

# Smoking uptake in UK children: analysis of the UK Millennium Cohort Study

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## ABSTRACT

We used data from 11 577 children in the UK Millennium Cohort Study, collected at approximately 14 years of age (early teens), to assess characteristics associated with smoking, and generated regional estimates of numbers of smokers. 13.8% of UK early teens studied had ever smoked; 1.9% were current smokers. This corresponds to 2 28 136 and 39 653 (13–14 year olds) in the UK, respectively. Ever smoking risk increased if caregivers (26.0% vs 10.9%) or friends smoked (35.1% vs 4.0%), with a dose–response effect for friends' smoking. Caregiver and peer-group smoking remain important drivers of child smoking uptake and thus important targets for intervention.

## INTRODUCTION

For the majority of smokers, their habit derives from an addiction starting in childhood, which is the time of most experimentation and uptake of smoking.<sup>1</sup> The achievement of a 'smoke-free generation' will require substantial efforts to reduce the number of children taking up smoking, informed by an understanding of the factors that drive this phenomenon.<sup>2</sup> Previous research has identified characteristics linked to smoking uptake, which have included both individual level and environmental factors.<sup>3</sup> While there are cross-sectional data collections such as the Smoking, Drinking and Drug Use Survey in England<sup>4</sup> and the Scottish Schools Adolescent and Lifestyle Substance Use

Survey,<sup>5</sup> there is a lack of prospectively collected data which allow analysis of the impact of exposures in early life on smoking behaviour. To address this, we used the nationally representative Millennium Cohort Study (MCS) to: (1) estimate the number of ever and current smokers among early teens in the UK and (2) assess risk factors for early teens being an ever, current or continuing current smoker, including maternal smoking in pregnancy, and exposure to caregiver and peer smoking.

## METHODS

Data come from the MCS, which is a birth cohort study in the UK of children born between September 2000 and January 2002, and alive at 9 months.<sup>6</sup> We use data collected in 'wave six' when children were aged approximately 14 years old, referred to here as 'early teens'. 11 872 early teens took part and after excluding individuals with missing data, 11 577 were available for study.

The outcome in this study was early-teen smoking, classified as ever smoking, current smoking (at least one cigarette per week) and continuing current smoking (being a current smoker at age 14 among those who reported being an ever smoker at age 11). We also used potentially relevant sociodemographic data: age, sex, country equivalised household income, ethnicity, caregiver current smoking and friends' smoking. We used two measures of early-life exposure to smoking: exposure to smoking in the same room and maternal smoking

**Table 1** Estimated ever use and current (at least weekly) use of cigarettes among early teens by region

Region	% of ever smokers (95% CI)	% of current smokers (95% CI)	No of ever smokers (95% CI)	No of current smokers (95% CI)
North East	22.5 (16.1 to 28.9)	5.4 (1.8 to 9.1)	12 387 (8856 to 15 917)	2994 (988 to 5000)
North West	17.6 (13.9 to 21.4)	3.3 (1.5 to 5.0)	27 879 (21 963 to 33 796)	5162 (2360 to 7964)
Yorkshire and the Humber	16.6 (14.4 to 18.7)	3.3 (1.5 to 5.0)	19 570 (17 029 to 22 110)	3854 (1754 to 5955)
East Midlands	16.5 (12.4 to 20.6)	1.5 (0.2 to 2.8)	16 913 (12 699 to 21 126)	1487 (156 to 2819)
West Midlands	15.1 (10.9 to 19.3)	2.2 (1.2 to 3.2)	19 918 (14 326 to 25 509)	2920 (1571 to 4270)
East of England	13.3 (9.2 to 17.5)	2.5 (1.0 to 3.9)	17 986 (12 380 to 23 592)	3326 (1331 to 5320)
London	11.1 (7.9 to 14.4)	1.0 (0.3 to 1.6)	20 321 (14 364 to 26 277)	1817 (629 to 3004)
South East	16.1 (12.1 to 20.0)	2.7 (1.6 to 3.8)	32 399 (24 343 to 40 456)	5480 (3271 to 7689)
South West	15.2 (12.6 to 17.9)	2.3 (1.1 to 3.5)	17 615 (14 526 to 20 704)	2653 (1298 to 4008)
Wales	15.3 (11.6 to 19.0)	2.3 (0.6 to 4)	10 388 (7867 to 12 909)	1586 (432 to 2740)
Scotland	22.0 (13.8 to 30.2)	6.5 (<0.1 to 14.0)	24 481 (15 367 to 33 596)	7258 (0 to 15 552)
Northern Ireland	14.5 (11.6 to 17.3)	0.7 (0.3 to 1.2)	6570 (5258 to 7883)	339 (121 to 557)
Overall	16.0 (14.7 to 17.3)	2.8 (2.0 to 3.6)	2 28 136 (209 980 to 24 6293)	39 653 (28 634 to 50 672)

These percentages adjusted for survey weighting.



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during pregnancy. We produce estimates of national and regional numbers of smoking using data on population from the Office for National Statistics.

Further methodological details are outlined in the online appendix.

**RESULTS**

A description of the sample can be found in online appendix table 1.

After adjustment for survey weighting, 16.0% (95% CI 14.7 to 17.3) of 13 and 14 year olds in the UK were ever smokers by the time they were early teens (table 1). Applying these estimates to national population data suggests that 228 136 (209 980 to 246 293) early teens had ever smoked. 2.8% (2.0; 3.6) of early teens were current smokers, equating to 39 653 (28 634 to 50 672) early teens.

Children who reported current caregiver smoking were more than twice as likely to have ever smoked tobacco (26.0% vs 10.9%, adjusted OR (AOR) 1.69, 1.38 to 2.06) (table 2). Among children who reported at least some of their friends smoked, 35.1% had tried tobacco, compared with 4.0% of those reporting no tobacco use among their friends (AOR 10.35, 8.35 to 12.81). Current smoking was also more common among children whose caregivers currently smoked (4.9% vs 1.2%, AOR 1.92 (1.16 to 3.19)). Both reporting that at least some of their friends smoke (AOR 22.29, 4.91 to 101.21) and not answering this question were related to being a current smoker (AOR 9.21, 1.64 to 51.78). There were also notable differences in smoking prevalence across family income groups.

Children exposed to smoking in the same room in at least one survey wave of the MCS were more likely to be ever smokers (20.3% vs 10.3% for those never exposed to smoking in the

**Table 2** Fully adjusted associations with smoking among early teens

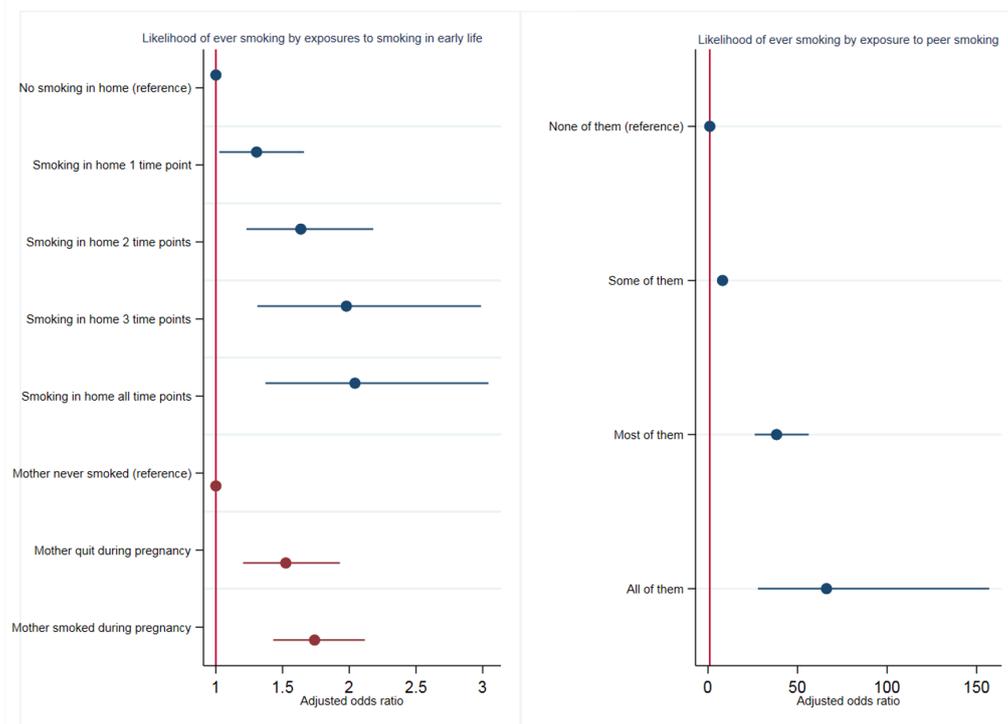
	Ever smoking, n=11 557		Current smoking, n=11 557		Continuing current smoking, n=1598	
	%	AOR (CI)	%	AOR (CI)	%	AOR (CI)
<b>Age (years)</b>						
13	10.5	ref	1.1	Ref	10.4	ref
14/15	14.9	<b>1.31 (1.07 to 1.60)</b>	2.2	1.46 (0.83 to 2.56)	14.6	1.40 (0.78 to 2.51)
<b>Gender</b>						
Female	14.9	ref	2.4	Ref	16.2	ref
Male	12.7	<b>0.81 (0.67 to 0.97)</b>	1.4	<b>0.62 (0.40 to 0.95)</b>	11.0	0.75 (0.49 to 1.15)
<b>Country</b>						
England	13.6	ref	2.0	Ref	14.4	ref
Wales	15.8	0.97 (0.76 to 1.24)	2.1	0.67 (0.40 to 1.14)	13.4	0.64 (0.37 to 1.10)
Scotland	14.9	<b>1.55 (1.04 to 2.30)</b>	2.2	2.45 (0.83 to 7.22)	15.0	1.59 (0.55 to 4.64)
Northern Ireland	11.5	1.00 (0.77 to 1.29)	0.9	0.41 (0.16 to 1.02)	8.2	0.39 (0.15 to 1.04)
<b>Family income group</b>						
1 (highest)	8.5	ref	0.3	Ref	3.4	ref
2	11.0	<b>1.35 (1.06 to 1.72)</b>	1.4	<b>5.63 (2.28 to 13.95)</b>	12.8	<b>4.94 (1.99 to 12.30)</b>
3	13.4	<b>1.85 (1.42 to 2.42)</b>	1.6	<b>6.29 (2.66 to 14.87)</b>	12.2	<b>4.14 (1.75 to 9.83)</b>
4	20.7	<b>2.56 (1.87 to 3.53)</b>	3.8	<b>16.03 (5.90 to 43.57)</b>	18.1	<b>10.06 (3.92 to 25.83)</b>
5 (lowest)	20.0	<b>2.74 (2.00 to 3.75)</b>	3.6	<b>13.58 (5.51 to 33.47)</b>	18.3	<b>8.07 (3.24 to 20.12)</b>
<b>Ethnic group</b>						
White	15.0	Ref	2.1	Ref	14.2	ref
Mixed	13.1	<b>0.45 (0.23 to 0.89)</b>	4.0	0.79 (0.29 to 2.11)	30.8	1.25 (0.28 to 5.47)
Indian	4.3	<b>0.39 (0.20 to 0.75)</b>	0.7	0.46 (0.10 to 2.05)	15.4	1.16 (0.22 to 6.18)
Pakistani and Bangladeshi	8.6	<b>0.53 (0.33 to 0.85)</b>	0.5	<b>0.27 (0.09 to 0.84)</b>	5.7	0.33 (0.09 to 1.20)
Black	7.9	0.56 (0.31 to 1.00)	0.5	<b>0.21 (0.05 to 0.94)</b>	6.5	0.28 (0.07 to 1.10)
Other ethnic group	6.7	0.95 (0.43 to 2.10)	0.5	0.86 (0.10 to 7.20)	7.1	0.67 (0.07 to 6.82)
<b>Caregiver current smoking</b>						
No	10.9	ref	1.2	Ref	10.8	ref
Yes	26.0	<b>1.69 (1.38 to 2.06)</b>	4.9	<b>1.92 (1.16 to 3.19)</b>	18.8	1.49 (0.92 to 2.41)
<b>Peer smoking</b>						
No	4.0	ref	<0.1	Ref	1.1	ref
Some/most/all	35.1	<b>10.35 (8.35 to 12.81)</b>	6.0	<b>115.57 (26.03 to 513.08)</b>	17.2	<b>22.29 (4.91 to 101.21)</b>
No answer	9.3	<b>1.96 (1.34 to 2.88)</b>	7.1	<b>14.51 (2.58 to 81.66)</b>	7.6	<b>9.21 (1.64 to 51.78)</b>

Continuing current smoker refers to those reporting having ever smoked at age 11 who were current smokers.

Bold values represent p≤0.05.

AOR is adjusted for all other covariates in table.

AOR, adjusted OR.



**Figure 1** Early-life exposure to smoking and associations of being an ever smoker when an early teen.

same room, AOR 1.55, 1.21 to 1.98) (figure 1) (online appendix table 2). 35.8% of those exposed to smoking in the same room in all survey waves aged 0–7 years were ever smokers by early-teen years compared with 10.3% of those never exposed to smoking in the same room (AOR 2.67, 1.51 to 4.70). Children whose mother smoked during pregnancy were more likely to be both ever and current smokers. For example, 5.2% of children whose mothers smoked during pregnancy were current smokers as early teens compared with 0.9% of children whose mother never smoked during pregnancy (AOR 2.16, 1.42 to 3.26).

Results of additional analyses are presented in online appendix tables 3 and 4 and show that earlier age of first smoking was associated with continuing current smoking as well as evidence of a dose–response effect between friend smoking and child smoking.

## DISCUSSION

The principle findings from this nationally representative UK prospective cohort study are that smoking among early teens is associated with smoking by caregivers and peers and specifically with early-life exposure to smoking. We also estimate that over 220 000 13 and 14 year olds in the UK have tried tobacco and almost 40 000 are current smokers. These data reinforce findings regarding the links between caregiver smoking and smoking uptake, adding prospective data to that from other large cross-sectional surveys, further adding to this research by allowing detailed consideration of early-life exposures among the same children.

Our data highlight the ‘transmissible’ nature of the tobacco epidemic in young people and support the need for further urgent and comprehensive action on smoking to protect children. In addition to reducing exposure to secondhand smoke, the data on passive exposure to smoke in the same room suggest that the promotion of smoke-free homes has the potential to reduce youth smoking. Caregivers and those with children

should be further supported to quit.<sup>7</sup> These findings also reinforce the view that tackling smoking in pregnancy can reduce child smoking uptake, as well as highlighting well-known links between these and adverse socioeconomic circumstances during childhood.<sup>8</sup> School-based strategies such as the A Stop Smoking in School Trial (ASSIST) programme which trains peer supporters in schools are also recommended by the National Institute for Health and Care Excellence to reduce smoking uptake among children.<sup>9</sup>

There are some limitations to this work. Our measures of smoking among both caregivers and children were based on self-report, although previous work has found these to be accurate.<sup>8</sup> Our measure of exposure to early-life exposure is exposure in the same room rather than in the home in general which would potentially show stronger associations. Some previous research has found differences in associations of caregiver smoking by sex, but we were unable to examine this due to a low number of fathers identified as caregivers in the study.<sup>10</sup> We have not included analyses here of any potential associations between the use of e-cigarettes and tobacco among this age group, although previous analyses of the MCS have revealed that the majority of e-cigarette use in this age group was among children using tobacco.<sup>11 12</sup>

Despite a decline in overall smoking prevalence, large numbers of children in the UK experiment with and continue to smoke. Associations with smoking during pregnancy and smoking among peers and caregivers suggest the need for further comprehensive action to target this avoidable driver of disease.

**Correction notice** This article has been corrected since it was published Online First. There was a typographical error to the “ever smoking risk” for “friends smoked” in the Abstract.

**Contributors** AAL had full access to all of the data and takes responsibility for the integrity of the data and the accuracy of the data analysis. Study concept and design was by AAL and NSH. All authors were involved in the interpretation of data, drafting of the manuscript and revising it for critical intellectual content.

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**Competing interests** None declared.

**Patient consent** Not required.

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**Data sharing statement** The millennium cohort study data is available free of charge to accredited researchers from the UK Data Service <https://www.ukdataservice.ac.uk/>.

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