Appendix 2: NS-SEC group 4

The groups included in NS-SEC group 4 are diverse – those who are long-term unemployed or have never worked, potentially for a wide variety of reasons, students and those who have retired. As such, the smoking trends in this group may vary between the different component parts of the group with potentially substantial heterogeneity in estimates across the group. For this reason the group is described separately from the other NS-SEC groups, with the constituent parts of the group, and the results of the simulation, presented in this section.

Component parts of NS-SEC 4-group classification group 4

Within the NS-SEC 8 / 5 / 3 group classifications is the group "Never worked and long-term unemployed" (Table **1**). This groups can cause difficulty in stratified analyses by NS-SEC group due to the greater degree of heterogeneity of individuals included in this group as compared with all other NS-SEC groups.

Table 1. NS-SEC classes and collapses.

Eight classes	Five classes	Three classes
1. Higher managerial, administrative and professional occupations	1. Higher managerial, administrative and professional occupations	1. Higher managerial, administrative and professional occupations
1.1 Large employers and higher managerial and administrative occupations		
1.2 Higher professional occupations		
2. Lower managerial, administrative and professional occupations		
3. Intermediate occupations	2. Intermediate occupations	2. Intermediate occupations
4. Small employers and own account workers	3. Small employers and own account workers	
5. Lower supervisory and technical occupations	4. Lower supervisory and technical occupations	3. Routine and manual occupations
6. Semi-routine occupations	5. Semi-routine and routine occupations	
7. Routine occupations		
8. Never worked and long-term unemployed	***Never worked and long-term unemployed**	***Never worked and long-term unemployed**

A brief review was undertaken to understand whether this group can be broken down in to smaller, constituent groups in order to better stratify results and simulation populations. The groups included under "Never worked and long-term unemployed" in the APS can be stratified to include full-time students (16 years or older), those who have never worked or are long-term unemployed (recommended to pool as one group) and those who could not be classified (Table **2**). This would result in sample sizes (from the 2017 APS) of 13,155 full-time

students, 9,099 respondents who have never worked / are long-term unemployed, and 50,385 who were not classifiable (total "group 4" sample of 72,639). It is not clear why those who weren't classified were not grouped, or how these respondents may differ from those in other categories, nor is it straightforward to find a way to group this population into subgroups.

Table 2. Constituent parts of NS-SEC group 4 (never worked / long-term unemployed).

NSECMJ10 (8 group classification)		**Sample size from 2017 APS**	**NSEC10 (much more specific categories)**			**Sample sizes from 2017 APS**	
Code	**Category**		**Code**	**Category**	**Contains**		
8	Never worked, unemployed, students, not classified	72,639	15	Full-time students	At school (full-time)	13,155	
					Sandwich course		
					Full-time at univpoly or college		
			14.1	Never worked		7,935	9,099
			14.2	Long-term unemployed		1,164	
			16	Not classified or inadequately stated	Secm=0 (? Probably missing?)	1,380	50,385
					Searchtx=-8 (?)		
					es2000m=8 (?)		
					ocod10m=-8 (occupation no answer)		
			17	Not classifiable for other reasons		49,005	

NS-SEC Group 4 Results

Smoking prevalence

Under the baseline scenario the proportion of adults 20 years or older in NS-SEC group 4 who smoke was projected to change from 13.5% in 2017 to 14.0% in 2039 (Figure 19), with the smoke-free ambition not met before 2039 in this group. Among male adults (20 years of age or above) smoking prevalence was projected to change from 15.8% in 2017 to 21.0% in 2039, among females the projected change was from 12.0% in 2017 to 7.6% in 2039, with the smoke-free ambition of 5% not met for either sex.

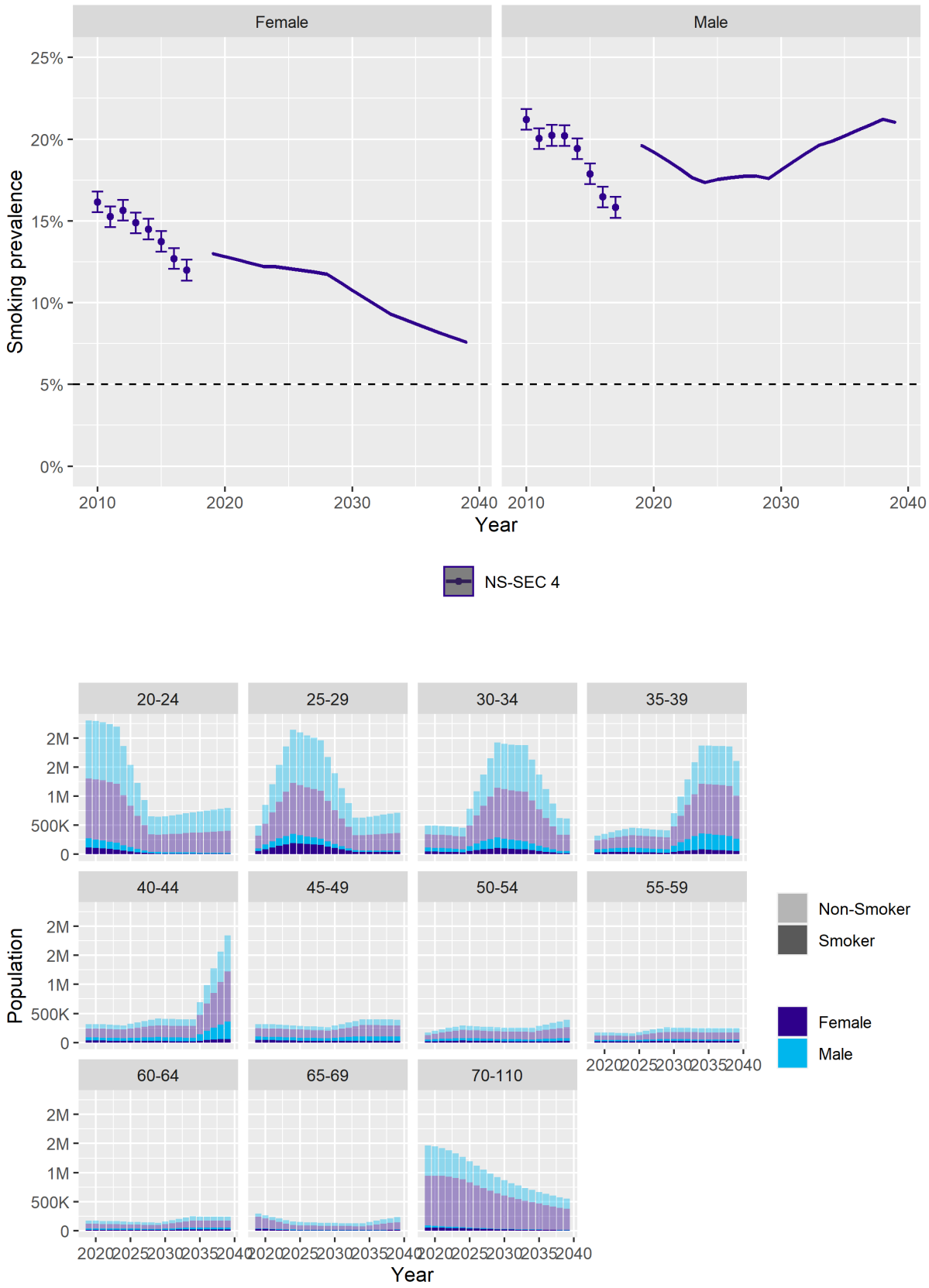

Figure 19. Proportion of adult females (left) and males (right) (age 20+) who smoke in the UK, projected for 2019–2039 by the HL Microsimulation model, NS-SEC group 4

Empirical data is from ONS[28]. *Dotted line = 5% smoking, below which is a "smokefree" generation.*

The trend seen in male prevalence, with the proportion of smokers increasing in the microsimulation from around 2029 until the end of the simulation, is likely a product of the component parts of the group 4 population and represents a limitation of this study. Group 4 comprises a more heterogenous population than the other NS-SEC groups with a young age structure (Figure 20).

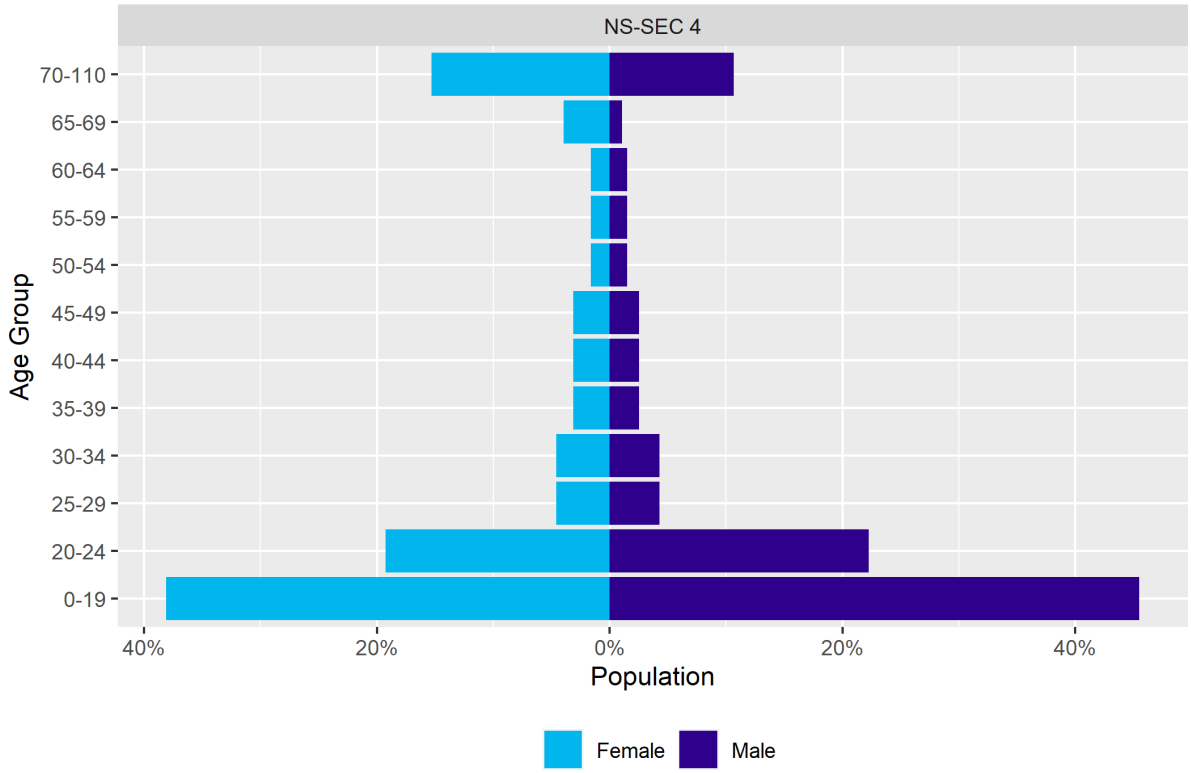

Figure 20. Age structure the population of NS-SEC group 4, 20191.

In the younger age group smoking rates are similar to other NS-SEC groups (Figure **1**) with the highest proportion of smokers seen in the 40-59 years age group.

[1] Scaled from 2011 census data

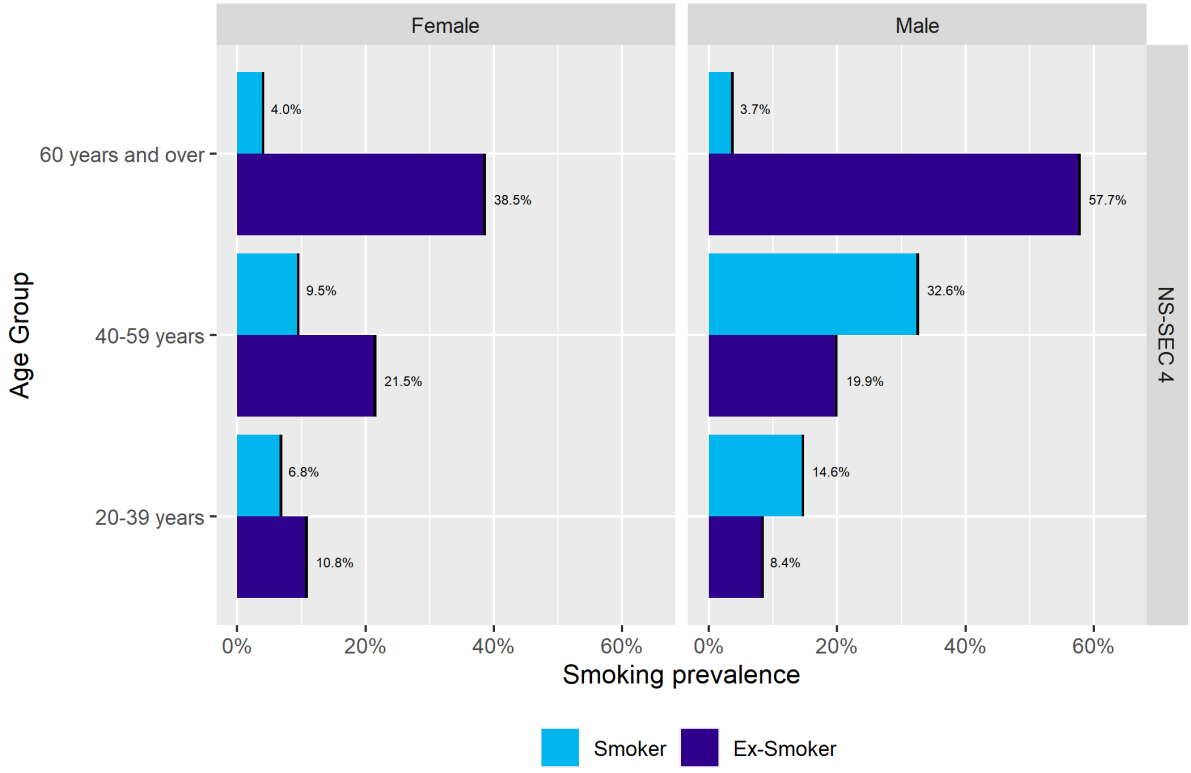

Figure 1. Proportion of people who smoke in the UK in 2039 under the baseline scenario, age and sex, NS-SEC group 4.

The microsimulation does not account for people moving between NS-SEC groups which would be expected to occur for some proportion of the younger population, of whom a significant percentage are students (16.3% in 2017). As this cohort pass into older age groups in the microsimulation a large number of this cohort in effect "take up" smoking as they pass into the next age group, resulting in an overall increase in smoking prevalence among males in this group. Therefore, the increase in smoking prevalence seen in group 4 males should be considered a quite extreme product of the nature of NSSEC shift rather than an effect which is likely to manifest in this population in the future.

For NS-SEC group 4 it was projected that the percentage of adults aged 20 years and over who smoke would reach 14.0% [±<0.01] in 2039 under the baseline scenario, 9.5% [±<0.01] under the VBA + referral scenario, 10.1% [±<0.01] under the VBA + prescription scenario and 9.1% [±<0.01] under the Ottawa Model (Figure 21). The 5% smoke-free ambition would be not be reached before 2039 under any scenario, with all scenarios resulting in at least a 5% fall in smoking prevalence.

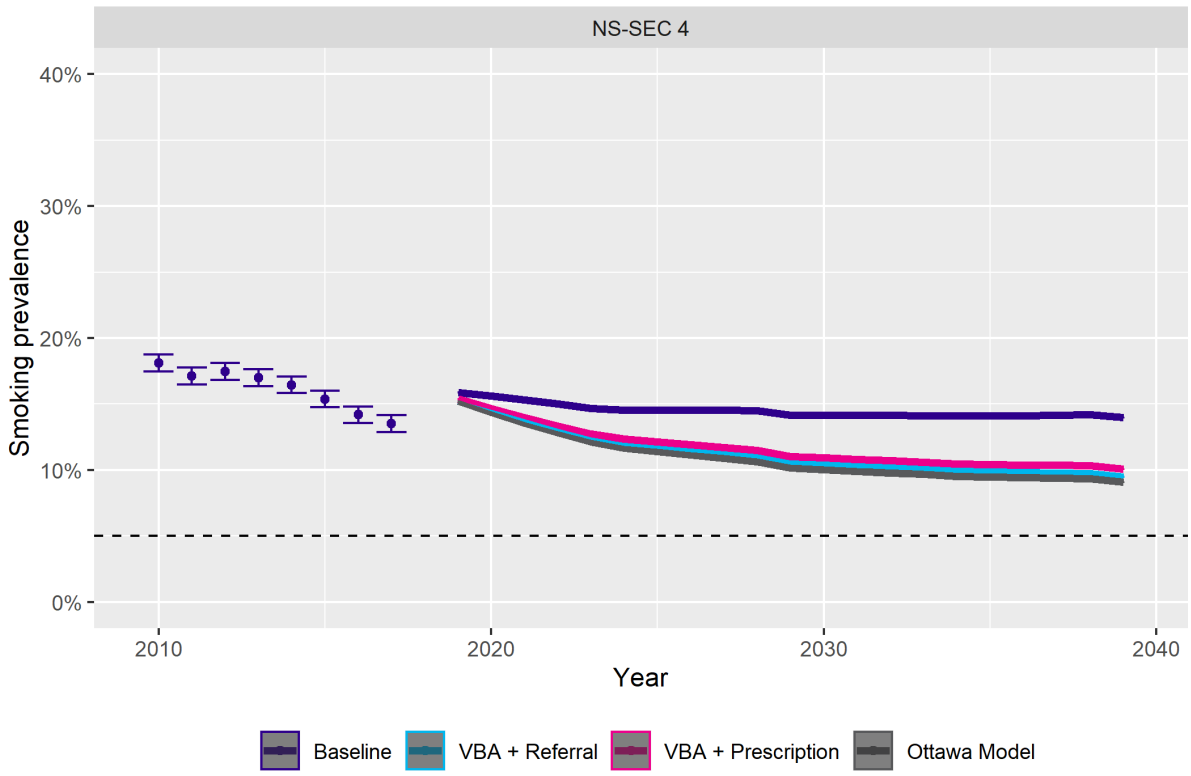

Figure 21. Proportion of adults (age 20+) who smoke in the UK, projected for 2019–2039 by scenario, NS-SEC group 4.

Empirical data is from ONS[28]. *Dotted line = 5% smoking, below which is a "smokefree" generation.*

Disease incidence

It was predicted that, in the baseline scenario (should current trends continue), there will be 369,000 [±1,449] (3,056 per 100,000) cases of disease attributable to smoking in the UK between 2019 and 2039 in NS-SEC group 4. Depression, lung cancer, CHD, COPD and stroke contributed the largest share of attributable disease in all three groups (Figure 22). Collectively, cancers comprised 29.0% (106,981) of smoking-attributable diseases. Depression has a higher prevalence than lung cancer in younger groups and given that a large proportion of the NS-SEC 4 population is young explains this finding.

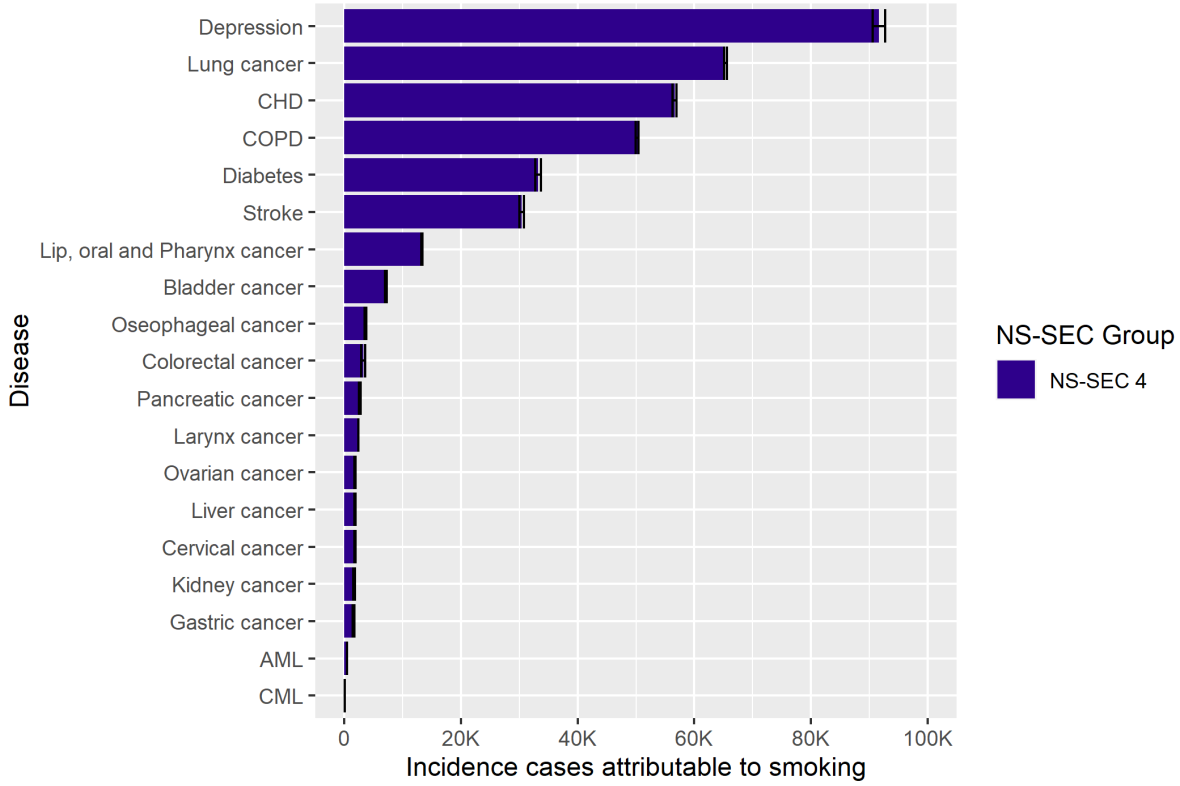

Figure 22. Cumulative disease incidence (millions of cases) in the UK attributable to smoking by disease, as estimated by subtracting a 0% smoking prevalence scenario from in the baseline scenario, 2019–2039, NS-SEC group 4.

Implementation of the Ottawa Model was predicted to reduce the greatest burden of disease associated with smoking, avoiding 56,992 [±1,570] cases of disease over the 20-year modelling period, slightly more than the VBA with referral scenario which avoided 55,060 [±1,570] cases. The simulation projected that 51,317 [±1,570] cases would be avoided in the VBA with prescription scenario. The diseases where most cases were avoided in the intervention scenarios included depression, lung cancer, stroke, COPD, diabetes and lip, oral and pharynx cancer (Figure 23).

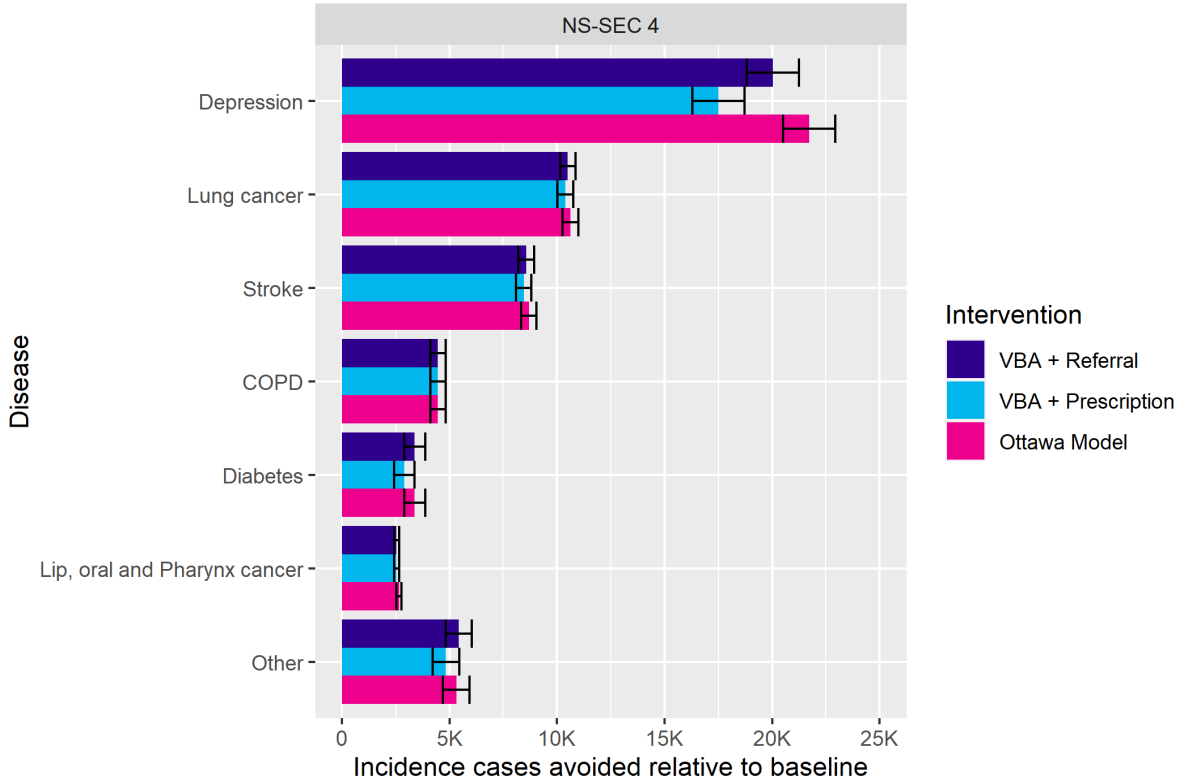

Figure 23. Cumulative disease incidence avoided in intervention scenarios relative to baseline by disease, 2019–2039, NS-SEC group 4.

Only most incident diseases shown for each scenario. Error bars = 95% confidence interval.

Premature mortality

Should trends continue, 34,718 [±534] premature deaths (death before the age of 75) could be attributed to smoking between 2019 and 2039 in NS-SEC group 4, equivalent to 297 deaths per 100,000 population. Under the VBA with referral and VBA with prescription scenarios, 4,959 [±534] and 4,609 [±534] premature deaths were predicted to be avoided relative to baseline, respectively. This number was similar under the Ottawa Model at 5,064 [±534] (Figure 24).

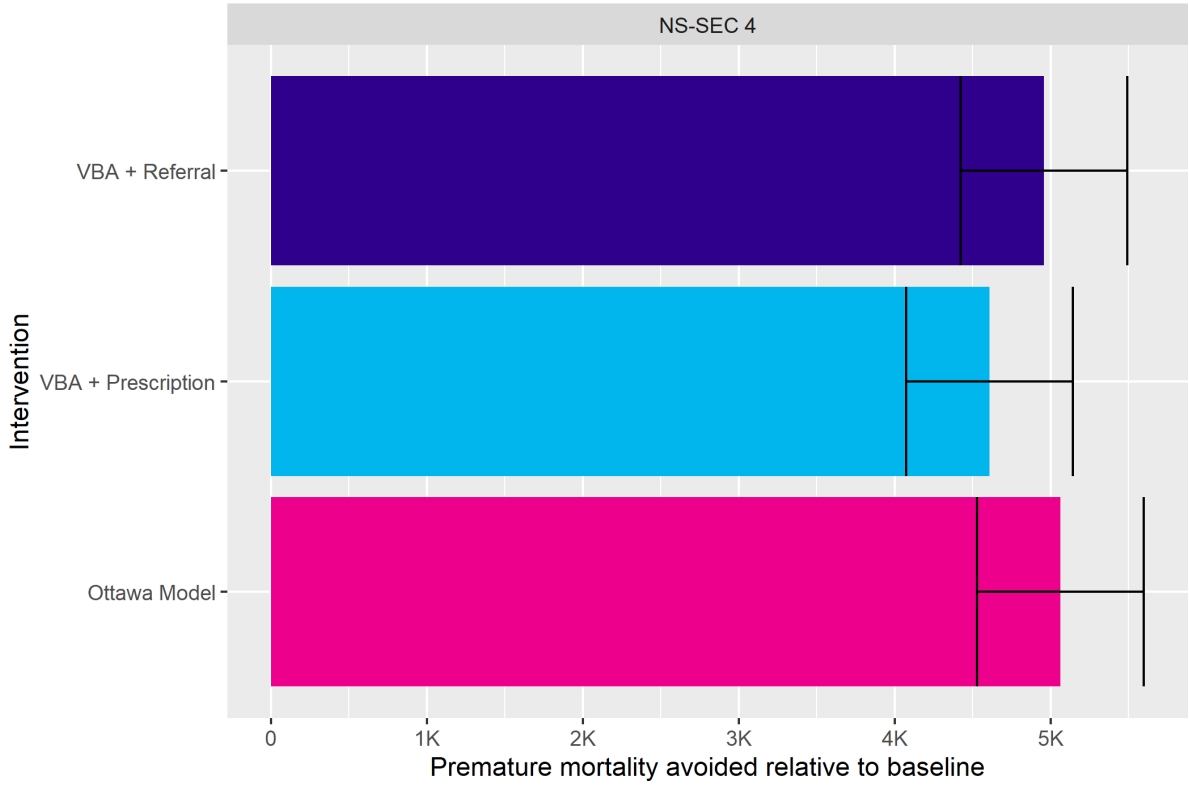

Figure 24. Premature mortality (before age 75 years) avoided in intervention scenarios relative to baseline, 2019–2039, NS-SEC group 4.
Error bars = 95% confidence interval.

Primary care costs and GP appointments

Assuming current trends continue, in NS-SEC group 4, £0.64 [±<0.01] billion worth of primary care costs, corresponding to 21,396,746 GP appointments, were projected to be attributable to smoking between 2019 and 2039. COPD would cost primary care the most in this scenario, at £0.52 billion over the 20 years, with diabetes contributing £0.1 billion of the total cost (Figure 25). Note that, as primary care costs were only available for a subset of modelled diseases, these costs are likely to be underestimated.

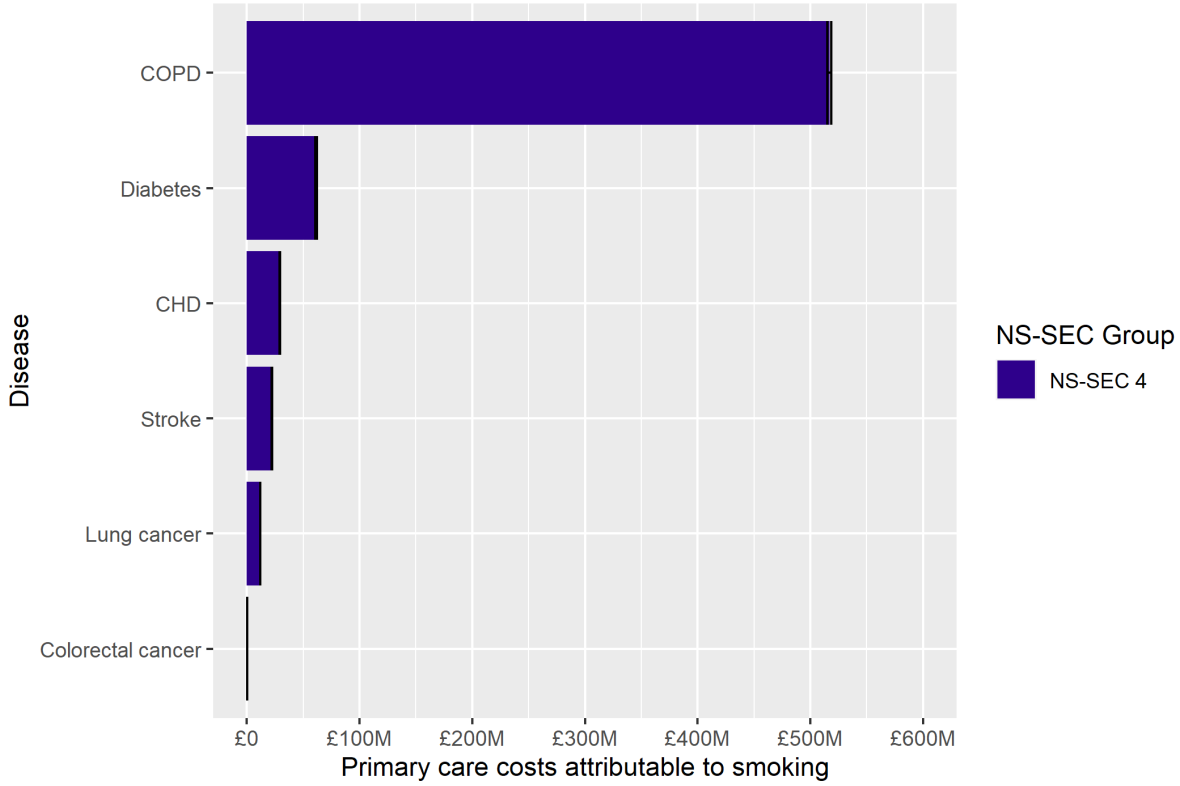

Figure 25. Smoking -attributable primary care costs, by disease, as estimated by subtracting a 0% smoking prevalence scenario from the baseline scenario, 2019–2039, NS-SEC group 4.
Error bars = 95% confidence interval.

Over this period primary care cost savings for the VBA with referral, VBA with prescription, and Ottawa Model scenarios were £48.6 [±2.0] million, £52.9 [±2.0] million, and £50.3 [±2.0] million, respectively. This could be disaggregated to a saving of 1,619,757, 1,763,867, and 1,678,188 GP appointments, respectively. COPD would cost primary care the most in all scenarios, over £39 million over the 20 years for all scenarios (Figure 26).

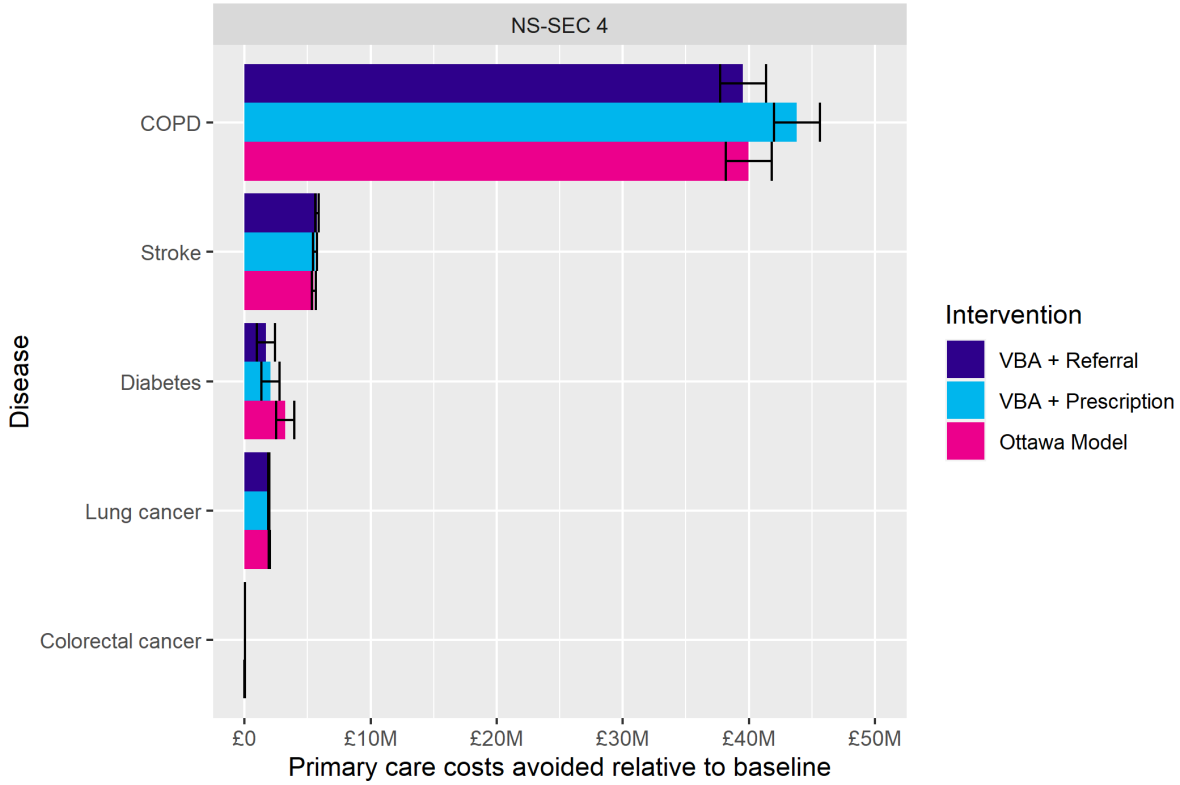

Figure 26. Smoking-attributable primary care costs avoided, by scenario and disease, in intervention scenarios relative to baseline, 2019–2039, NS-SEC group 4.
Error bars = 95% confidence interval.

Hospitalisations

Following current trends, it was predicted that, in NS-SEC group 4, 361,015 [±1,133] hospitalisations would be attributed to smoking between 2019 and 2039. Lung cancer was the primary cause of hospitalisation, with stroke, bladder cancer and COPD the other main causes (Figure 27).

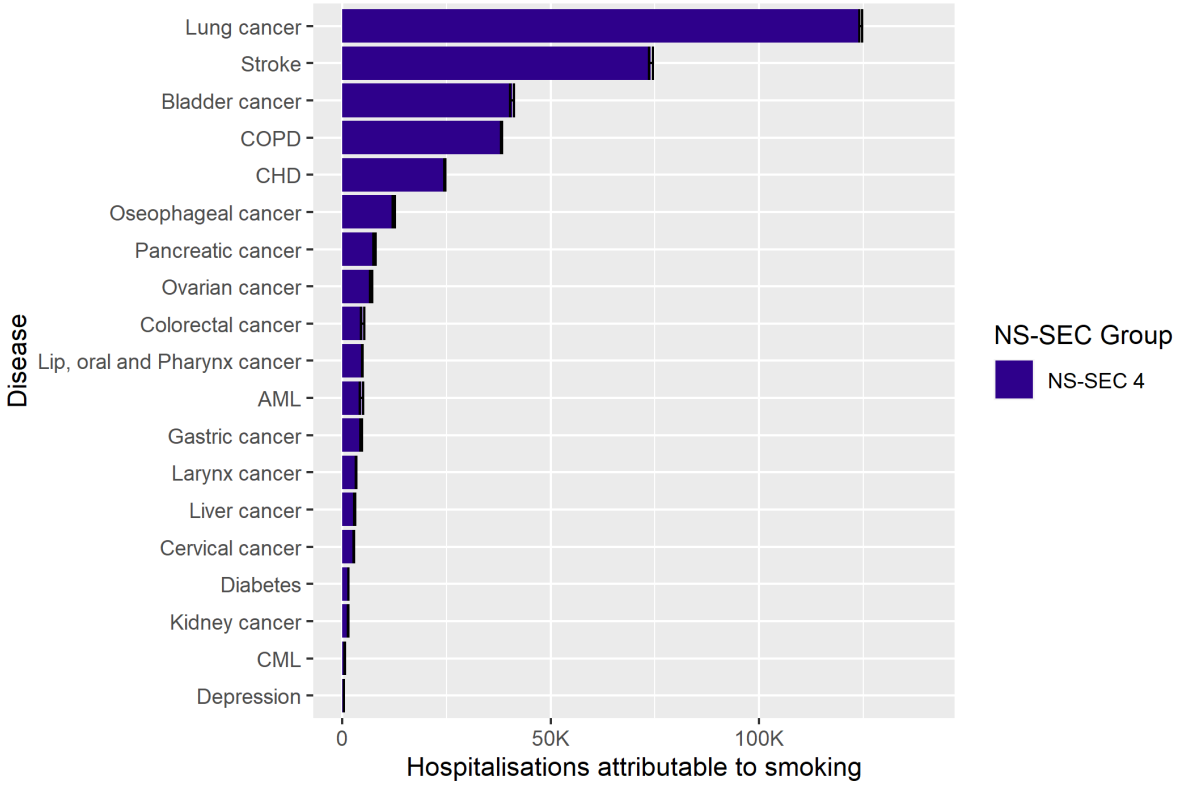

Figure 27. Smoking-attributable hospitalisations, by disease, as estimated by subtracting a 0% smoking prevalence scenario from the baseline scenario, 2019–2039, NS-SEC group 4.
Error bars = 95% confidence interval.

The VBA with referral and Ottawa Model scenarios showed the greatest reduction in hospitalisations over the modelled period at 61,981 [±1,186] and 61,825 [±1,186] fewer than baseline, respectively, with 59,929 [±1,187] hospitalisations avoided under the VBA with prescription scenario. Lung cancer was the primary cause of hospitalisation, with stroke and bladder cancer the other most common causes under all scenarios (Figure 28).

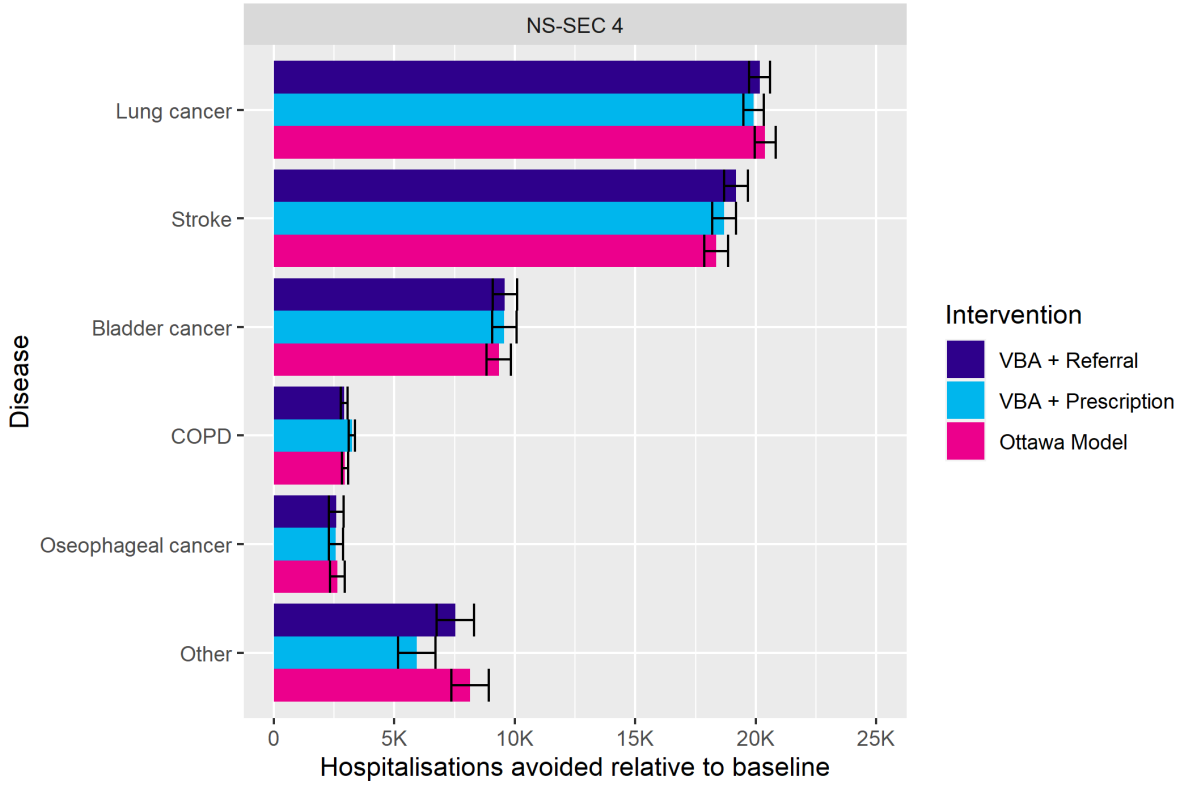

Figure 28. Smoking -attributable hospitalisations, by scenario and disease, in intervention scenarios relative to baseline, 2019–2039, NS-SEC group 4.
Error bars = 95% confidence interval.

Economic costs

Total healthcare costs

In the baseline scenario, for NS-SEC group 4 it was projected that £6.5 [±0.02] billion in healthcare costs would be attributable to smoking in the UK over the next 20 years. Depression would cost the health service the most in this scenario, at £1.5 billion over the 20 years, with cancers collectively contributing £2.1 billion of the total cost (Figure 29).

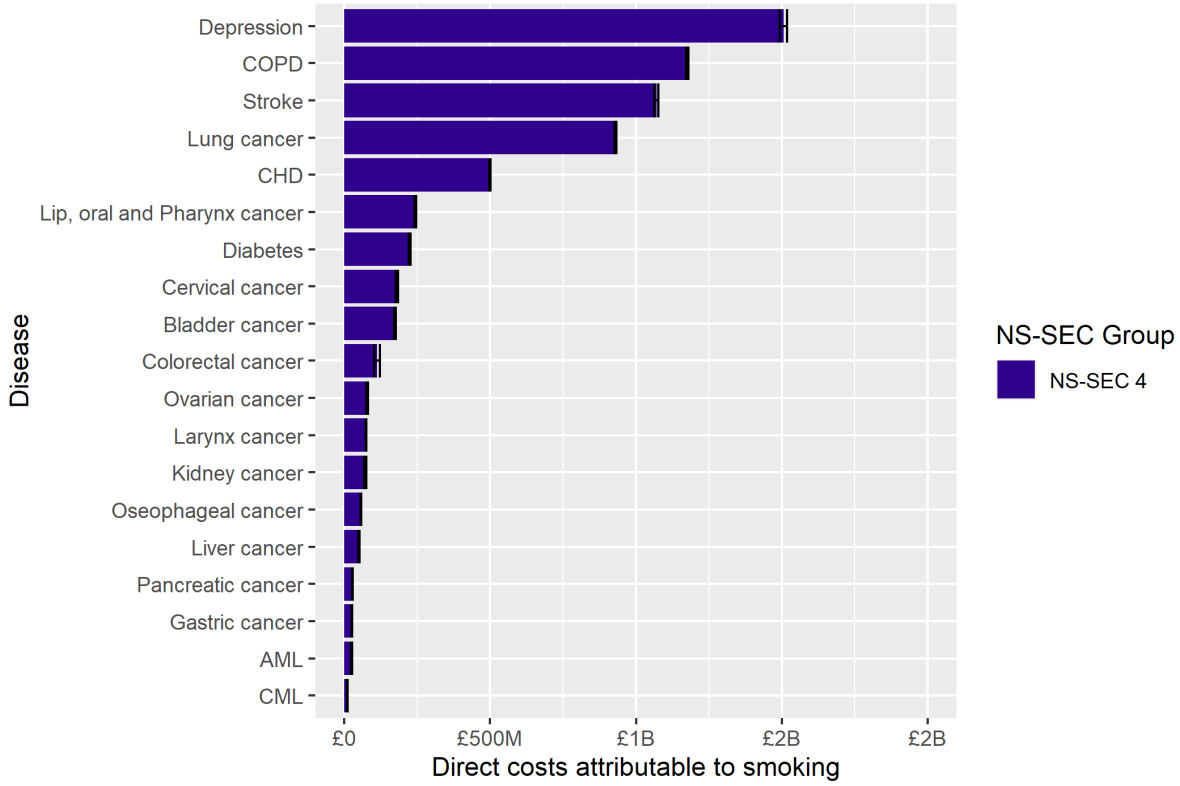

Figure 29. Smoking-attributable direct NHS healthcare costs, by disease, as estimated by subtracting a 0% smoking prevalence scenario from in the baseline scenario, 2019–2039, NS-SEC group 4.

Under the VBA with referral scenario, the reduction in smoking-related disease incidence (relative to baseline) is projected to save the health service £1.07 [±0.02] billion in healthcare costs over the modelled period. The largest costs avoided were depression, stroke and lung cancer, where reductions in these diseases would save £0.35 [±0.01] billion, £0.28 [±0.01] billion and £0.15 [±<0.01] billion, respectively, during the 20-year period (Figure 30). In the VBA with prescription scenario, reduction in smoking-related disease incidence (relative to baseline) was projected to save the health service £1.00 [±0.02] billion in healthcare costs over the modelled period. The largest costs avoided were depression, stroke and lung cancer, where reductions in these diseases would save £0.30 [±0.01] billion, £0.27 [±0.01] billion and £0.15 [±<0.01] billion, respectively, during the 20-year period (Figure 30). In the Ottawa Model scenario the reduction in incident cases reduces the health service costs of smoking-related diseases by £1.07 billion [±0.02] over the next 20 years. More than half of the costs avoided come from a reduction in the incidence of depression (£0.36 [±0.01] billion), stroke (£0.26 [±0.01] billion) and lung cancer (£0.15 [±<0.01] billion) (Figure 30).

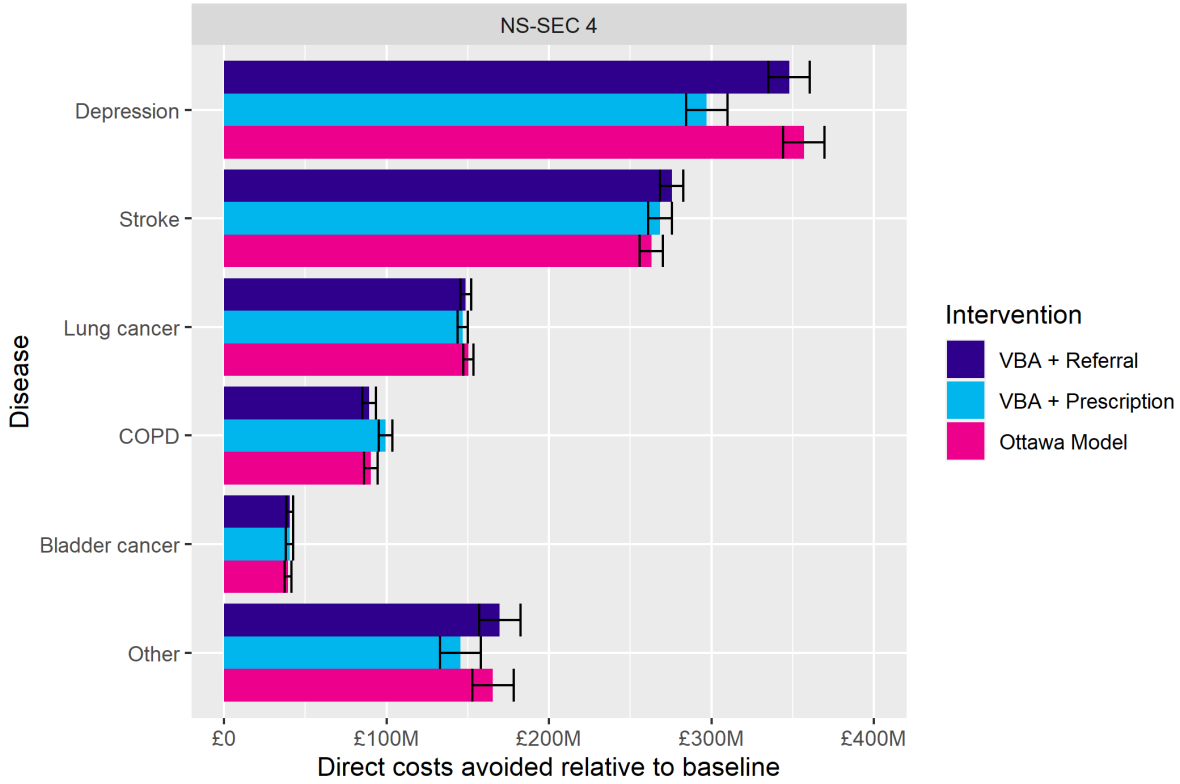

Figure 30. Wider societal costs avoided under each scenario, 2019–2039, NS-SEC group 4.
Only most incident diseases shown for each scenario. Error bars = 95% confidence interval.

Wider societal costs

In the baseline scenario in NS-SEC group 4 £14.4 [±0.1] billion in total wider societal costs were predicted to be attributable to smoking over the next 20 years, of which £13.7 billion (94.5%) was from morbidity costs, with the remaining £0.8 billion from mortality costs (Figure 31).

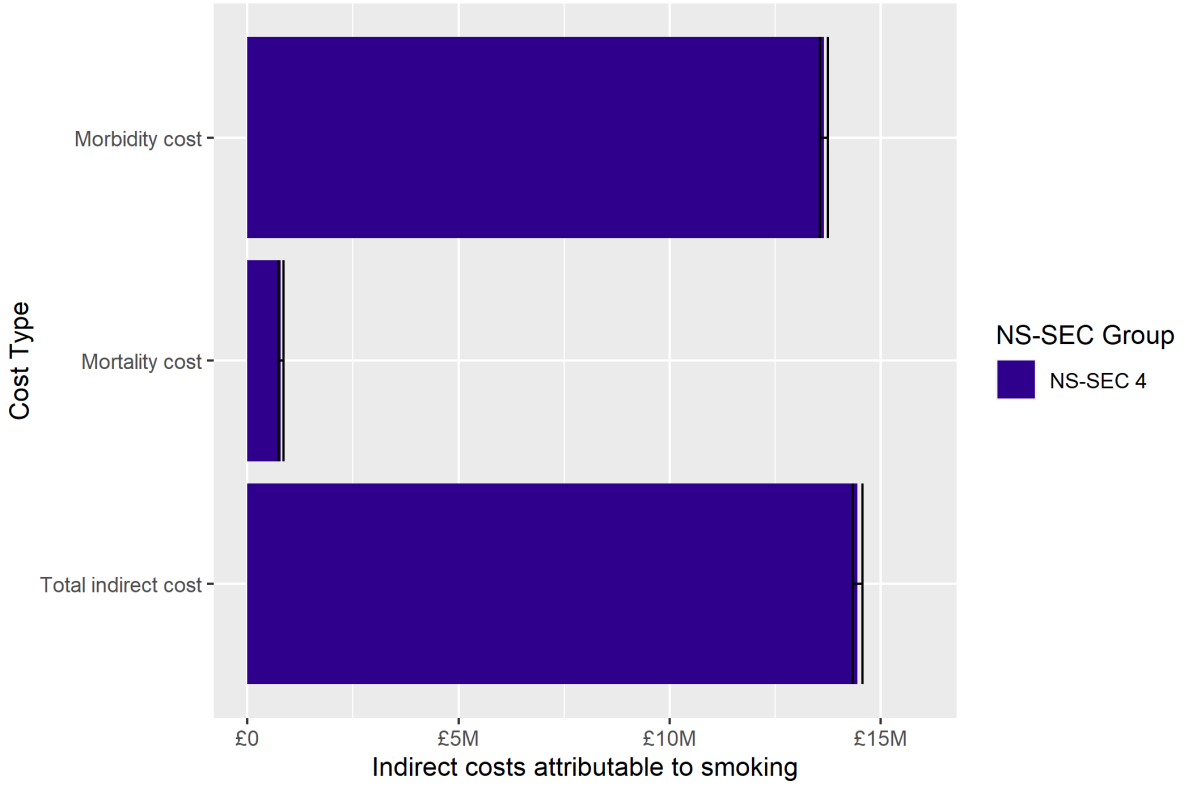

Figure 31. Wider societal costs avoided in each NS-SEC group under the baseline scenario, 2019–2039. *Error bars = 95% confidence interval.*

In NS-SEC group 4, under the VBA with referral scenario, £2.4 [±0.1] billion in wider societal costs were predicted to be avoided over the 20 years of the simulation, with morbidity costs accounting for 95.0% of these costs (Figure 32). Under the VBA with prescription scenario this saving was £2.2 [±0.1] billion, with morbidity costs comprising 95.3% of costs and under the Ottawa Model the saving was £2.5 [±0.1] billion, with morbidity costs accounting for 95.3%.

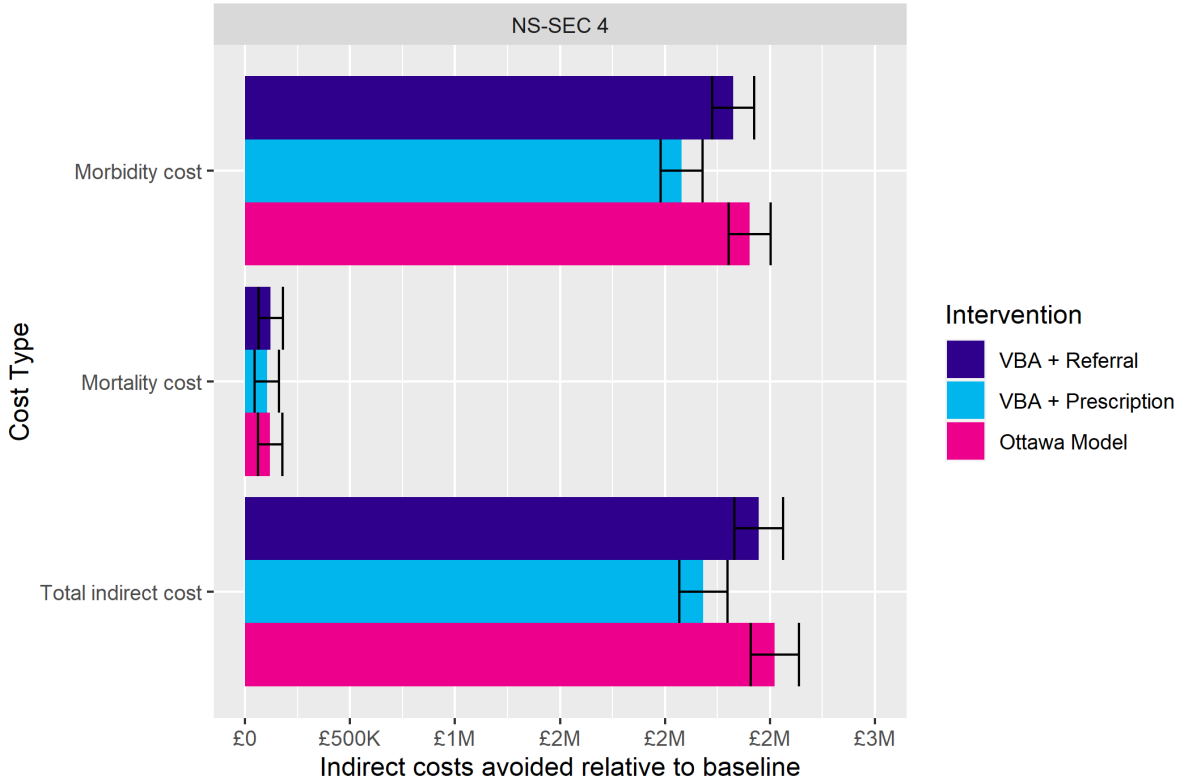

Figure 32. Wider societal costs avoided under each scenario, 2019–2039, NS-SEC group 4.