



# Health Survey for England 2015

## Children's smoking and exposure to other people's smoke

Published 14<sup>th</sup> December 2016

This report examines the prevalence of children's smoking and exposure to other people's smoke in England using data from 2014 and 2015. It compares the prevalence of smoking and amount of exposure to other people's smoke in different population groups, such as age, sex, income, and region. It also examines e-cigarette use.

### Key findings

- 1% of children aged 8 to 15 in the years 2014 and 2015 reported that they smoked regularly (at least one cigarette per week). 4% of all children aged 8 to 15 in 2015 reported that they had ever smoked a cigarette, down from 19% in 1997.
- Among non-smoking children aged 4 to 15, 34% of boys and 38% of girls had detectable levels of cotinine in 2014-2015, indicating exposure to other people's smoke.
- Mean cotinine levels were higher (indicating more exposure to secondhand smoke) for children from lower income households, for children living in households where one or more people smoked in the home on most days, and for children with one or more parents who currently smoked cigarettes.
- In 2015, 6% of all children aged 13 to 15 reported current or previous use of a non-tobacco nicotine delivery product. Over one-third of children (38%) aged 13 to 15 who had ever smoked a cigarette reported current or previous use of a nicotine delivery product, but use amongst children who had never tried a cigarette was rare at 2%.

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**ISBN 978-1-78386-896-4**

This report may be of interest to members of the public, policy officials and people working in public health to monitor the prevalence of children's smoking and exposure to other people's smoke.

## Introduction

### Contents

This report presents data on children's smoking and related exposures from the Health Survey for England in 2014 and 2015. The data were collected from a representative sample of the general population. They are used to show the overall prevalence of smoking among children aged 8 to 15 and the exposure to other people's smoke of all children aged under 16. In addition, this report includes an objective assessment of children's passive smoking exposure, measured by analysis of saliva cotinine samples among those aged 4 to 15. It also examines the self-reported use of non-tobacco nicotine delivery products (NDP), including e-cigarettes, among children aged 13 to 15 in 2015.

Detailed tables accompanying this report can be accessed via <http://digital.nhs.uk/pubs/hse2015>.

### Background

#### Health effects of smoking and exposure to tobacco smoke

The negative effects of smoking on health have been well documented. Tobacco use is the leading cause of preventable death.<sup>1</sup> Smoking contributes to a number of health conditions, including many cancers and respiratory, digestive and circulatory diseases.<sup>2</sup> Individuals who start smoking at a young age have higher age-specific rates for all types of tobacco-related cancers, linked primarily to their earlier exposure to the harmful toxins from cigarettes. Young smokers also experience more short and long-term respiratory symptoms than their non-smoking peers. Smoking can lead to impaired lung growth in children and young adults. Further, smoking both aggravates asthma symptoms in those already diagnosed with asthma and increases the risk of asthma in young people with no history of the condition.<sup>3</sup>

Secondhand tobacco smoke, also known as passive smoking, environmental tobacco smoke, or tobacco smoke pollution, also has negative impacts on health. Exposure to other people's tobacco smoke affects children's lung function, subsequent lung function as adults, and the risk of chronic disease as adults.<sup>4,5,6,7,8,9</sup> Children are particularly at risk from the effects of secondhand tobacco smoke.<sup>10</sup> Children have more rapid respiratory rates, so they take proportionately more secondhand smoke into their lungs than adults. Their developing organs are also at greater risk from exposure to toxins. Exposure to secondhand smoke can also cause childhood cancers, cancer in adulthood, meningitis, and the initiation of cardiovascular disease.<sup>11</sup>

Over the past few years, the availability and usage of e-cigarettes has been rising, and this has been accompanied by controversy. Although e-cigarettes may be useful in weaning smokers off cigarettes, opponents of e-cigarettes fear that their promotion may introduce people to nicotine who have never previously smoked, may encourage subsequent cigarette smoking, or renormalise smoking. In 2014, the survey of Smoking, Drinking and Drug Use among Young People in England estimated that 22% of children aged 11 to 15 had ever used e-cigarettes, including 4% who said they used them regularly or occasionally. Although the use of e-cigarettes was more common among young people who already smoked cigarettes, 11% of children who had never smoked said that they had tried an e-cigarette, including 1% who said they used them regularly or occasionally.<sup>12</sup>

## Methods and definitions

### Methods

Full details of the protocols for carrying out all the measurements are contained in the Methods report;<sup>13</sup> they are summarised briefly here.

### Questions about cigarette smoking

Questions on children's smoking have been included in the HSE every year since 1995.<sup>14</sup> Parents were present when children were interviewed. Questions about cigarette smoking were therefore collected by self-completion questionnaire to ensure greater privacy and encourage honest answers. Parents can see the blank questionnaire before it is given to the child but not the completed booklet.<sup>15</sup> Children aged 13 to 15 were also asked about current or previous use of non-tobacco nicotine delivery products including e-cigarettes and nicotine chewing gum, lozenges, mini lozenges, patches, inhalers, mouth and nasal spray.

### Exposure to other people's smoke

Parents/guardians were asked whether those aged 0 to 12 were looked after for at least two hours a week by someone who smoked while looking after them. In addition, a responsible adult was asked a question to establish how many people smoked inside the home on most days. Those aged 13 to 15 were asked (in the self-completion booklet) how many hours a week they were exposed to other people's smoke. The self-completion booklets for those aged 8 to 15 also contained questions about whether children were often near people who were smoking in different locations, and if so, whether this bothered them.

### Cotinine measurements

Cotinine, a metabolite of nicotine, provides an indicator of recent exposure to tobacco or its smoke. Cotinine is generally considered the most useful of the various biological markers that are indicators of smoking. Saliva samples were taken from children aged 4 to 15 during the nurse visit and were analysed for cotinine. The measurement of cotinine in the HSE provides an objective check on self-reported smoking behaviour. When analysed in a specialist laboratory, as is done for HSE, low levels are also a sensitive marker of exposure to other people's smoke. Cotinine has a half-life in the body of between 16-20 hours, so it will detect regular smoking but may not detect occasional smoking if the last occasion was several days ago. Sources of cotinine other than tobacco can for practical purposes be ignored.<sup>16</sup>

Cotinine levels for this survey were measured using a very sensitive method.<sup>17</sup> The limit of detection is 0.1ng/ml. Levels below this indicate no or minimal exposure to tobacco smoke. In this report, as in the HSE 2013 report when this subject was last discussed, cotinine levels of 12ng/ml or above have been used to indicate personal smoking, while levels between 0.1ng/ml to below 12ng/ml are used to indicate exposure to secondhand smoke among non-smokers. The upper limit of 12ng/ml was revised from the threshold of 15ng/ml used in HSE reports before HSE 2013. The change was in response to research using HSE data which suggested a lower optimal cotinine cut-off to be indicative of personal smoking in populations with lower smoking prevalence.<sup>18</sup>

## Analysing the data

In the current HSE design, a sample of around 2,000 children are interviewed each year and around 1,500 also have a nurse visit. Around 800 children aged 8 to 15 fill in self-completion questions about smoking, and around 700 children aged 4 to 15 provide saliva samples. In addition, there was a boost sample of about 3,500 children aged 0 to 15 in HSE 2015.

In this report, data from HSE 2014 and 2015 have been aggregated to increase sample sizes. In HSE 2015, more than two children could be selected from households.<sup>19</sup> Only children selected as part of the core sample in HSE 2015 were eligible for cotinine measurements. Different tables are based on different age groups because they were asked different questions.

The format of the questions on current or previous use of non-tobacco nicotine delivery products (NDPs) was different in HSE 2014 and in HSE 2015. In HSE 2014, children were asked whether they had ever used any of the listed nicotine replacement products with 'current use' and 'used in the past but not using now' arranged as separate but adjacent columns. In HSE 2015, the questions on current and previous use of nicotine replacement products were asked separately. A sizeable proportion of children in HSE 2014 completed the items on current use but skipped the items on previous use. The proportion of children with missing data was much smaller in HSE 2015, reflecting the amended questionnaire design. Therefore for this report we have analysed current or previous use of non-tobacco nicotine delivery products using data only from HSE 2015.

Weights were applied to all data to correct for non-response: different weights were applied to interview and to cotinine data.<sup>13</sup>

## Definitions

### Ever smokers

Children aged 8 to 15 are defined as ever smokers if they reported that they had ever tried a cigarette.

### Regular smokers

Children aged 8 to 15 are defined as regular smokers if they reported that they smoked at least one cigarette per week.

### Cotinine-validated non-smokers

Children below the age of 8 were not asked about smoking: all child participants aged 4 to 7 are assumed not to smoke currently. Those aged 8 to 15 are included as cotinine-validated non-smokers if they said that they did not currently smoke (i.e. did not smoke at least one cigarette per week; those who smoked sometimes but not every week are included as non-smokers), and this is confirmed by a cotinine level of less than 12ng/ml.

### Geometric mean cotinine levels

Tables 9 to 12 show geometric mean cotinine values for self-reported, cotinine-validated non-smokers aged 4 to 15. Non-smokers aged 13 to 15 who reported current use of nicotine delivery products were excluded from these analyses. Geometric means have been calculated as they take less account of extreme values that might distort the average.<sup>20</sup>



## Prevalence of smoking

### Smoking status, by age and sex

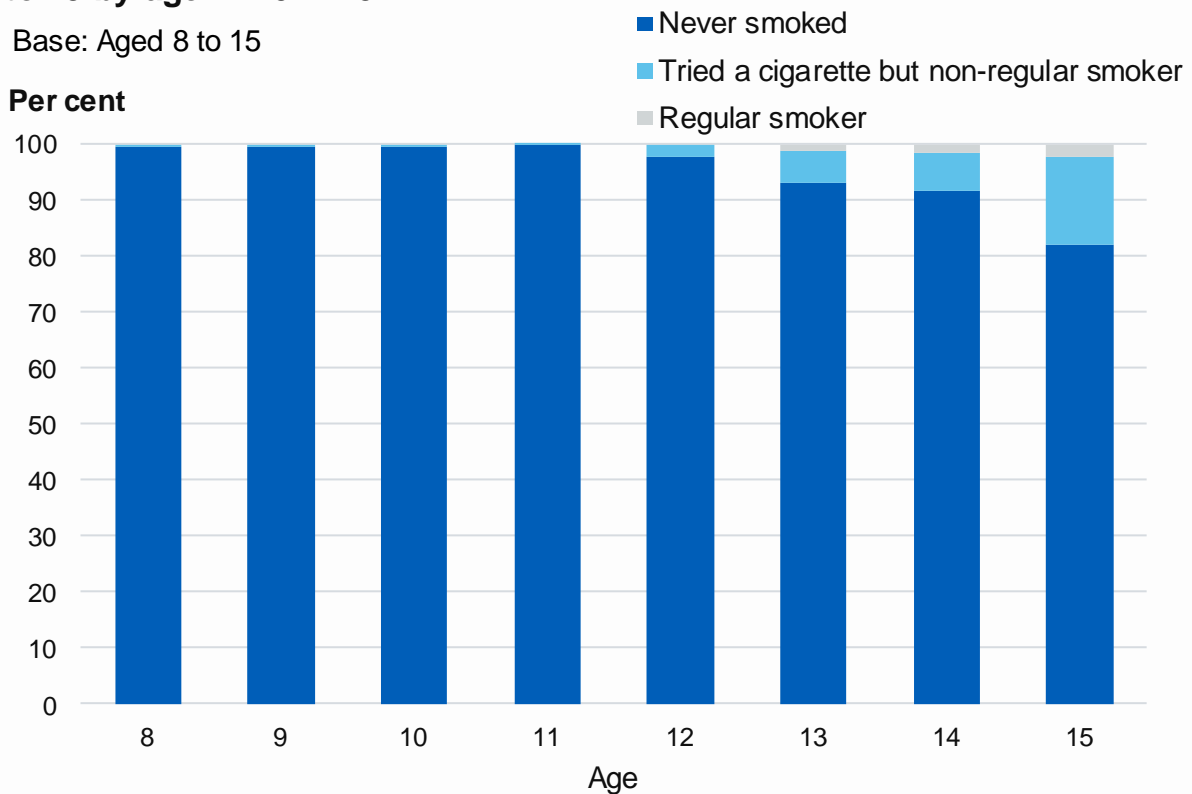
In 2014-15, 5% of children aged 8 to 15 had ever smoked a cigarette. 1% of all children aged 8 to 15 reported that they smoked regularly (at least one cigarette per week). As Figure 1 shows, smoking was very rare under the age of 13. From age 13 onwards both proportions increased with age. Similar proportions of boys and girls had tried smoking and smoked regularly.

Just over one in four (27%) children aged 13 to 15 who reported that they had ever tried a cigarette had smoked a cigarette in the last week.

Figure 1, Tables 1 and 3

**Figure 1 Self-reported smoking status of children aged 8 to 15 by age in 2014-15**

Base: Aged 8 to 15



Source: NHS Digital

### Smoking status by region

The proportion of children aged 8 to 15 who reported that they had ever smoked varied between regions, from 3% to 8%. The proportion of children aged 8 to 15 who were regular smokers was low (1% or less), with some variation across regions.

Table 2



## Trends over time

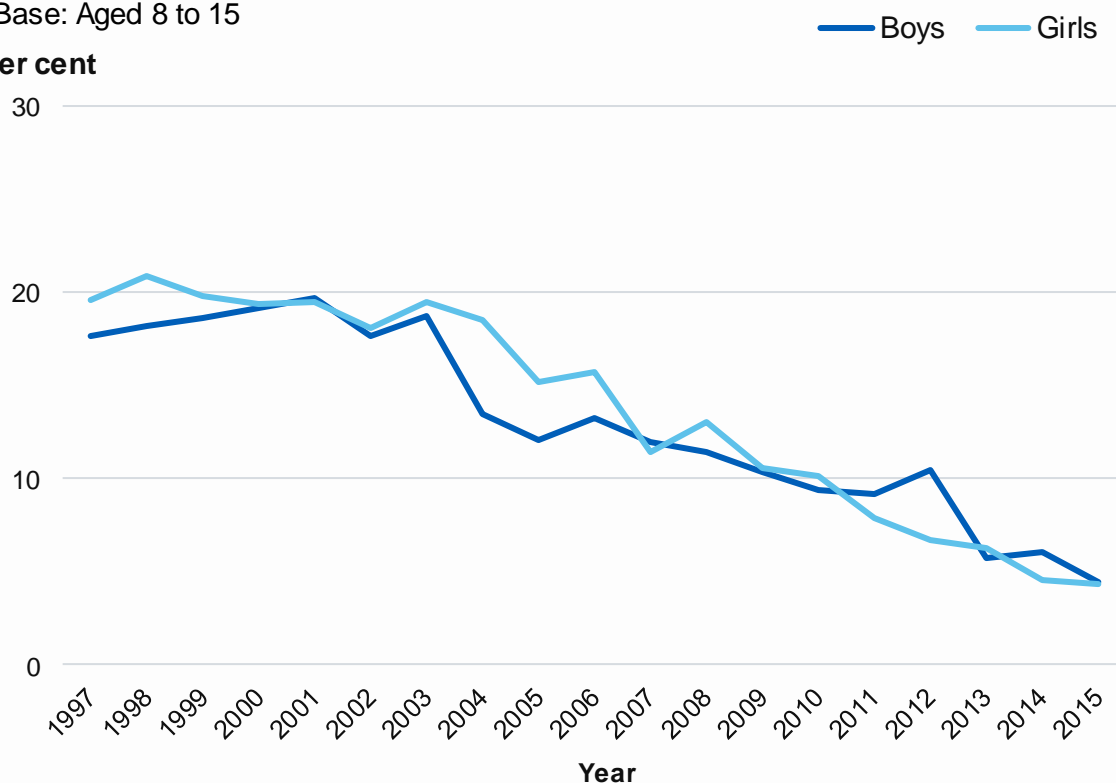
Trend data on children's self-reported cigarette smoking status are given in Table 5 in the Trend tables for children.<sup>21</sup> The proportion of children aged 8 to 15 who reported that they had ever smoked cigarettes declined substantially between 1997 (19%) and 2015 (4%).<sup>22</sup>

Figure 2

**Figure 2 Proportion of children who had ever smoked cigarettes, by sex**

Base: Aged 8 to 15

Per cent



Source: NHS Digital

## Reported secondhand smoke exposure

### Exposure to smoke from carers

7% of all children aged 0 to 12 were reported by their parents to have been in the care of someone who smoked while looking after them, for at least two hours a week. This proportion increased with age, for girls but not for boys.

Figure 3, Table 4

**Figure 3 Prevalence of exposure to smoke from carers, by age and sex**

Base: Aged 0 to 12

Per cent

10

5

0

0-4

5-12

Boys

0-4

5-12

Girls

Age group

■ Looked after for more than two hours a week by carer who smoked while looking after them

Source: NHS Digital

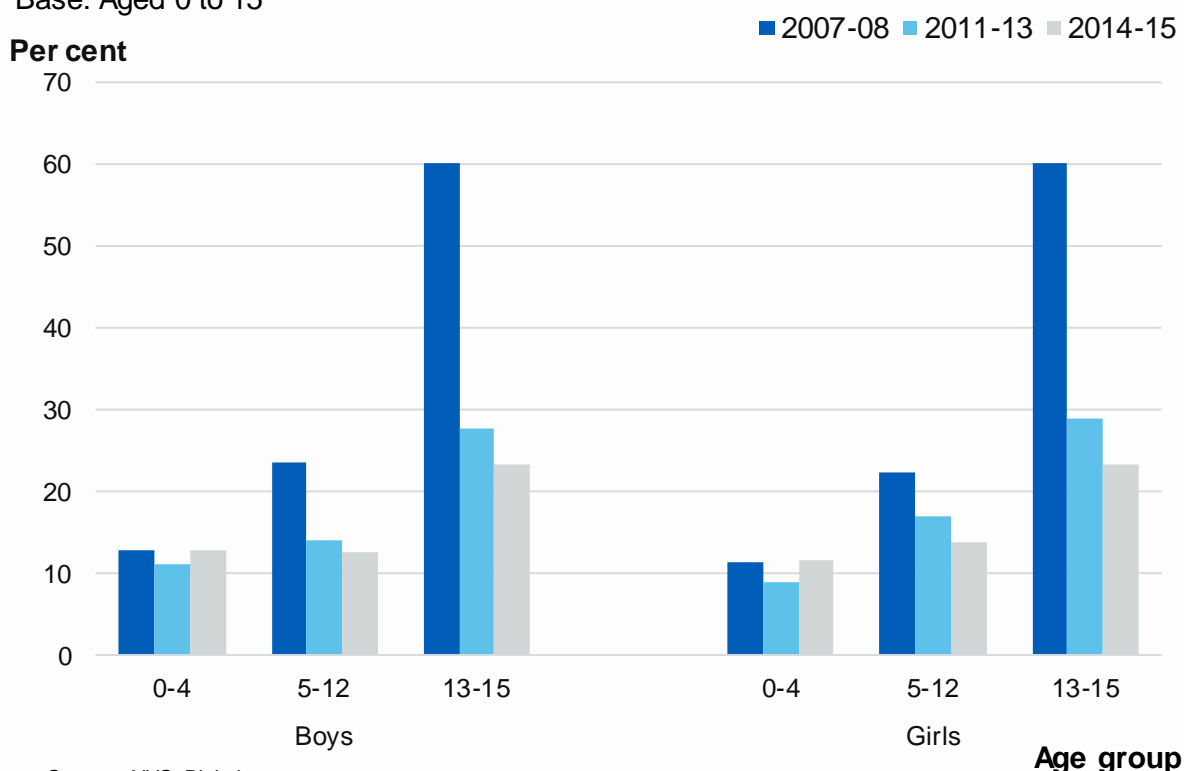
## Exposure to other people's smoke

The proportion of children aged 0 to 15 exposed to other people's smoke for one hour or more per week increased with age. To assess changes over time in reported exposure to other people's smoke, HSE data from 2014-15 is compared with combined data from 2007-08 and from 2011-13. The proportion of children aged 5 to 15 exposed to other people's smoke for one hour or more per week decreased from 2011-13 to 2014-15.

Figure 4, Tables 5 and 6

### Figure 4 At least one hour a week exposure to other people's smoke, by survey year, age and sex

Base: Aged 0 to 15



Source: NHS Digital

## Locations of exposure to other people's smoke

Children aged 8 to 15 were asked if they were often near to people who were smoking and where this occurred. The most frequently mentioned locations were in the street (55%), outdoor areas of pubs/restaurants/cafes (31%), and other public places (31%). Among children who reported tobacco smoke exposure in at least one location, girls were more likely than boys to report being bothered by exposure to other people's smoke (60% and 55% respectively).

Table 7

## Objectively measured secondhand smoke exposure

### Cotinine analysis

Saliva samples were taken from children aged 4 to 15 during the nurse visit from which cotinine measurements were derived.<sup>23</sup> Of 1,530 boys and 1,498 girls interviewed, 795 boys and 758 girls provided a valid cotinine measurement. Table 8 compares the characteristics of children with a valid cotinine measurement with the total core sample who were eligible for inclusion. Among both boys and girls, the youngest participants (those aged 4 to 6) were slightly less likely to give a sample (some small children find it difficult to produce sufficient quantities of saliva for analysis). Weighting has been applied to the cotinine sample to adjust for this and any other imbalance in response.

Table 8

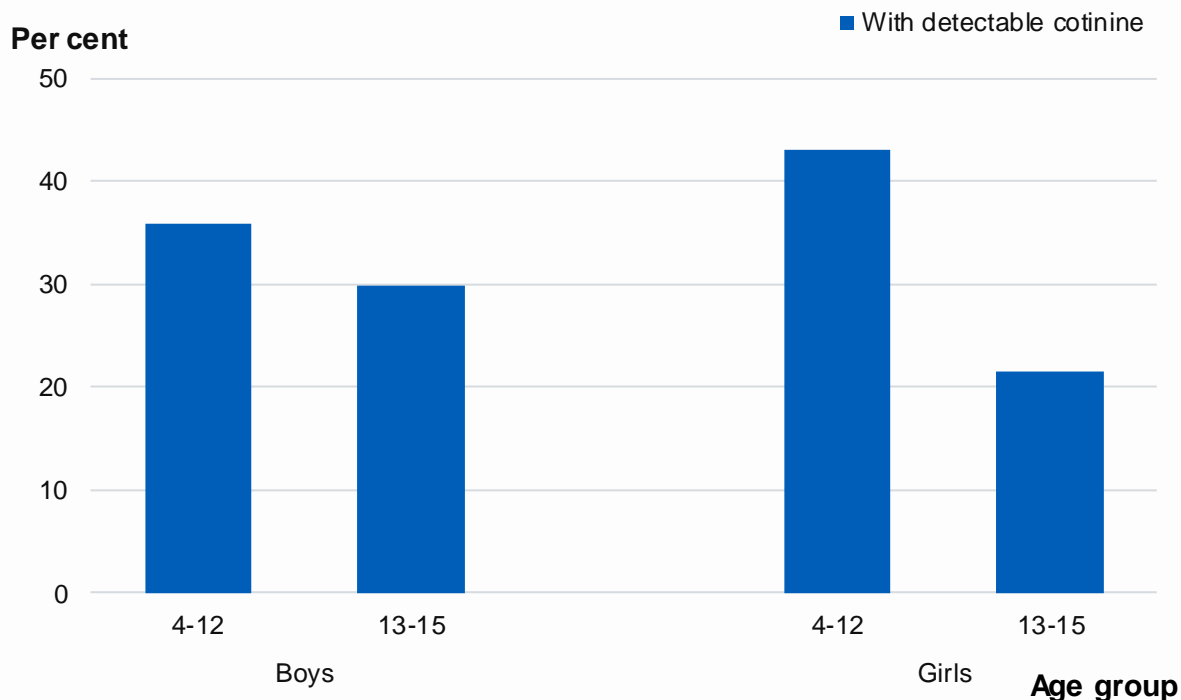
### Cotinine levels among non-smokers, by age and sex

Younger children’s cotinine levels indicated that they were more likely to be exposed to secondhand smoke than older children. 36% of children aged 4 to 15 who were cotinine-validated non-smokers had detectable levels of cotinine (0.1ng/ml to less than 12ng/ml). The proportions of non-smokers with detectable cotinine decreased with age, more so for girls than for boys, as shown in Figure 5. Similarly, geometric mean cotinine levels were higher for children aged 4 to 12 than for children aged 13 to 15, although there was no difference between boys and girls.

Figure 5, Table 9

#### Figure 5 Detectable cotinine status, by age and sex

Base: Aged 4 to 15 cotinine-validated non-smokers



Source: NHS Digital

## Cotinine levels among non-smokers, by equivalised household income and sex

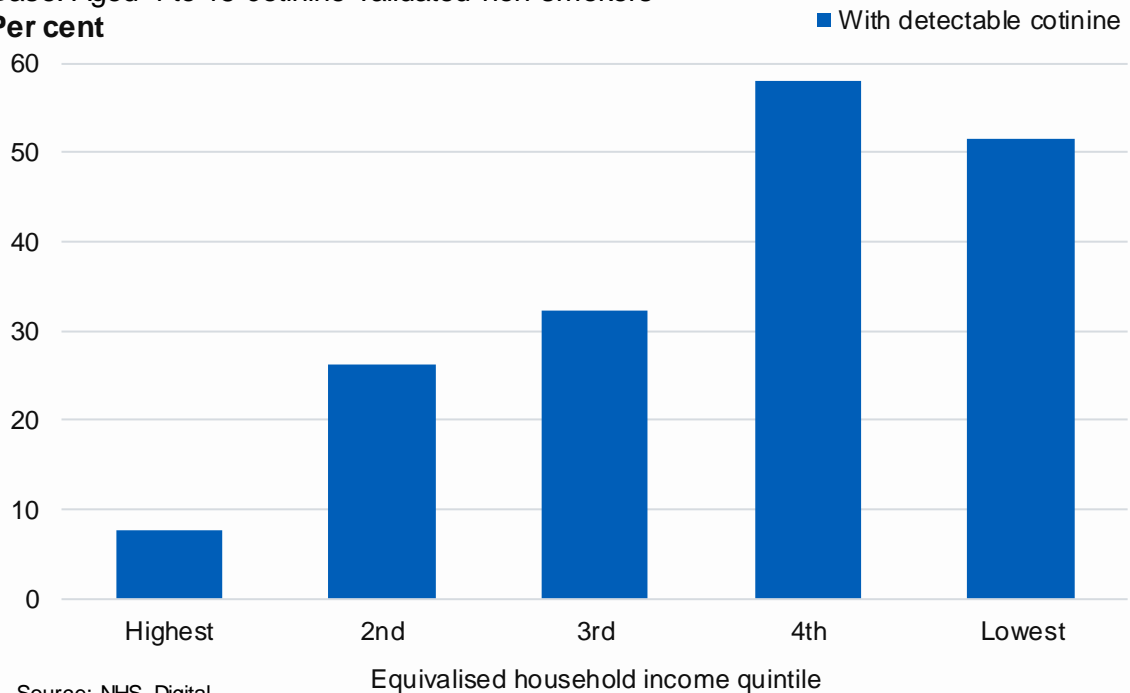
Cotinine levels among non-smoking children aged 4 to 15 varied significantly by quintile of equivalised household income. Geometric mean cotinine levels increased as income quintile decreased, indicating that children from lower income households were exposed to more secondhand smoke, on average. The pattern of geometric means across equivalised household income quintiles was confirmed by the proportions of non-smokers with no detectable cotinine (levels below 0.1ng/ml). While the majority of children in the highest three income quintiles had no detectable cotinine, more than half of non-smoking children in the lowest two income quintiles were exposed to tobacco smoke.

Figure 6, Table 10

### Figure 6 Detectable cotinine status, by equivalised household income

Base: Aged 4 to 15 cotinine-validated non-smokers

Per cent



Source: NHS Digital

## Cotinine levels among non-smokers, by number of people smoking regularly in the home

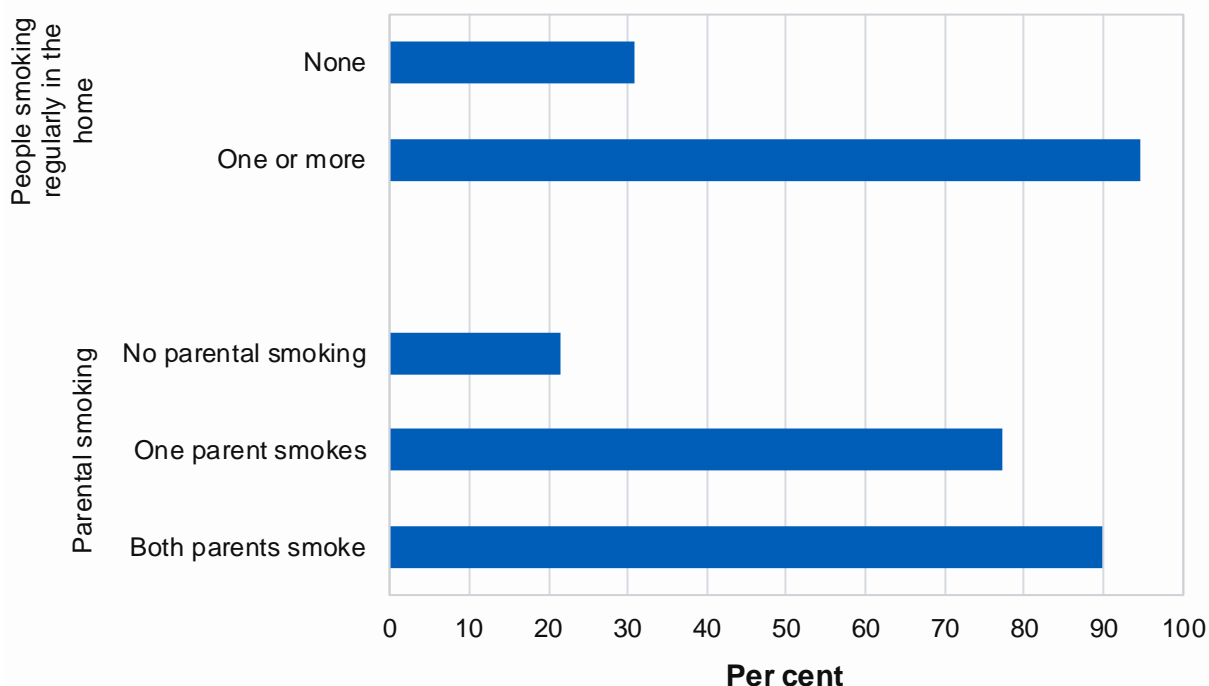
Figure 7 shows the proportion of non-smoking children aged 4 to 15 with detectable cotinine (0.1ng/ml to less than 12.0ng/ml) by the number of people smoking regularly in the home. 95% of non-smoking children with one or more people smoking in the home on most days had detectable cotinine levels, indicating exposure to secondhand smoke, compared with 31% of non-smoking children where on most days no-one smoked in the home. A similar pattern was confirmed by the average levels of salivary cotinine in children: non-smoking children aged 4 to 15 living in households where one or more people smoked in the home on most days had a much higher geometric mean cotinine level than children living in non-smoking households.

Figure 7, Table 11

### Figure 7 Detectable cotinine status, by people smoking regularly in the home and by parental smoking status

Base: Aged 4 to 15 cotinine-validated non-smokers

■ With detectable cotinine



Source: NHS Digital

## Cotinine levels among non-smokers, by parental smoking

Figure 7 also shows the proportion of non-smoking children aged 4 to 15 with detectable cotinine (0.1ng/ml to less than 12.0ng/ml) by parental smoking status. 21% of non-smoking children aged 4 to 15 whose parent(s) did not report being current smokers had detectable cotinine compared with 90% of non-smoking children aged 4 to 15 living in a household where parents both currently smoked. The geometric mean cotinine levels showed a similar pattern by parental smoking status, with higher levels among non-smoking children whose parent(s) currently smoked cigarettes than among children whose parents did not smoke.

Figure 7, Table 12

## Use of non-tobacco nicotine delivery products including e-cigarettes

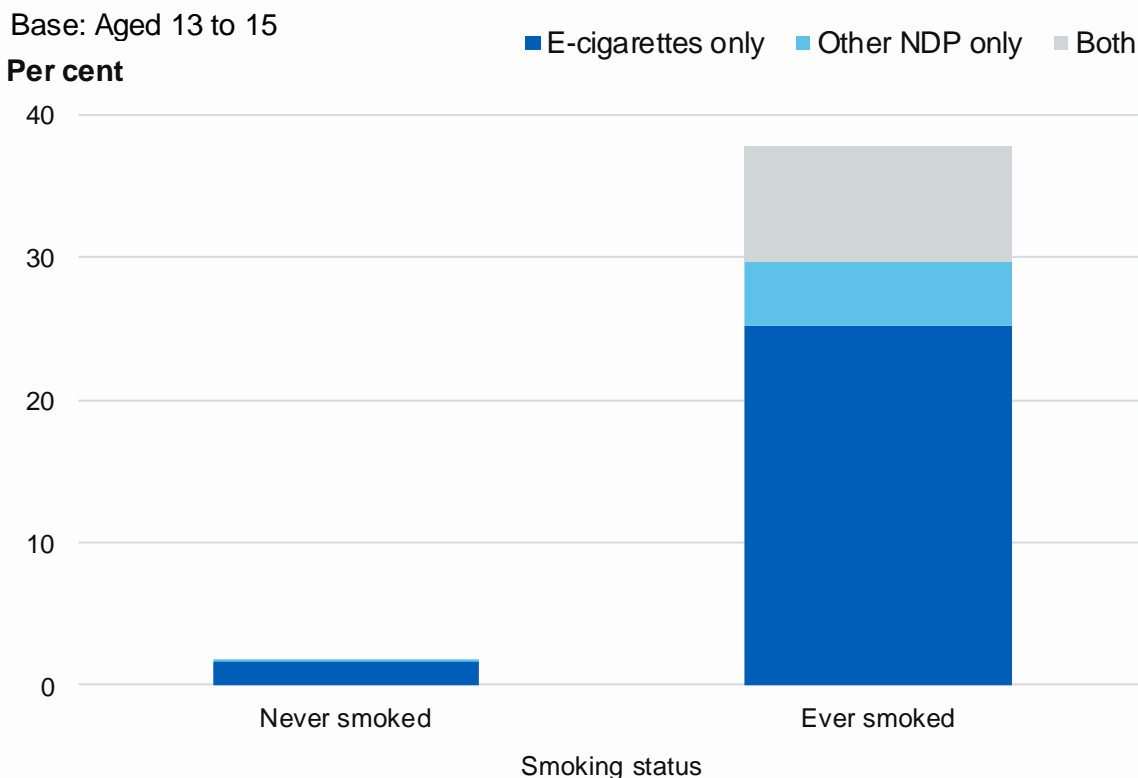
Children aged 13 to 15 were also asked about current or previous use of non-tobacco nicotine delivery products including e-cigarettes and nicotine chewing gum, lozenges, mini lozenges, patches, inhalers, mouth and nasal spray. Current or previous use of non-tobacco nicotine delivery products was analysed using data only from HSE 2015, because of changes to the questionnaire.

In 2015, 6% of all children aged 13 to 15 reported current or previous use of a non-tobacco nicotine delivery product (NDP). This proportion was higher for children who had ever smoked a cigarette, as shown in Figure 8. Over one-third of children (38%) aged 13 to 15 who had ever smoked a cigarette reported some use of a non-tobacco nicotine delivery product. Current or previous use of a non-tobacco nicotine delivery product was rare amongst children aged 13 to 15 who had never tried a cigarette (2%). The extent and pattern of NDP use amongst children aged 13 to 15 who had ever smoked a cigarette should be viewed with caution due to the low numbers.

Figure 8, Table 13



**Figure 8 Prevalence of ever use of non-tobacco nicotine delivery products, by smoking status**



Source: NHS Digital

## Discussion

### Trends in smoking initiation and prevalence

HSE trend data on smoking show that the proportion of children aged 8 to 15 who reported that they had ever smoked declined substantially between 1997 (19%) and 2015 (4%).<sup>21</sup> Recent declines in smoking prevalence among children may indicate changing social norms around smoking behaviour. The decline in cigarette smoking prevalence among adults is likely to have had a positive impact on the levels of children's smoking.

The declines in smoking initiation and prevalence among children may also indicate the success of measures such as the raising of the minimum age for the purchase of tobacco from 16 years to 18 years (from October 2007); the introduction of graphic picture health warnings on the reverse of cigarette packets (from October 2008); the ban on the sale of cigarettes from vending machines (from October 2011); and a ban on the display of tobacco products in retail outlets (from April 2012). Further legislative changes, including the requirement for standardised cigarette packaging, have been introduced since the end of the data collection period for HSE 2015. A new tobacco control plan is being considered by the government, to replace the last five-year strategy which has come to an end.<sup>24</sup> The HSE results for 2014-15 showed that 4% of children aged 15 smoked regularly or occasionally, although the equivalent figure from the national school-based survey in 2014 was 13%.<sup>12</sup>

## Comparisons with other data

Even with the precautions taken for smoking data collection from children in HSE, there is still a risk that children will under-report smoking because they are worried that parents might see their answers. Comparison with the survey of Smoking, Drinking and Drug Use among Young People (SDD), conducted annually in secondary schools among children aged 11 to 15, indicates that lower levels of both smoking and alcohol use are reported in home-based interview surveys compared with surveys carried out under 'examination conditions' in schools (Table A). For example, in SDD 2014, 3% of children aged 11 to 15 reported being regular smokers compared with 1% of children of the same age in HSE 2014-2015 (Table A).

**Table A: Prevalence of regular cigarette smoking among children aged 11 to 15, comparison of HSE (2014-2015) and SDD (2014), by age and sex**

Children aged 11-15	11 %	12 %	13 %	14 %	15 %	Total %
<b>HSE 2014-2015 self-reported</b>						
Boys	-	-	2	1	2	1
Girls	-	-	-	2	3	1
All	-	-	1	2	2	1
<b>HSE 2014-2015 self-reported regular smoking or cotinine level 12ng/ml or more</b>						
Boys	-	-	3	-	9	2
Girls	-	-	-	2	6	2
All	-	-	2	1	7	2
<b>SDD 2014</b>						
Boys	-	0	2	2	6	3
Girls	-	0	2	6	9	4
All	-	0	2	4	8	3

However, when including those with saliva cotinine levels of 12ng/ml or more, indicating personal tobacco or nicotine use, the prevalence of assumed regular cigarette smoking was similar in both surveys. The pattern for self-reported smoking was confirmed by higher levels of smoking in the last week amongst children who had ever smoked in SDD 2014 (Table B).

**Table B: Prevalence of cigarette smoking in the last week by children aged 13 to 15, comparison of HSE (2014-2015) and SDD 2014, by sex**

	Total %
Children aged 13-15 who have ever smoked	
<b>HSE 2014-2015</b>	
Boys	25
Girls	29
All	27
<b>SDD 2014</b>	
Boys	21
Girls	30
All	26

### Trends in objectively measured exposure to other people's smoke

HSE data for 2014-2015 continue to show the encouraging picture of decline in children's exposure to other people's smoke. Among children aged 4 to 15 who were cotinine-validated non-smokers, analysis of HSE 2011-13 data showed that 41% of boys and 37% of girls had detectable levels of cotinine. By 2014-15, the proportion of boys aged 4 to 15 with detectable levels of cotinine had decreased to 34%, but the level remained steady for girls, at 38%.

Declines in the levels of exposure to other people's smoke are likely to lead to significant reductions in the risk of disease attributable to secondhand smoke.<sup>25</sup> Further legislative changes including the banning of smoking in vehicles carrying children and adolescents under the age of 18 have been introduced since the end of the data collection period for HSE 2015.

The proportion of non-smoking children aged 4 to 15 with detectable cotinine continues to be higher for children living in households where one or more people smoked in the home on most days, and for children with one or more parents who currently smoked cigarettes. However, fewer than 9% of the children who provided saliva samples lived with at least one adult smoker who smoked at home on most days. Thus although these children are more likely to have detectable levels of cotinine (95% had detectable cotinine levels, compared with 31% among children with no adult smoking at home on most days), this is confined to a decreasing proportion of the population.<sup>25</sup>

Levels of exposure to secondhand smoke also continue to show higher levels in the lower socioeconomic groups, at least in part because children from lower socioeconomic groups are more likely to have smoking parents. However, the HSE data also show the importance of parents choosing to make their homes smokefree, even if they themselves smoke.

### Use of non-tobacco nicotine delivery products

Public Health England and other UK public health organisations share a commitment to provide up-to-date information on the emerging evidence on e-cigarettes.<sup>26</sup> In August 2015, Public Health England reported that there was no evidence to suggest that the increasing availability of e-cigarettes was undermining the long-term decline in

smoking, including among young people.<sup>27</sup> Evidence from online surveys and from the survey of Smoking, Drinking and Drug Use among Young People in England conducted in secondary schools continue to suggest that e-cigarette use among children is largely confined to those who smoke.<sup>12,28,29</sup> The results from HSE 2015, based on a nationally representative sample, confirm this picture. Amongst children aged 13 to 15 who have never tried a cigarette, current or previous use of a non-tobacco nicotine delivery product (including e-cigarettes) was rare at 2%. However the report by Public Health England acknowledges that protecting non-smoking children is an important goal of e-cigarette regulation. Since October 2015, it has been illegal to sell e-cigarettes to anyone under the age of 18, or for an adult to buy e-cigarettes for anyone under the age of 18.<sup>30</sup> Since this change occurred towards the end of the HSE 2015 data collection period, any resultant change in levels of e-cigarette use will not be reflected in this report. Future years' HSE data will be needed to estimate any change in the levels of e-cigarette use after this legislative change.

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- <sup>14</sup> Children aged 8-15 were asked whether they had ever tried a cigarette, and if so how often they smoked cigarettes (if at all) and how many cigarettes they had smoked in the last week (if any).
- <sup>15</sup> After answering the self-completion questionnaire, the child hands the booklet directly to the interviewer.
- <sup>16</sup> Jarvis M. Dietary nicotine: Won't mislead on passive smoking. *BMJ* 1994;308:61-62.
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- <sup>19</sup> From 1995 to 2014, a maximum of two children were selected per household, two being selected at random from households with three or more children. From 2015 onwards, a maximum of two children aged 0-12 and two children aged 13-15 are selected per household.
- <sup>20</sup> Geometric means have been presented for non-smokers as their cotinine data have a very skewed distribution: there are large numbers of extremely low values and a small number of very high values. Using the arithmetic mean is not appropriate as this can be distorted with such a distribution. The geometric mean is an average calculated by multiplying the cotinine values and taking the nth root, where n is the number of values. The geometric mean takes the outliers with very high values into account by estimating the typical value (or central tendency) of the set of data.
- <sup>21</sup> The HSE 2015 Trend tables are available at <http://digital.nhs.uk/pubs/hse2015trend>
- <sup>22</sup> The figure for 2015 (4%) is based on 2015 data alone, and therefore differs from the data in Table 1 of this report, which combines 2014 and 2015.

<sup>23</sup> Cotinine was taken only from the core sample of HSE 2015. This analysis therefore excluded children selected as part of the HSE 2015 boost sample.

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ISBN 978-1-78386-896-4

This publication may be requested  
in large print or other formats.

**Published by NHS Digital, part of the  
Government Statistical Service**

NHS Digital is the trading name of the  
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