectively. The risk of dying for current smokers was then calculated by:  $Pd_1 = Pd_0 \times R_{cur}$ , where  $Pd_0$  is the death risk for never smokers and  $R_{cur}$  is the relative risk of death for current smokers. The risk of dying for ex-smokers was correspondingly calculated by:  $Pd_2 = Pd_0 \times R_{ex}$ , where  $R_{ex}$  is the relative risk of death for ex-smokers.

The number of people aged 16 and their smoking status were obtained from official statistics,<sup>2</sup> and provided exogenously to the model. Similarly, the number of net immigration by age and gender to England each year was obtained,<sup>3</sup> and exogenously added to the population by assuming that the immigrants had the same age-sex-specific smoking prevalence as the population in England.

## 3 Smoking status and data sources

The population were separated into subgroups by age, sex, and smoking status. The smoking status of the population were classified as never smokers, current smokers and former smokers. As the cycle length of time in the present study was one year, former smokers were defined as those who stopped smoking for  $\geq 12$  months, and were further classified according to time since cessation (quit smoking for 1, 2, 3, 4, 5, 6, 7, 8, 9, and  $\geq 10$  years).

### 3.1 Data on smoking status in England

The rates of prevalence of current and former cigarette smoking by sex and age in England were obtained from a series of General Lifestyle Surveys in England.<sup>4,5</sup> The former smokers in surveys were defined as those who were not regularly smoking at the time of survey, including those who quit  $< 12$  months. The present study used a different definition of former smokers, excluding people who quit smoking for  $< 12$  months. Therefore, the current smokers in the present study included these short-term quitters.

We used original data obtained from the Opinion Surveys in England<sup>6</sup> from 2001 to 2009 to estimate a ratio of smoking prevalence with and without short-term quitters. Due to data limitation, we applied the average ratios by age group to smoking prevalence rates in different years. After including short-term quitters, the smoking prevalence was on average increased by 1.090 or 1.083 times, for women and men, respectively (Table 1w). Using the same dataset from Opinion Surveys in England, prevalence rates of former smokers were reduced correspondingly after excluding short-term quitters (Table 2w). The rate ratios (RRs) were used to adjust the rate of former smokers in 2001 (Table 2w). Clearly, prevalence rates of current and former smokers were more sensitive to the inclusion or exclusion of short-term quitters for younger adults.

**Table 1w: Prevalence rates of current smokers with and without short-term quitters**

Age	Women			Men		
	Original	With Quit<12m	RR	Original	With Quit<12m	RR
16-17	23.27	27.23	1.170	27.91	30.81	1.104
18-19	29.49	35.48	1.203	35.03	36.31	1.037
20-24	35.96	39.65	1.103	35.68	38.03	1.066
25-29	34.25	38.54	1.125	40.78	44.84	1.100
30-34	28.73	31.99	1.113	32.97	36.2	1.098
35-39	27.23	29.93	1.099	30.82	33.75	1.095
40-44	27.09	29.28	1.081	28.36	30.93	1.091
45-49	26.77	28.03	1.047	28.05	30.3	1.080
50-54	26.3	27.95	1.063	28.38	30.61	1.079
55-59	23.21	24.66	1.062	26.89	28.53	1.061
60-	14.12	15.18	1.075	14.1	15.27	1.083
Overall	23.11	25.2	1.090	25.31	27.4	1.083

**Table 2w: Prevalence rates of former smokers with and without short-term quitters**

Age	Women			Men		
	Original	Exclude quit<12m	RR	Original	Exclude quit<12m	RR
16-17	5.94	1.98	0.333	4.07	1.16	0.285
18-19	10.6	4.61	0.435	5.1	3.82	0.749
20-24	14.42	10.74	0.745	14.05	11.71	0.833
25-29	17.42	13.13	0.754	13.87	9.81	0.707
30-34	18.19	14.94	0.821	18.28	15.05	0.823
35-39	18.38	15.68	0.853	19.1	16.18	0.847
40-44	22.91	20.72	0.904	22.56	19.98	0.886
45-49	22.23	20.97	0.943	24.06	21.82	0.907
50-59	27.91	26.45	0.948	33.74	32.1	0.951
60-	32.23	31.17	0.967	52.47	51.3	0.978
total	24.62	22.53	0.915	32.04	29.95	0.935

### 3.2 Smoothing reported rates of smoking prevalence

Given a general trend of declining smoking prevalence in all age groups, there were some fluctuations in rates of reported smoking prevalence over time, which was likely caused by sampling errors. To facilitate the simulation evaluation, we smoothed the smoking prevalence over time by simple linear equations (see Table 3w).

**Table 3w: Smoothed reported smoking prevalence (including those who quit for <12 months) by sex, age and year**

Female	2001	2002	2003	2004	2005	2006	2007	2008

16-17	0.344	0.331	0.319	0.307	0.294	0.282	0.270	0.257
18-19	0.353	0.341	0.328	0.315	0.303	0.290	0.277	0.265
20-24	0.381	0.374	0.368	0.361	0.355	0.349	0.342	0.336
25-29	0.349	0.340	0.331	0.321	0.312	0.303	0.293	0.284
30-34	0.346	0.336	0.327	0.318	0.309	0.300	0.290	0.281
35-39	0.307	0.299	0.291	0.283	0.276	0.268	0.260	0.252
40-44	0.302	0.294	0.287	0.279	0.271	0.263	0.256	0.248
45-49	0.293	0.285	0.278	0.270	0.263	0.255	0.248	0.240
50-54	0.261	0.254	0.247	0.240	0.233	0.226	0.219	0.212
55-59	0.261	0.254	0.247	0.240	0.233	0.226	0.219	0.212
60-	0.158	0.154	0.150	0.146	0.143	0.139	0.135	0.132
total	0.271	0.263	0.256	0.249	0.242	0.235	0.228	0.220
Female	2009	2010	2011	2012	2013	2014	2015	2016
16-17	0.245	0.233	0.221	0.208	0.196	0.184	0.171	0.159
18-19	0.252	0.239	0.227	0.214	0.201	0.189	0.176	0.163
20-24	0.329	0.323	0.317	0.310	0.304	0.297	0.291	0.285
25-29	0.275	0.265	0.256	0.247	0.237	0.228	0.219	0.209
30-34	0.272	0.263	0.253	0.244	0.235	0.226	0.216	0.207
35-39	0.244	0.236	0.228	0.221	0.213	0.205	0.197	0.189
40-44	0.240	0.232	0.225	0.217	0.209	0.201	0.194	0.186
45-49	0.233	0.225	0.218	0.210	0.203	0.195	0.188	0.180
50-54	0.205	0.198	0.191	0.184	0.177	0.170	0.163	0.156
55-59	0.205	0.198	0.191	0.184	0.177	0.170	0.163	0.156
60-	0.128	0.124	0.120	0.117	0.113	0.109	0.105	0.102
total	0.213	0.206	0.199	0.192	0.184	0.177	0.170	0.163
Male	2001	2002	2003	2004	2005	2006	2007	2008
16-17	0.278	0.272	0.265	0.258	0.251	0.244	0.238	0.231
18-19	0.261	0.255	0.249	0.242	0.236	0.230	0.223	0.217
20-24	0.419	0.407	0.394	0.381	0.369	0.356	0.344	0.331
25-29	0.402	0.393	0.384	0.375	0.367	0.358	0.349	0.340
30-34	0.401	0.393	0.384	0.375	0.366	0.357	0.348	0.340
35-39	0.340	0.332	0.325	0.317	0.310	0.302	0.294	0.287
40-44	0.339	0.331	0.323	0.316	0.308	0.301	0.293	0.285
45-49	0.335	0.328	0.320	0.313	0.305	0.298	0.290	0.283
50-54	0.286	0.279	0.272	0.265	0.258	0.251	0.244	0.237
55-59	0.281	0.274	0.267	0.261	0.254	0.247	0.240	0.233
60-	0.165	0.162	0.159	0.156	0.153	0.150	0.147	0.143
total	0.296	0.289	0.282	0.275	0.269	0.262	0.255	0.248
Male	2009	2010	2011	2012	2013	2014	2015	2016
16-17	0.224	0.217	0.210	0.204	0.197	0.190	0.183	0.176
18-19	0.210	0.204	0.198	0.191	0.185	0.178	0.172	0.166
20-24	0.318	0.306	0.293	0.281	0.268	0.255	0.243	0.230

25-29	0.331	0.322	0.313	0.305	0.296	0.287	0.278	0.269
30-34	0.331	0.322	0.313	0.304	0.295	0.286	0.278	0.269
35-39	0.279	0.271	0.264	0.256	0.248	0.241	0.233	0.226
40-44	0.278	0.270	0.263	0.255	0.247	0.240	0.232	0.225
45-49	0.275	0.268	0.260	0.253	0.245	0.238	0.230	0.223
50-54	0.230	0.223	0.217	0.210	0.203	0.196	0.189	0.182
55-59	0.227	0.220	0.213	0.206	0.199	0.193	0.186	0.179
60-	0.140	0.137	0.134	0.131	0.128	0.125	0.122	0.119
total	0.241	0.235	0.228	0.221	0.214	0.207	0.201	0.194

### 3.3 Years since cessation for former smokers

In the present study, ex-smokers were defined as those who stopped smoking for  $\geq 12$  months, and were further classified according to time since cessation: from 1, 2, 3, ... and  $\geq 10$  years. To estimate the distribution of former smokers by time since cessation at baseline in 2001, we used data from Opinion Surveys in England<sup>6</sup> to obtain results shown in Table 4w.

**Table 4w: Distribution of years since cessation for ex-smokers**

Women	Years since cessation									
	1	2	3	4	5	6	7	8	9	$\geq 10$
age										
16-17	0.750	0.150	0.100	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18-19	0.300	0.400	0.100	0.100	0.100	0.000	0.000	0.000	0.000	0.000
20-24	0.239	0.254	0.194	0.134	0.075	0.045	0.045	0.015	0.000	0.000
25-29	0.091	0.246	0.109	0.109	0.127	0.109	0.055	0.036	0.027	0.091
30-34	0.112	0.094	0.071	0.088	0.100	0.088	0.059	0.077	0.035	0.277
35-39	0.097	0.048	0.091	0.059	0.070	0.048	0.022	0.075	0.027	0.462
40-44	0.041	0.032	0.041	0.064	0.060	0.028	0.055	0.060	0.018	0.601
45-49	0.035	0.030	0.035	0.065	0.060	0.025	0.020	0.045	0.015	0.668
50-54	0.036	0.041	0.046	0.031	0.046	0.010	0.010	0.031	0.041	0.711
55-64	0.036	0.029	0.026	0.035	0.038	0.022	0.024	0.016	0.006	0.769
65-74	0.022	0.042	0.040	0.034	0.030	0.016	0.018	0.026	0.012	0.758
75+	0.011	0.019	0.009	0.015	0.031	0.009	0.011	0.020	0.006	0.869
Men	Years since cessation									
age	1	2	3	4	5	6	7	8	9	$\geq 10$
16-17	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
18-19	0.200	0.200	0.200	0.100	0.100	0.100	0.100	0.000	0.000	0.000
20-24	0.240	0.220	0.140	0.200	0.060	0.040	0.050	0.050	0.000	0.000
25-29	0.158	0.175	0.140	0.105	0.070	0.053	0.053	0.053	0.018	0.175
30-34	0.127	0.119	0.087	0.040	0.103	0.064	0.056	0.079	0.032	0.294
35-39	0.097	0.097	0.069	0.063	0.056	0.035	0.049	0.042	0.035	0.458
40-44	0.043	0.043	0.075	0.038	0.081	0.043	0.027	0.043	0.016	0.591
45-49	0.011	0.069	0.057	0.029	0.034	0.051	0.040	0.011	0.017	0.680
50-54	0.029	0.017	0.025	0.038	0.063	0.034	0.021	0.034	0.017	0.723
55-64	0.021	0.028	0.018	0.028	0.023	0.024	0.021	0.021	0.023	0.795
65-74	0.015	0.004	0.012	0.022	0.019	0.015	0.016	0.013	0.006	0.878
75+	0.002	0.005	0.007	0.007	0.016	0.009	0.005	0.020	0.005	0.924

### 3.4 Number of population aged 16 years

The number of people aged 16 years and their smoking status by sex and age category in England each year from 2002 to 2016 were provided exogenously to the model. The population data was obtained from Official Statistics.<sup>2</sup> The smoking status was based on data from a series of **General Lifestyle Surveys in England**,<sup>4,5</sup> and opinion surveys in England.<sup>6</sup> Because of limited data availability, we used the same prevalence rate of ex-smokers among people aged 16 years of age for all simulation years (Table 5w).

**Table 5w. Number of people aged 16 and their smoking status from 2002 to 2016 in England**

Year	Female population	Male population	Female: current smokers	Male: current smokers	Female: former smokers	Male: former smokers
2002	304928	321360	31.9%	23.0%	1.3%	0.4%
2003	312190	322227	30.3%	22.2%	1.3%	0.4%
2004	321181	331413	28.8%	21.4%	1.3%	0.4%
2005	318274	329206	27.2%	20.6%	1.3%	0.4%
2006	318915	336838	25.7%	19.8%	1.3%	0.4%
2007	329588	346710	24.1%	19.0%	1.3%	0.4%
2008	328004	339009	22.5%	18.2%	1.3%	0.4%
2009	319661	334158	21.0%	17.4%	1.3%	0.4%
2010	320118	338208	19.4%	16.6%	1.3%	0.4%
2011	313401	330224	17.8%	15.7%	1.3%	0.4%
2012	313179	333138	16.2%	14.9%	1.3%	0.4%
2013	315861	332004	14.7%	14.1%	1.3%	0.4%
2014	309406	325470	13.1%	13.2%	1.3%	0.4%
2015	307539	324096	11.5%	12.4%	1.3%	0.4%
2016	300447	317256	9.9%	11.5%	1.3%	0.4%

### 3.5 Smoking initiation and taking up

New smoking take-ups included 16-year-old smokers, which were exogenously added to the simulated population. We initially estimated uptake rates using a plot presented in Vugrin et al.<sup>7</sup> However, **the use of fixed uptake rates was found to be unsatisfactory, because new smokers aged 16 were already exogenously added to the simulated population in the current study, and uptake rates were unlikely to be the same during the whole simulation period.** Therefore, we estimated the additional number of new up-takes in year  $t-1$  (among sex-specific never smokers aged 'a-1') based on the observed increase in the number of current and former smokers between year ' $t-1$ ' and ' $t$ ' (note: the following calculations were conducted separately for women and men).

First, we estimated the number of current smokers aged 'a' in year ' $t$ ', assuming that there were no new take-ups:

$$C'(t, a) = (C(t-1, a-1) + R(t-1, a-1)) * (1 - D(t-1, a-1)) - F1(t-1, a-1);$$

Where  $C(t, a)$  refers the number of current smokers,  $R(t, a)$  refers the number of relapsers,  $D(t, a)$  refers the death probability, and  $F1(t, a)$  refers the number of new former smokers (quit for >12 months but <24 months).

Then we estimated the number of current smokers aged 'a' in year ' $t$ ' according to the observed smoking rate:

$$C(t, a) = POP(t-1, a-1) * (1 - D(t-1, a-1)) * SP(t, a);$$

In which  $POP(t-1, a-1)$  is the number of population aged 'a-1';  $SP(t, a)$  is the observed smoking prevalence. The new take-ups at age 'a-1' during year ' $t-1$ ' was estimated as:

$$TKUP(t-1, a-1) = C(t, a) - C'(t, a).$$

### 3.6 Smoking relapse among former smokers

Rates of smoking relapse among former smokers who quit at least one year were estimated based on the relapse rate curve in a paper by Stapleton and West 2012.<sup>8</sup> The rate of smoking relapse was estimated to be 15.0%, 8.0%, 4.5%, 2.0%, 1.5%, 1.0%, 0.5%, 0.3%, 0.2% and 0.1% among former smokers who stopped smoking for 1, 2, 3, 4, 5, 6, 7, 8, 9, and  $\geq 10$  years, respectively.

### 3.7 Relative risk of death among current and former smokers

Relative risks by smoking status were based on data summarised in a study by Vugrin et al.<sup>7</sup> For example, current smoking increased the risk of all cause mortality by 2.79 for men aged 55-64 years and 2.35 for women aged 55-64 years. For those aged 55-64 years, the relative risk reduced to 1.54 for men and 1.71 for women if they quit smoking at 40-49 years of age.<sup>7</sup>

## 4 Quit attempts and success rates

### 4.1 Quit attempts among current smokers

Data on overall attempts to give up smoking in the last year were obtained from Opinion Surveys in England.<sup>6</sup> The rates of people who attempted to quit in the last year were shown in Table 6w. For estimating rates of quit attempts in 2010-2016, we used a ratio of attempt rate in year t vs. in year t-1, based on data from Smoking Toolkit Study (STS).<sup>9</sup>

**Table 6w: Proportion of quit attempts among current smokers**

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Women	0.27	0.26	0.24	0.27	0.29	0.31	0.32	0.3	0.29	0.27	0.28	0.31	0.3	0.26	0.25	0.28
Men	0.21	0.2	0.22	0.24	0.24	0.27	0.3	0.28	0.27	0.25	0.26	0.29	0.28	0.24	0.23	0.26

We used all data from the OSE 2001/09 to calculate the rate of quit attempts by age group (Table 7w), which were used to estimate quit attempts by age in each of the simulation years; attempt rate for a age group was adjusted according to the ratio of the average rate (2001/09) and the reported rate in a give year. For example, the ratio of the average rate and the rate in 2001 was  $0.985=0.256/0.260$  for women, the attempt rate for women aged <18 was adjusted as  $0.2865=0.291*0.985$  in 2001.

**Table 7w: Rate of quit attempts by age and sex**

Age	Women	Men
<18	0.291	0.283
18-34	0.332	0.277
35-44	0.247	0.233
45-59	0.219	0.167
60+	0.183	0.181
Total	0.256	0.220

A person who attempted to quit in the last year may have multiple attempts. We estimated the average number of attempts per person who attempted in a year using data from the OSE 2001/09. Results for 2009 were applied to year 2010-2016.

### 4.2 Quit attempts and success rates at NHS stop smoking clinics

Data on the number of people setting a quit date and quit rates at the 4 week follow-up at NHS SSS clinics were obtained from Statistics on NHS Stop Smoking Services.<sup>10</sup> In the current study, we used self-reported quit rates, in order to be consistent with the self-reported prevalence of smoking in England.

There were no routinely collected data on relapse among 4 week quitters by 12 months, and we used data from three long-term follow-up studies.<sup>11-13</sup> Use of data from two observational studies found that the average rate of self-reported abstinence at 12 months was 28.1% among all 4-week quitters,<sup>11,13</sup> although it was not reported separately by gender and age. Self-reported abstinence at 12 months by gender and age was available from a control study (SHARPISH).<sup>12</sup> We used a ratio of relapse risk in the SHARPISH trial and the two observational studies to estimate relapse risk by age and gender among 4-week quitters (Table 8w).

**Table 8w: One year cessation rate for short-terms quitters**

Notes: Overall: sharpish=0.516; pooled Ferguson & Bauld = 0.281; ratio =  $0.281/0.516=0.544$



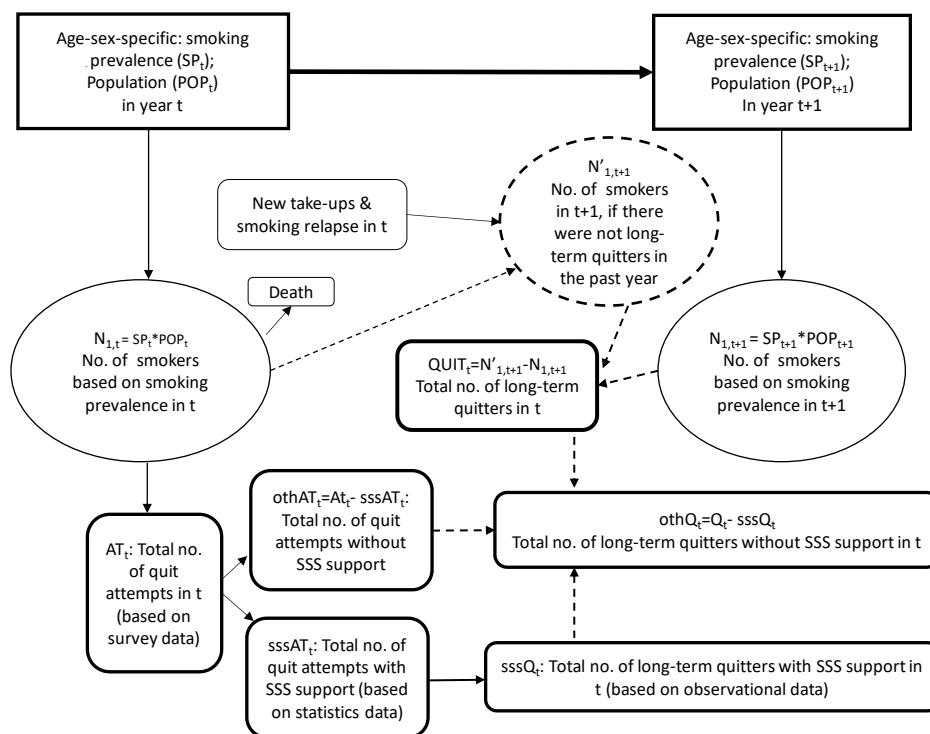
Age	Women			Men		
	sharpish	Adjusted	relapse rate	sharpish	Adjusted	relapse rate
18-34	0.467	0.254	0.746	0.436	0.237	0.763
35-44	0.492	0.268	0.732	0.524	0.285	0.715
45-59	0.511	0.278	0.722	0.533	0.290	0.710
60+	0.531	0.289	0.711	0.603	0.328	0.672

The overall quit success rate had increased from 14.1% during 2007-2011 to 17.8% during 2012-2016,<sup>14</sup> likely due to increased use of e-cigarettes by people who attempted to quit. This increase in quit success rate should also be applicable to quit attempts with SSS-support. Therefore, the success rate among quit attempts with SSS-support was correspondingly increased by 26% since 2012 in the simulation modelling.

### 4.3 Total number of long-term quitters ( $\geq 12$ months)

There were no reliable data on the quit rates at 12 months for quit attempts without the SSS-support. Therefore, we used a novel modelling approach to estimating the number of long-term quitters in year 't+1' based on change in smoking prevalence from year 't' to year 't+1', given other inflow and outflow parameters (Figure 2w). We first calculated the number of current smokers in year t+1 ( $N'_{1,t+1}$ ) by assuming there were no smokers who stopped smoking for at least 12 months in year 't', and the number of current smokers based on the observed smoking prevalence in year 't+1' ( $N_{1,t+1}$ ). Then the difference in the number of smokers in year 't+1' by the two calculations was used to estimate the total number of quitters required in year 't' to achieve the observed smoking prevalence in year t+1 ( $QUIT_t = N'_{1,t+1} - N_{1,t+1}$ ), given other inflow and outflow-related parameters. The number of long-term quitters associated with SSS-support was estimated based on data from statistics or observational studies ( $sssQ_t$ ), while the number of long-term quitters without SSS-support was the difference between total number of long-term quitters and those with SSS-support ( $othQ_t = QUIT_t - sssQ_t$ ).

**Figure 2w. A novel modelling approach to estimating the number of quit attempts and long-term quitters with or without SSS support in England**



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## Supplementary appendix 2.

### Estimated inflow into and outflow from the population of current smokers in England: 2001 - 2016

Year	Total inflow	New smokers	Relapsed smokers	Migrant smokers	Total outflow	Quitters	Deaths of smokers	In-out difference	Total smokers
<b>2001</b>	440,630	257,349	132,784	50,497	652,809	524,279	128,530	212,179	11,295,663
<b>2002</b>	442,563	247,569	147,782	47,212	653,787	529,084	124,703	211,224	11,077,949
<b>2003</b>	441,204	242,386	154,613	44,205	657,054	533,643	123,411	215,850	10,863,640
<b>2004</b>	472,488	241,323	159,322	71,843	654,232	538,222	116,010	181,744	10,647,500
<b>2005</b>	457,606	234,884	162,221	60,501	654,734	541,822	112,912	197,128	10,458,968
<b>2006</b>	442,450	228,131	164,296	50,023	648,242	539,924	108,318	205,792	10,258,323
<b>2007</b>	452,769	226,698	165,289	60,782	645,979	540,455	105,524	193,210	10,051,392
<b>2008</b>	420,671	218,941	166,133	35,597	644,066	540,098	103,968	223,395	9,850,421
<b>2009</b>	418,126	210,322	166,254	41,550	640,721	541,299	99,422	222,595	9,619,687
<b>2010</b>	424,821	204,663	166,759	53,399	637,634	540,861	96,773	212,813	9,392,534
<b>2011</b>	407,963	195,115	167,117	45,732	633,962	541,216	92,746	225,999	9,171,698
<b>2012</b>	391,868	188,774	167,362	35,731	633,072	540,941	92,131	241,204	8,941,180
<b>2013</b>	392,148	182,217	167,505	42,425	631,132	539,948	91,184	238,984	8,695,778
<b>2014</b>	402,581	173,388	167,626	61,568	627,632	539,358	88,274	225,051	8,449,957
<b>2015</b>	397,029	166,907	168,129	61,992	631,338	541,066	90,272	234,310	8,219,329
<b>2016</b>	372,389	160,134	168,796	43,459	630,352	542,634	87,718	257,963	7,978,537
<b>Annual average:</b>									
2001-12	434,430	224,680	159,994	49,756	646,358	537,654	108,704	211,928	10,135,746
2013-16	391,037	170,662	168,014	52,361	630,114	540,752	89,362	239,077	8,335,900
<b>2001-16</b>	423,582	211,175	161,999	50,407	642,297	538,428	103,869	218,715	9,685,785

## Supplementary appendix 3.

## Estimated quit attempts and quitting outcomes

Year	Total quit attempts	Proportion of smokers attempting to quit	Proportion of quit attempts with SSS-support	No. of all quitters	No. of quitters with SSS-support	Proportion of quitters with SSS-support	Success rate of quit attempts without SSS-support	Success rate of quit attempts with SSS-support
<b>2001</b>	4,132,596	36.6%	5.5%	524,279	33,191	6.3%	12.6%	14.6%
<b>2002</b>	4,422,473	39.9%	5.3%	529,084	34,108	6.4%	11.8%	14.5%
<b>2003</b>	4,399,321	40.5%	8.2%	533,643	56,184	10.5%	11.8%	15.6%
<b>2004</b>	4,960,485	46.6%	10.7%	538,222	81,506	15.1%	10.3%	15.4%
<b>2005</b>	5,014,573	47.9%	12.0%	541,822	90,291	16.7%	10.2%	15.0%
<b>2006</b>	5,745,782	56.0%	10.4%	539,924	87,778	16.3%	8.8%	14.6%
<b>2007</b>	6,032,231	60.0%	11.3%	540,455	95,819	17.7%	8.3%	14.1%
<b>2008</b>	5,003,506	50.8%	13.4%	540,098	90,424	16.7%	10.4%	13.5%
<b>2009</b>	4,738,229	49.3%	16.0%	541,299	101,254	18.7%	11.1%	13.4%
<b>2010</b>	4,311,324	45.9%	18.3%	540,861	104,133	19.3%	12.4%	13.2%
<b>2011</b>	4,322,726	47.1%	18.9%	541,216	108,690	20.1%	12.3%	13.3%
<b>2012</b>	4,712,125	52.7%	15.4%	540,941	128,039	23.7%	10.4%	17.7%
<b>2013</b>	4,440,708	51.1%	13.2%	539,948	103,109	19.1%	11.3%	17.6%
<b>2014</b>	3,755,949	44.4%	12.0%	539,358	79,037	14.7%	13.9%	17.5%
<b>2015</b>	3,473,718	42.3%	11.0%	541,066	67,293	12.4%	15.3%	17.6%
<b>2016</b>	3,742,387	46.9%	8.2%	542,634	54,052	10.0%	14.2%	17.6%
<b>Annual average:</b>								
2001-12	4,816,281	47.5%	12.1%	537,654	84,285	15.7%	10.7%	14.5%
2013-16	3,853,191	46.2%	11.2%	540,752	75,873	14.0%	13.6%	17.6%
<b>2001-16</b>	4,575,508	47.2%	11.9%	538,428	82,182	15.3%	11.3%	15.1%

**Supplementary appendix 4:****Estimated number of quit attempts per 100 current smokers by support received**